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ORIGINAL ARTICLE

PROGNOSTIC VALUE OF TUMOR STROMA RATIO IN TRIPLE NEGATIVE BREAST CANCER

DOI: 10.36740/WLek202103201

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ABSTRACT

The aim: The purpose of this study is to investigate prognostic value of tumor stroma ratio in triple negative breast carcinomas.

Materials and methods: This cohort retrospective study included a total number of 232 previously untreated operational materials with primary stage I-III triple negative breast cancer. The median follow-up period was 3.8 years for overall survival and 3.2 years for disease-free survival. Tumor stroma ratio was evaluated by two pathologists (Kappa coefficient was 0.71 and 0.84, respectively).

Results: Kaplan-Meier curves with logrank test statistically significantly showed relationship between tumor stroma ratio and both overall and disease-free survival. The Cox proportional hazards model showed tumor stroma ratio is a strong independent prognostic factor for triple negative breast carcinomas with hazard ratios of 2.11 ($p=0.002$) for overall survival and 1.83 ($p=0.004$) for disease-free survival in multivariate analysis.

Conclusions: Triple negative breast tumors with high stroma ratio have worse overall and disease-free survival compared to low stroma ratio tumors. Investigation of tumor stroma ratio doesn't require any additional costs and slide preparation. It can be added to routine breast cancer investigation to expand knowledge about cancer prognosis.

KEY WORDS: triple negative breast cancer, tumor microenvironment, stromal cells, cancer associated fibroblasts

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INTRODUCTION

Breast cancer remains to be among leading women cancers worldwide. Triple negative breast cancer which lacks estrogen, progesterone and human epidermal growth factor receptor 2 (HER2) amplification/overexpression has the worst outcomes compared to other molecular subgroups [1, 2]. Despite the progress the treatment options for triple negative disease are still limited [3]. Questions about over- and under treatment have forced search of additional prognostic markers.

Interactions between tumor microenvironment (TME) and tumor itself play an important role in cancer progression, as well as in metastatic potential and chemotherapy resistance [4]. Tumor stroma ratio (TSR) which is a part of TME is of increased investigation interest in this regard. It is a parameter which can be easily evaluated on H&E slide. It doesn't require additional slides and takes minimal time consume. TSP has already been investigated in cancers of different localizations, in particular tumors of gastrointestinal tract [5, 6] where it became evident TSR is an independent prognostic factor for survival. It was also investigated as a predictive marker in some other types of tumors [7, 8]. Several research papers indicate that tumor stroma ratio is also an independent prognostic marker for breast cancer [9, 10] including triple negative cancer as well [9, 11]. Gujam et al [12] found that high tumor stroma ratio was also statistically significantly associated

with high tumor grade, lymph node positivity, low CD68 macrophage infiltrate and shorter cancer-specific survival. However, they stated that TSP was not an independent prognostic factor for triple negative patients. Kramer et al. [13] published a literature review on the prognostic value of TSR in breast cancer patients. General trend goes towards high stroma ratio and poor overall survival with more significant hazard ratios in triple negative tumors. Vangangelt et al. [14] showed that the TSR was most discriminative in triple-negative tumors and also in grade III tumors, compared to grade I and grade II. TSR was not modified by age, tumor size, histology, ER status, PR status, HER2 status and lymph node status which advises TSR as a potential prognostic factor.

THE AIM

In this research, we continue to expand the value of TSR as prognostic parameter for highly heterogeneous group of triple negative breast carcinomas.

MATERIALS AND METHODS

A total number of 350 samples from patients with triple negative breast cancer treated during 2009-2018 in Kiev City Oncology Hospital was investigated. Histopathological assessment was made only for previously untreated

Table 1. General characteristics of histological parameters of tumors and treatment options.

Parameter	Number	
	N (232)	%
Age		
=<40	22	9.5
>40<60	114	49.1
>60	96	41.4
Stage		
I	76	32.8
II	124	53.4
III	32	13.8
pT (Tumor)		
pT1	91	39.2
pT2	129	55.6
pT3	5	2.2
pT4	7	3.0
pN (Nodes)		
pN0	173	74.6
pN1	34	14.6
pN2	15	6.5
pN3	10	4.3
Histologic type		
NST (No special type)	197	84.9
Lobular	9	3.9
Papillary	10	4.3
Medullary features	9	3.9
Micropapillary	1	0.4
Secretory	2	0.9
Metaplastic	1	0.4
Adenocystic	1	0.4
Adenosquamous low grade	1	0.4
Apocrine	1	0.4
Grade		
G1	1	0.4
G2	75	32.3
G3	145	62.5
Non-specified	11	4.7
TSR (Tumor stroma ratio)		
Stroma high (>50%)	100	43.1
Stroma low (<=50%)	132	56.9
Ki-67		
=<15%	12	5.2
>16%--<=30%	39	16.8
>30%	130	56
Non-specified	51	22
Necrosis		
Yes	85	36.6
No	147	63.4
DCIS (LCIS)		
Yes	14	6.1
No	218	93.9
Surgery		
Breast preserving surgery	141	60.8
Mastectomy	91	39.2
Adjuvant chemotherapy		
Yes	207	89.2
No	25	10.8
Radiotherapy		
Yes	203	87.5
No	29	12.5

operational material so biopsies and operational material after chemotherapy were excluded with eventual number of 232 samples. Tumor stage was evaluated based of the Seventh Edition of the TNM Classification of Malignant Tumors [15]. Stage IV tumors and patients with another type of malignancy were excluded. Triple negative breast cancer was defined according to the negative immunohistochemical expression of estrogen receptor (Clone EP1, Dako, USA), progesterone receptor (Clone PgR 636, Dako, USA) and HER2 (Clone SP3, ThermoScientific, USA). Overall survival (OS) was defined as the duration from the date of diagnosis to death from any cause or last follow-up. Disease-free survival (DFS) was defined as the duration of time from the date of diagnosis to locoregional or distant recurrence. Study protocol complied with the Declaration of Helsinki and was approved by National Medical Bogomolets University Ethics Committee (№5\24.01.2018).

Tumor stroma ratio was evaluated according to protocol proposed by Mesker et al. for establishment of TSR in colon cancer [16]. The most invasive part of the tumor was selected. Then 5x magnification was used to search for the area which contains the biggest amount of stroma. This area was zoomed using 10x magnification and the most stromal area was selected again. Tumor cells were presented on all sides of the view. Finally, stroma amount was reported using 10% increments. According to the results patients were categorized into stroma-low group ($\leq 50\%$) and stroma-high group ($> 50\%$).

All samples were analyzed by two pathologists who were not informed about clinical information of the patients.

Additional histopathological parameters which were evaluated included nuclear grade, histological type, presence of necrosis, presence of ductal or lobular carcinoma in situ (DCIS or LCIS) and Ki-67 (table I).

Statistical analysis was performed using EZR 1.35 software package (R statistical software version 3.4.3, R Foundation for Statistical Computing, Vienna, Austria) [17]. The Cohen's Kappa coefficient was used to calculate inter-observer variability. The Kaplan–Meier method with logrank test was used to perform the survival curves. The Cox proportional hazards model was used to calculate univariate and multivariate hazard ratios (HR) for the parameters with 95% confidence interval (CI). Akaike information criterion (AIC) was used for selection of minimal set of parameters for multivariate analysis. p-Values of less than 0.05 were considered significant. Cutoff values for TSR had been chosen before statistical analysis was performed.

RESULTS AND DISCUSSION

350 patients were initially included in the study. However, only operational material without previous chemotherapy was taken into study. Patients who had biopsy and treatment options preliminary (n=89) were excluded. From 261 samples left some (n=29) contained too less of invasive component or there was lack of clinical information so they were excluded. Totally 232 patients were included. A total of 51 patients died during the study, 72 patients had

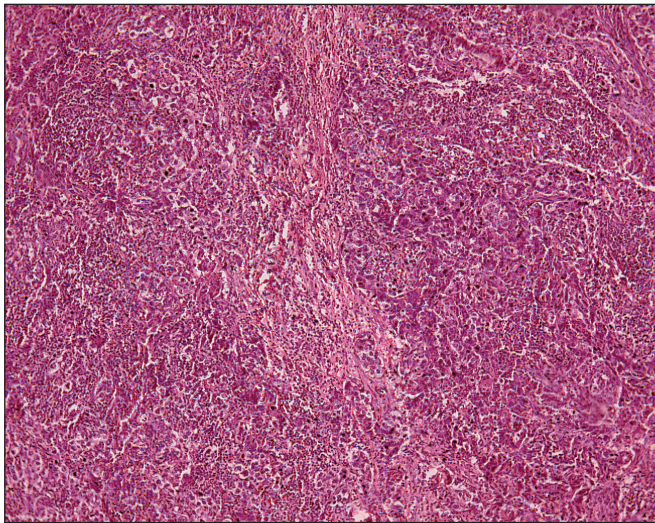


Fig 1. Stroma low (10%) invasive breast carcinoma. H&E, x10.

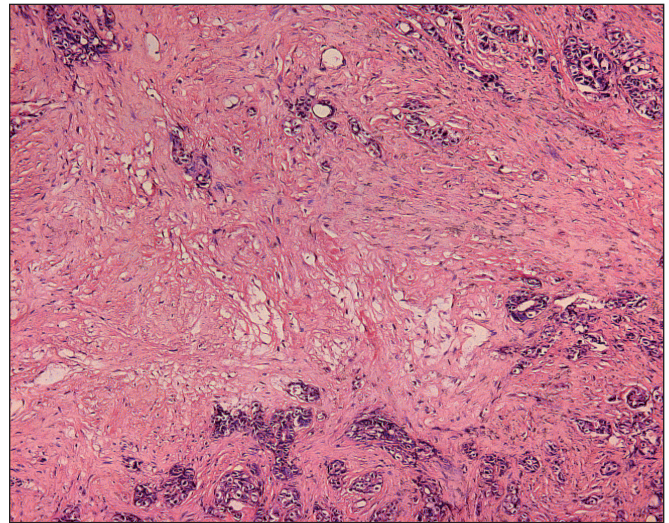


Fig 2. Stroma high (80%) invasive breast carcinoma. H&E, x10.

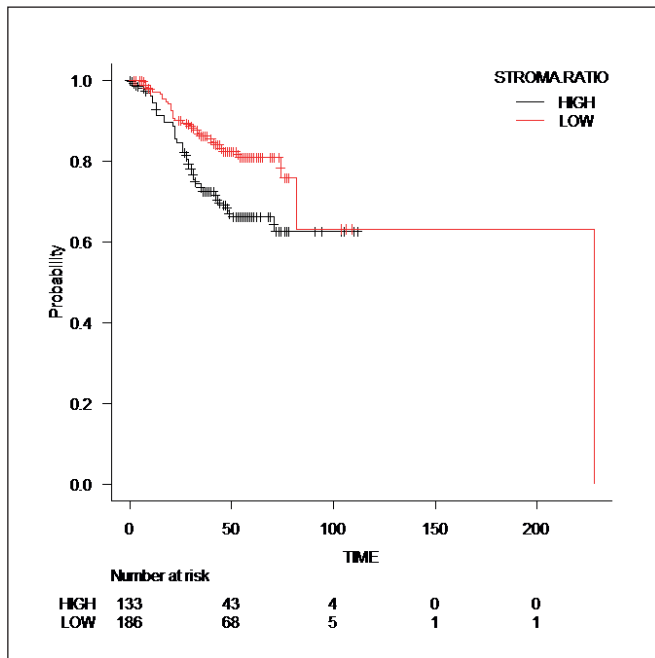


Fig.3. Kaplan-Meier curve for overall survival of patients stratified by tumor stroma ratio. P=0.008

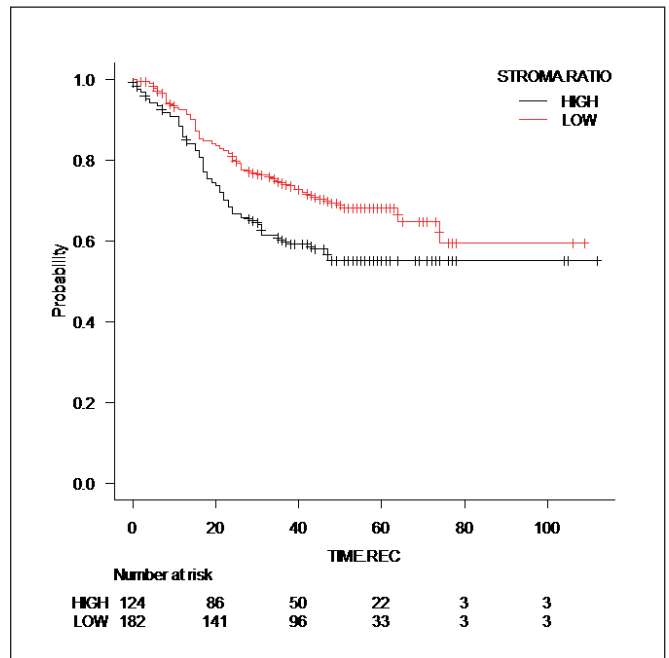


Fig 4. Kaplan-Meier curve for disease-free survival stratified by tumor stroma ratio. P=0.03

recurrent disease. The median follow-up period was 3.8 years (range from 0.3 to 9.3) for OS and 3.2 (range from 0.2 to 9.3) for DFS.

Tumors were categorized as stroma high (n=100) and stroma low (n=132) (figs 1, 2).

The three-year OS rate was $86.9 \pm 2.6\%$ for low TSR group and $75.3 \pm 3.9\%$ for high TSR group. The three-year DFS rate was $75.6 \pm 3.32\%$ for low TSR group and $61.3 \pm 4.54\%$ for high TSR group (Fig.3,4).

Kaplan-Meier curves statistically significantly showed relationship between TSR and overall and disease-free survival rates. Univariate analysis showed that stroma high tumors had statistically significantly worse OS (HR 1.89; 95% CI 1.18-3.03, p=0.008) and DFS (HR 1.55; 95% CI 1.05-2.28, p=0.027) (tables II, III).

After stepwise selection tumor size (pT), regional lymph nodes (pN) and tumor stroma ratio (TSR) were highlighted as parameters statistically significantly connected both to overall and disease-free survival (table IV, V).

TSR is an independent prognostic factor both in univariate and multivariate Cox regression analysis for OS and DFS.

TSR was assessed by two pathologists. In 25 cases (7.8%) there was no agreement in TSR at first individual assessment with kappa coefficient 0.84 which indicates overall good agreement. Kappa coefficient for TILS was 0.71, indicating good agreement as well. Second evaluation of debatable slides allowed to find consensus.

Tumor microenvironment which consist from cancer-associated fibroblasts, endothelial cells, pericytes and immune cell

Table 2. Univariate Cox regression analysis of factors predicting overall survival in triple negative breast cancer

Parameter	Univariate analysis		
	Hazard ratio	95% confidence interval	P -value
Age			0.580
<40			
40-60	1.2	0.47-3.04	0.705
60>	1.47	0.57-3.75	0.425
Grade			
Grade III			
Grade II	1.09	0.66- 1.81	0.738
Histological type			0.321
Lobular			
NST	0.517	0.22-1.2	0.000
Carcinomas with medullary features	0.000	0.26-4.2	0.995
Papillary carcinoma	1.049	0.25- 6.06	0.946
Others	1.219		0.808
Primary tumor			0.0006
T1			
T2	1.48	0.73-2.37	0.179
T3	4.4	2.04-11.36	0.0006
T4	3.4	3.26-7.44	0.002
Regional lymph nodes			0.003
N0			
N1	1.68	0.96-2.92	0.066
N2	2.9	1.6-5.27	0.0004
N3	3.038	1.33-6.93	0.008
Tumor stroma ratio			
High			
Low	1.89	1.18-3.03	0.008

Table 3. Univariate Cox regression analysis of factors predicting disease-free survival in triple negative breast cancer

Parameter	Univariate analysis		
	Hazard ratio	95% confidence interval	P -value
Age			0.097
<40			
40-60	0.9	0.38-2.14	0.827
60>	1.41	0.61-3.28	0.428
Grade			
Grade III			
Grade II	0.98	0.65- 1.47	0.916
Histological type			0.637
Lobular			
NST	0.613	0.28- 1.33	0.213
Carcinomas with medullary features	0.000	0.000	0.994
Papillary carcinoma	1.049	0.26-4.2	0.732
Others	1.102	0.28- 4.26	0.888
Primary tumor			0.000
T1			
T2	1.14	0.71-1.82	0.591
T3	5.75	2.93-11.3	0.000
T4	2.28	1.12-4.64	0.023
Regional lymph nodes			0.000
N0			
N1	1.62	1.00-2.61	0.049
N2	2.43	1.41-4.18	0.001
N3	2.39	1.10-5.00	0.026
Tumor stroma ratio			
Low			
High	1.55	1.05-2.28	0.027

Table 4. Multivariate Cox regression analysis of factors predicting overall survival in triple negative breast cancer with stepwise selection based on AIC

Parameter	Multivariate analysis		
	Hazard ratio	95% confidence interval	P value
Primary tumor (pT)			0.036
T1			
T2	1.24	0.68-2.27	0.292
T3	3.80	1.45-9.95	0.006
T4	2.09	0.83-5.24	0.113
Regional lymph nodes (pN)			0.035
N0			
N1	1.24	0.64-2.39	0.064
N2	2.16	1.05-4.45	0.058
N3	3.47	1.46-8.23	0.002
Tumor stroma ratio			
Low			
High	2.11	1.29-3.43	0.002

Table 5. Multivariate Cox regression analysis of factors predicting DFS in triple negative breast cancer with stepwise selection based on AIC

Parameter	Multivariate analysis		
	Hazard ratio	95% confidence interval	P value
Primary tumor (pT)			0.000
T1			
T2	1.002	0.62-1.64	0.986
T3	4.63	2.15-10.03	0.000
T4	1.05	0.44-2.48	0.915
Regional lymph nodes (pN)			0.003
N0			
N1	1.31	0.76-2.26	0.331
N2	2.32	1.25-4.32	0.007
N3	2.82	1.28-6.20	0.010
Tumor stroma ratio			
Low			
High	1.83	1.22-2.78	0.004

infiltration significantly influences on tumor invasion ability and potential for metastasis [18]. Stroma as a part of the TME can also be responsible for chemotherapy resistance and treatment failures as well as be an object of targeted therapy [19, 20]. According to Mierke et al. [21] the impact of the tumor stroma on cancer progression is controversial as there are two different and opposing effects within the stroma. On one hand, it can promote and enhance the proliferation, survival and migration of cancer cells as a result of increased stroma rigidity. On the other hand, the stroma acts as a “steric obstacle” for cancer cell motility in dense three-dimensional extracellular matrices, when the pore size is smaller than the cell’s nucleus.

Our study indicated that the tumor stroma ratio is an independent prognostic factor for triple negative breast cancer patients. Patients with high tumor stroma ratio statistically significantly show worse overall and disease-free survival compared to low tumor stroma ratio patients. Our results confirm results found in other studies investigating TSR in breast cancer patients.

Several studies show that biology of tumor associated stromal cells differs from their normal counterparts. In

particular, fibroblasts found in tumor stroma and named as cancer-associated fibroblasts (CAFs) are distinct from normal ones in their “activated phenotype” with enhanced production of collagen and growth factors [22]. They have more rapid proliferation rate and can promote breast cancer invasion and proliferation [23]. They also have another from normal fibroblasts phenotype. According to reverse Warburg effect, described by Pavlidis et al. [24], CAFs undergo myfibroblastic differentiation and secrete lactate and pyruvate. Epithelial cancer cells can take up these energy-rich metabolites and use them in the Krebs cycle, thereby promoting efficient energy production, resulting again in a higher proliferative capacity.

Mesenchymal stem cells (MSCs) which migrate toward tumor stroma also may change their functions. They incorporate into TME and become cancer-associated (CA-MSCs) and also contribute to tumor progression by different interaction with tumor cells. It has been shown that cross-talk between tumour cells and MSCs increases metastatic potential and promote epithelial-to-mesenchymal transition [25]. Previously MSCs have been reported

to have antitumor protective function including inhibition of angiogenesis, induction of tumor cell apoptosis and enhancement of immune response, but these effects are observed only when MSCs are used in higher ratios to tumor cells. The function of these cells is tissue dependent and naive MSC with antitumor effects can develop into CA-MSCs with pro-tumorigenic function. [26]

Still it is questionable whether biopsy is representative for TSR assessment. In our study only previously untreated operational material was investigated with concern that core biopsy can decrease opportunity for representative areas to be chosen. Study on esophageal adenocarcinomas [27] showed good reproducibility of tumor stroma ratio scoring in biopsies compared to operational material. But chemotherapy regimens are usually performed between biopsy and operational material in breast cancer patients obstructing such comparison.

Investigation of TSR doesn't require any additional costs and slide preparation and it is quite simple in methodology, that's why it can be easily added to routine breast cancer investigation. It can clarify prognosis of patients and probably expand treatment options in the future, that's why prospective cohort studies are needed to confirm eventually TSR value.

Our study has several limitations. Firstly, it is retrospective with prolonged time interval assessment (2009–2018) during which some treatment protocols have changed. Secondly, different chemotherapeutic agents were used, including regimens with taxanes, anthracyclins and platinum agents.

CONCLUSION

Tumor microenvironment influences tumor progression. Tumor stroma ratio can be easily evaluated on H&E. Tumor stroma ratio is a strong independent prognostic marker for triple negative breast cancer with worse overall and disease-free survival for tumors that contain much stroma.

REFERENCES

- Grybach S., Polishchuk L., Chekhun V. Analysis of the survival of patients with breast cancer depending on age, molecular subtype of tumor and metabolic syndrome. *Exp Oncol.* 2018; 40 (3): 243–248.
- Gonçalves H.Jr., Guerra M.R., Duarte Cintra J.R. et al. Survival Study of Triple-Negative and Non-Triple-Negative Breast Cancer in a Brazilian Cohort. *Clin Med Insights Oncol.* 2018; 12:1–10.
- Wahba H.A., El-Hadaad H.A. Current approaches in treatment of triple-negative breast cancer. *Cancer Biol Med.* 2015;12(2):106–116.
- Su S., Chen J., Yao H. et al. CD10(+)/GPR77(+)/Cancer-Associated Fibroblasts Promote Cancer Formation and Chemoresistance by Sustaining Cancer Stemness. *Cell.* 2018;172(4):841–856.
- Wang K., Ma W., Wang J. et al. Tumor-stroma ratio is an independent predictor for survival in esophageal squamous cell carcinoma. *J Thorac Oncol.* 2012;7(9):1457–61.
- Mesker W.E., Liefers G.J., Junggeburst J.M. et al. Presence of a high amount of stroma and downregulation of SMAD4 predict for worse survival for stage I-II colon cancer patients. *Cell Oncol.* 2009;31(3):169–78.
- Hale M.D., Hayden J.D., Grabsch H.I. Tumour-microenvironment interactions: role of tumour stroma and proteins produced by cancer-associated fibroblasts in chemotherapy response. *Cell Oncol (Dordr).* 2013;36(2):95–112.
- Provenzano P.P., Cuevas C., Chang A.E. et al. Enzymatic targeting of the stroma ablates physical barriers to treatment of pancreatic ductal adenocarcinoma. *Cancer Cell.* 2012;21(3):418–429.
- Dekker T.J., van de Velde C.J., van Pelt G.W. et al. Prognostic significance of the tumor-stroma ratio: validation study in node-negative premenopausal breast cancer patients from the EORTC perioperative chemotherapy (POP) trial (10854). *Breast Cancer Res Treat.* 2013; 139(2):371–9.
- Roeke T., Sobral-Leite M., Dekker T.J. et al. The prognostic value of the tumour-stroma ratio in primary operable invasive cancer of the breast: a validation study. *Breast Cancer Res Treat.* 2017;166(2):435–445.
- Moorman A.M., Vink R., Heijmans H.J. et al. The prognostic value of tumour-stroma ratio in triple-negative breast cancer. *Eur J Surg Oncol.* 2012; 38(4):307–13.
- Gujam F.J., Edwards J., Mohammed Z.M. et al. The relationship between the tumour stroma percentage, clinicopathological characteristics and outcome in patients with operable ductal breast cancer. *Br J Cancer.* 2014; 111(1):157–165.
- Kramer C.J., Vangangelt K.M., van Pelt G.W. et al. The prognostic value of tumour-stroma ratio in primary breast cancer with special attention to triple-negative tumours: a review. *Breast Cancer Res Treat.* 2019;173(1):55–64.
- Vangangelt K.M.H., Green A.R., Heemskerck I.M.F. et al. The prognostic value of the tumor-stroma ratio is most discriminative in patients with grade III or triple-negative breast cancer. *Int J Cancer.* 2020; 146(8):2296–2304.
- Greene F.L., Sobin L.H. A worldwide approach to the TNM staging system: collaborative efforts of the AJCC and UICC. *J Surg Oncol.* 2009;99: 269–272.
- Mesker W.E., Junggeburst J.M., Szuhai K. et al. The carcinoma-stromal ratio of colon carcinoma is an independent factor for survival compared to lymph node status and tumor stage. *Cell Oncol.* 2007;29(5):387–98.
- Kanda Y. Investigation of the freely available easy-to-use software 'EZ' for medical statistics. *Bone Marrow Transplant.* 2013; 48:452–458.
- Khamis Z.I., Sahab Z.J., Sang Q.X. Active roles of tumor stroma in breast cancer metastasis. *Int J Breast Cancer.* 2012;574025. doi:10.1155/2012/574025.
- Chen X., Song E. Turning foes to friends: targeting cancer-associated fibroblasts. *Nat Rev Drug Discov.* 2019; 18: 99–115.
- Plava J., Cihova M., Burikova M. et al. Recent advances in understanding tumor stroma-mediated chemoresistance in breast cancer. *Mol Cancer.* 2019;18: 67.
- Mierke C.T., Sauer F., Grosser S. et al. The two faces of enhanced stroma: Stroma acts as a tumor promoter and a steric obstacle. *NMR in Biomedicine.* 2017. e3831. doi:10.1002/nbm.3831.
- Raffaghello L., Dazzi F. Classification and biology of tumour associated stromal cells. *Immunology Letters.* 2015; 168(2): 175–182. doi:10.1016/j.imlet.2015.06.016.
- Eiro N., González L., Martínez-Ordoñez A. et al. Cancer-associated fibroblasts affect breast cancer cell gene expression, invasion and angiogenesis. *Cell Oncol (Dordr).* 2018;41(4):369–378. doi:10.1007/s13402-018-0371-y.
- Pavlidis S., Whitaker-Menezes D., Castello-Cros R. et al. The reverse Warburg effect: aerobic glycolysis in cancer associated fibroblasts and the tumor stroma. *Cell Cycle.* 2009;8(23):3984–4001. doi:10.4161/cc.8.23.10238.

25. Ahn S.Y. The Role of MSCs in the Tumor Microenvironment and Tumor Progression. *Anticancer Res.* 2020;40(6):3039-3047. doi:10.21873/anticancerres.14284.
26. Atiya H., Frisbie L., Pressimone C., Coffman L. Mesenchymal Stem Cells in the Tumor Microenvironment. *Adv Exp Med Biol.* 2020; 1234:31-42. doi:10.1007/978-3-030-37184-5_3.
27. Courrech Staal E.F., Smit V.T., van Velthuysen M.L. et al. Reproducibility and validation of tumour stroma ratio scoring on oesophageal adenocarcinoma biopsies. *Eur J Cancer.* 2011;47(3):375-382. doi:10.1016/j.ejca.2010.09.043.

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D – Writing the article, **E** – Critical review, **F** – Final approval of the article

ORIGINAL ARTICLE

RESEARCH OF PSYCHOLOGICAL READINESS OF DOCTORS TO ADAPTIVE TRAINING

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ABSTRACT

The aim: To empirically investigate the psychological readiness of physicians for adaptive learning during the acquisition of professional competences in the system of postgraduate medical education.

Materials and methods: We surveyed a sample of 148 physicians who began studying the discipline of Psychology of Conflict, which was specially developed by us on the principles of adaptive learning. There were three occupational groups among doctors: surgeons ($n = 47$), therapists ($n = 53$) and pediatricians ($n = 48$).

In the work a range of methods are used: content analysis, biblio-semantic, systematic approach, analysis of products of activity, psycho-diagnostic methods.

Results: When characterizing the identified and calculated integral indicators, the most pronounced for the entire study sample is the desire for dominance (85%), adaptation and emotional comfort at 75%. The lowest percentage of self-perception – 65%, slightly higher internality (68%). Acceptance of others at 78%.

In general, the dominant factor of the 148 physicians was service motivated, indicating that this group is truly focused on the benefit of their patients and others. Our researchers perceive their work as a service, as a means of being useful to people, society and humanity as a whole. This is an indicator of high readiness for adaptive learning in the postgraduate medical education system.

The results of the method of "Self-regulation style of behavior" by the doctors of the three medical specialties studied by us testify to their readiness for active inclusion in the system of adaptive training in postgraduate medical education.

Conclusions: Based on the results of our empirical study, we are able state that the doctors who participated in the study are ready for adaptive training in the system of postgraduate medical education. The results of our research can be basis for drafting recommendations for adaptive education, which can be grounded on a competent approach.

KEY WORDS: Adaptation Learning, Education, Readiness, Motive, Self-regulation

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INTRODUCTION

While educating modern physicians, medical education professionals face challenges that are fundamentally different from those of previous generations. Over the last few decades, changes in health care and the development of medicine have led to increased demands for educational material, leaving less time for teaching. Changes in care settings, from intensive care units to facilities for the support of people with chronic disorders, require appropriate adjustment in the educational field. Finding time to study such "new" areas as genomics, palliative care, geriatrics, or adjunct medicine can be a difficult task, especially when medical school curricula are already overloaded with "traditional" subjects.

Conventional teaching, centered on the teacher figure, has given way to a student-centered model that gives students control over their learning.

The prolonged progress in the psychological and pedagogical sciences opens the horizons of potential for improving medical education. This progress is relevant to almost all fields of medicine and is directly linked to the potential maximization of the benefits of modeling and implementing the latest technologies.

A key innovation in the training of health care professionals is modeling and other aspects of health education and is reflected in adaptive learning.

Adaptive learning technologies can optimize learning for each individual, integrate objective assessment throughout the learning process, and implement effective learning material acquisition criteria.

Until recently, it was considered that professionalism, as a matter of fundamental importance to medicine and society, should be absorbed directly throughout the period of medical education. As a result, most teachers in the medical disciplines were actively involved in the creation and implementation of structured programs (including postgraduate programs) training and assessment of professionalism, combined with the programs of professional retraining and development of the teaching corps itself.

Teaching and training of professionalism was positioned as one of the priority goals in higher educational establishments of medical education. Based on the experience and development of our understanding of the formation of a professional in the medical field, we believe that such an educational goal is too narrow and should be broadened and reformulated based on the notion of professional identity formation in the process of adaptive physician training.

Table I. Arithmetic mean values by the method of diagnostics of social and psychological adaptation of Rogers – Diamond

Nº	Indicators	Surgeons (n=47)	Therapists (n=53)	Pediatricians (n=48)	Overall (n=148)
1.	Adaptability	108	121	115	115
2.	Disadaptability	45	34	39	39
3.	Falsehood	3	4	2	3
4.	Self-acceptance	43	28	37	36
5.	Failure to accept oneself	9	15	12	12
6.	Acceptance of others	14	20	25	20
7.	Non-acceptance of others	26	15	7	16
8.	Emotional comfort	17	29	23	23
9.	Emotional discomfort	22	15	18	18
10.	Internal control	48	39	37	41
11.	External control	16	20	22	19
12.	Domination	14	10	8	11
13.	Conquest	9	12	15	12
14.	Escapism	8	16	11	12

THE AIM

To empirically investigate the psychological readiness of physicians for adaptive learning during the acquisition of professional competences in the system of postgraduate medical education.

MATERIALS AND METHODS

We surveyed a sample of 148 physicians who began studying the discipline of Psychology of Conflict, which was specially developed by us on the principles of adaptive learning. There were three occupational groups among doctors: surgeons (n = 47), therapists (n = 53) and pediatricians (n = 48).

In the work a range of methods are used: content analysis, biblio-semantic, systematic approach, analysis of products of activity, psycho-diagnostic methods.

RESULTS

The term “competency approach in medical education” became widespread in the early 2000s. despite its widespread use, however, there are differences in the use of appropriate terminology and related concepts. In our work, we will provide a brief historical overview of the term, focusing on a clear definition and measurement of the competence approach.

During the 1950s, R. Taylor established that medical training content (content) was delivered more effectively if it focused on clinical effectiveness [1]. Based on the works of R. Taylor, they have developed a concise description of the competency approach in medical education, distinguishing it from a subject-oriented and integrated curriculum on the following points:

1) The training is organized on the basis of the functions necessary for medical practice in a specific, defined environment

2) Belief that all medical students can master at least the basic learning goals

3) The belief that learning and learning processes can be empirically researched and measured [2].

According to researchers [2], the expected result of a competent approach in medical training is a healthcare professional who can practice medical practice at a certain specific professional level, according to local conditions and needs. As a result-oriented competency approach in medical education, much attention is paid to postgraduate education and training.

The word “competence”, most literally interpreted as “the ability or inability to do something successfully and / or effectively,” has often led to confusion among teachers. As the competency approach in education did not always fit within this definition, the term “competence” was rethought.

The Council of Education of the Netherlands has proposed [3] a definition of competency that includes six attributes: competence is specific, complex, sustainable, performance-oriented, mastered, and competencies are mutually dependent. This coincides with the later definition of researchers [4] who added that competencies should reflect external expectations and lead to behaviors that would be measured using absolute standards, that is, completely independent of the results and behavior of other students. Other authors have emphasized [5] that the ability to act successfully is to some extent dependent on the context of circumstances and events. A person may have competence in one context, for example, on a beautiful clear day in a well-equipped hospital, but may not have competence in another setting, such as during a nighttime rainstorm in a remote countryside in the complete absence of medication and equipment.

If we call the ability to work effectively in the entirety of the medical profession “Medical competence,” then med-

Table II. Percentages of integral indicators by the method of diagnostics of social and psychological adaptation of Rogers – Diamond

Nº	Integrated Indicators	Surgeons (n=47)	Therapists (n=53)	Pediatricians (n=48)	Overall (n=148)
1.	Adaptation	71	78	75	75
2.	Acceptance of others	74	81	78	78
3.	Internship	63	72	68	68
4.	Self-perception	60	69	65	65
5.	Emotional comfort	71	78	75	75
6.	Striving for domination	83	88	85	85

Table III. Arithmetic mean values by the method of investigation of the motivation of Shane's professional career.

Nº	Scales	Surgeons (n=47)	Therapists (n=53)	Pediatricians (n=48)	Overall (n=148)
1.	Professional competence	42,1	34,6	36,3	37,7
2.	Management	33,4	36,5	28,2	32,7
3.	Autonomy	29,3	28,3	24,5	27,4
4.	Stability (places of work and residence)	19,4	32,7	34,6	28,9
5.	Service	34,3	41,9	38,7	38,3
6.	Challenge	43,7	32,5	34,4	36,9
7.	Lifestyle integration	28,6	39,7	41,6	36,6
8.	Entrepreneurship	21,7	28,4	25,8	25,3

ical competence can be defined as a mastered, sustained, and measurable ability to perform a specific complex task that is part of the whole set of tasks that make up the medical profession as a whole. This is a generalized ability, the specific manifestations of which can vary greatly depending on the situational context. As defined by R. Epstein and E. Gundert [5], areas of competence are higher-level entities that encompass several competence units. For example, patient care will include competencies such as “ability to collect patient information”, “accurate medical examination” and “develop and implement a management plan”.

The following psycho-diagnostic techniques were used for the experimental study:

- 1) The method of diagnostics of social and psychological adaptation of Rogers – Diamond;
- 2) A technique for researching the motivation of Shane's professional career;
- 3) Questionnaire “Style of self-regulation of behavior”;
- 4) Questionnaire on implicit theories and learning goals K. Dwek.

According to the method of diagnostics of social and psychological adaptation of Rogers – Diamond, we surveyed our sample of 148 physicians who began the study of the discipline “Psychology of conflict”, which was specially developed by us on the principles of adaptive learning.

There were three occupational groups among doctors: surgeons (n = 47), therapists (n = 53) and pediatricians (n = 48). The results by the method are shown in table. I. and table. II.

The results obtained can be interpreted as follows. In general, the sample was diagnosed with low falsehood,

which means that the subjects were sincere in their answers (arithmetic mean 3 at norms from 18 to 36). Only on two scales – “Disadaptability” and “Non-acceptance” – the arithmetic mean went beyond the normative values, in particular in these cases were lower. This indicates the overall sufficiently high adaptability of the sample under study, as well as the tendency to accept oneself as they are.

If we analyze the results by groups of doctors (surgeons, therapists, pediatricians), we see the following picture. The least adapted surgeons (108), the most therapists (121). The value of pediatric adaptability is in line with the overall mean of the sample (115).

Surgeons (43) are more likely to accept themselves as they are, while therapists (28) are less likely too.

Pediatricians have the highest scores on acceptance by others (25), while surgeons have the lowest (14).

Therapists have the highest rates of emotional comfort (29), while surgeons have the lowest scores again on this scale (17).

Surgeons are most prone to internal control (48), while pediatricians are most important to external control (22).

Surgeons are most likely to be dominant (14), while pediatricians are least likely to be (8).

Therapists are more inclined to escapism (escape from problems) than representatives of other medical specialties (16), while for surgeons' escapism is the least characteristic (8).

If to characterize the revealed and calculated integral indicators, the most pronounced for the whole study sample is the desire for dominance (85%), adaptation and emotional comfort at the level of 75%, the lowest percentage of the total. adoption – 65%, slightly higher internality (68%). Acceptance of others at 78%.

Table IV. Arithmetic mean values of the Behavior Self-Regulation Questionnaire

Nº	Regulatory Scales	Surgeons (n=47)	Therapists (n=53)	Pediatricians (n=48)	Overall (n=148)
1.	Overall level of self-regulation	33,8	32,9	30,1	32,3
2.	Planning (PI)	5,3	7,1	6,2	6,2
3.	Modeling (M)	7,1	5,3	4,8	5,7
4.	Programming (PR)	6,2	4,8	3,6	4,9
5.	Score of results (SR)	5,7	6,5	6,7	6,3
6.	Flexibility (F)	4,3	6,3	5,2	5,3
7.	Independence (I)	7,2	5,6	6,1	6,3

In interpreting the data as a whole, it should be noted that, as a whole, the three study groups have adapted and ready for adaptive learning in the postgraduate medical education system.

However, some psychological peculiarities of adaptation of the studied groups revealed the necessity of individual approach and development of informational and psychological recommendations of adaptive training of doctors, which would be based on the data of psycho-diagnostic examination.

The results of the psycho-diagnostic experiment by the method of investigation of the motivation of Shane's professional career are presented in Table. III.

In interpreting the results of a psycho-diagnostic study by the method of examining the motivation of Shane's professional career, the following should be noted. Different profiles of professional motives and values have been identified for surgeons, therapists and pediatricians.

Surgeons (47) are most challenge oriented (43.7) and professional (42.1). This means that their core values are competition, overcoming obstacles and solving complex problems. The social situation can be perceived by such professionals in the win-lose dichotomy. In their professional activities, novelty, diversity and challenge are important to these people. At the same time, the value of professional competence indicates that the surgeons under study have the capabilities and talents in their professional field. They want to be masters of their business. They are particularly pleased with their success in their work. Such people can quickly lose interest in a job that does not allow them to develop their own abilities and talents. At the same time, recognition and a certain social status are important.

Therapists (53) are most ministry oriented (41.9). This means that the main values for them are "service to humanity", "desire to make the world a better place", "help to others" and so on. This orientation is very favorable in a person-to-person ergodic system, because the therapists we studied are primarily focused on the benefit of other people.

Pediatricians (48) have the most pronounced professional motivation for integrating lifestyles (41.6). This means that these professionals are focused on the unity and balance of different aspects of their lives. They do not want family, career or personal development to dominate – the main thing is that everything is in harmony. Such profes-

sionals value their lives more generally than a particular job or career.

The results of the psycho-diagnostic experiment by the method "Style of self-regulation of behavior" are given in Table. IV.

Surgeons have the highest overall level of self-regulation (33.8), according to the normative data such indicators refer to a high level of self-regulation. The lowest overall level of self-regulation in the sample has pediatricians (30,1), according to the normative data, these indicators refer to the average level of self-regulation. Therapists have an indicator of 32.9, which according to the normative data refers to the average level of self-regulation.

According to the "Planning (PL)" scale, the therapists have the highest rates. This scale refers to the individual self-regulatory characteristics of goal setting and the ability to reach the goal, as well as the formation of informed planning of activities.

The therapists our study shows have high scores on this scale, which testifies to the realistic detail, hierarchy and constancy of the plans, as well as independence in the pursuit of the goals of the activity.

The lowest arithmetic scores on this scale in surgeons (5,3), which, however, lie in the space of averages and can characterize both the surgeons we study and pediatricians (6,2) as quite prone to scheduling.

On the scale of "Modeling (M)" the highest rates at surgeons (7,1), and by normative values these indicators can be characterized as high. This indicates that the surgeons we study have an individual development of ideas about internal and external meaningful conditions, their degree of awareness, adequacy and detail. Surgeons studied by us are able to identify significant conditions for achieving the goal in the present as well as in the future, which is manifested in the conformity of professional actions to the plans of activity and compliance of the obtained results with the stated goals. The lowest arithmetic scores on the Modeling (M) scale in pediatricians (4,8), which, however, lie in the space of averages and can characterize both our pediatricians and therapists (5,3) as being very prone to modeling their own activities and detail the conditions and circumstances that can lead to meaningful goals.

On the "Programming (Pr)" scale, the highest rates for surgeons (6.2). However, these indicators lie within the

Table V. Arithmetic mean values by questionnaire of implicit theories and learning goals K. Dweck

Nº	Scales	Surgeons (n=47)	Therapists (n=53)	Pediatricians (n=48)	Overall (n=148)
1.	Adoption of the implicit theory of «increasing» intelligence	7,1	6,5	8,1	7,2
2.	Adoption of the implicit theory of «enriched» personality	4,5	5,2	4,3	4,7
3.	Acceptance of learning goals	5,3	4,8	5,2	5,1
4.	Self-esteem of the study	4,2	3,9	4,8	4,3

normative values of the average level of programming ability development. The therapists studied by us also have averages on this scale (4,8). And pediatricians have low rates (3,6). This indicates a general tendency of inability and unwillingness to think through the sequence of their actions. Low Programming (PR) scores are also indicative of an inability to form an agenda of action, a propensity to act through trial and error. Surgeons and therapists, on the other hand, are more inclined to consciously program their own actions.

On the scale of “Score of results” (SR), the highest scores are found in pediatricians (6,7). However, these indicators, like those of therapists (6,5) and surgeons (5,7), relate to the average level of development of the adequacy of self-assessment and the results of one's own behavior and professional activity.

On the “Flexibility (F)” scale, the highest rates are found in therapists (6,3), the lowest in surgeons (4,3), and in pediatricians, the arithmetic mean is 5,2. By normative values, all of these indicators are considered to be of medium level of regulatory flexibility, that is, the ability to readjust and adjust to the system of self-regulation according to changes in external or internal conditions. This means that all the doctors we study are characterized by an average level of plasticity in regulatory processes.

On the scale of “Independence (I)”, the highest rates are found in surgeons (7,2), the lowest in Therapists (5,6), and in pediatricians the arithmetic mean is 6,1. On this scale, the results of all three groups belong to the average level of development of regulatory autonomy.

This characterizes the moderate level of development of the ability to independently plan activities and behavior, to organize work to achieve this goal, to control the progress of work, to evaluate the intermediate and final results of the activity, in particular professional (in the medical field).

The results of the method of “Self-regulation style of behavior” by the doctors of the three medical specialties studied testify to their readiness for active inclusion in the system of adaptive training in postgraduate medical education.

The results of the psycho-diagnostic experiment according to the questionnaire of implicit theories and learning goals of K. Dweck are given in Table V.

Interpreting the results of the methodology, it should be noted that on the scale “Adopting the implicit theory of” incremental “intelligence” the highest results in pediatricians (8,1), the average of the study sample in surgeons (7,1), the lowest in therapists (6,5). This means that pediatricians are

somewhat more likely to have implicit perceptions that intellectual capacity is developing and growing, especially if one is in an enriched environment. It should also be noted that pediatricians are dealing with children and can clearly see the results of intellectual development, sometimes quite significant, over time.

Representatives of all three study groups of physicians, to a lesser extent, tend to believe that personality changes under the influence of circumstances and interaction with other people. The highest scores on the scale “Acceptance of the implicit theory of” enriched “personality” in therapists (5,2), lowest in pediatricians (4,3), average in surgeons (4,5). However, the difference between arithmetic averages is not significant. In general, our physicians are inclined to believe that personality enriches and develops in relationships with others, but these are moderate beliefs that relate less to ideas about personality development than to life-long intelligence. However, indicators on both scales suggest that there are implicit perceptions of “enriched” personality and “building up” intelligence, which is a good positive predictor of academic success and persistence. As with the previous methods, the results of the questionnaire of implicit theories and learning goals of K. Dweck testify to the readiness of our investigated physicians to adaptive learning in the system of postgraduate medical education.

The arithmetic mean across the sample of doctors on the Acceptance of Learning Goals scale is 5,1, with surgeons having the highest scores on this scale (5,3), while pediatricians average (5,2) and therapists lowest (4, 8). On the Self-Assessment of Learning scale, pediatricians have the highest values (4,8), the lowest in therapists (3,9), and among them are the values obtained in the sample of surgeons (4,2). This means that the sample we study sufficiently accepts the goals of the training, sufficiently positively assesses their own learning and is ready for the experimental education system in the form of adaptive physician training.

DISCUSSION

In interpreting the data in general, it should be noted that, as a whole, the three study groups are adapted and ready for adaptive education in the postgraduate medical education system. However, some psychological peculiarities of adaptation of the studied groups revealed the necessity of individual approach and development of informational and psychological recommendations of adaptive training of doctors, based on the data of psycho-diagnostic exam-

ination. Based on the above review, the implementation of the need for expert research on the effectiveness of the introduction of information and psychological component in the adaptive training of healthcare professionals motivates human behavior aimed at research and analysis new situations in the environment that arise with the emergence of new subjects and based on an emotional assessment of their relationships with other people, as well as their correlation with common values. It is argued that psychological adaptation is a process of motivating adaptive human behavior, the formation of goals and programs for its implementation, arising in response to the significant novelty of changes in the environment [1].

Significant changes in the thinking of higher education seekers cause the need for appropriate changes in their preparation for future professional activities. This is emphasized in the works of many researchers [2, 3, 5]. The outlined problem of using information and psychological components in adaptive education in the training of doctors in postgraduate education still remains unfinished. One of the ways to solve it can be the transition from traditional-subject to adaptive learning of such students. Therefore, it is necessary to select the leading principles of adaptive learning in order to implement them in the professional training of students in this field.

CONCLUSIONS

Our study groups are adapted and ready for adaptive education in the postgraduate medical education system. However, some psychological peculiarities of adaptation of the studied groups revealed the necessity of individual approach and development of informational and psychological recommendations of adaptive training of doctors, which would be based on the data of psycho-diagnostic examination.

The prospect of further research is related to the development of recommendations for adaptive physician training, based on a competency-based approach.

REFERENCES

1. Thayer McGahee, Maureen Bravo, Lisa Simmons, Tom Reid Nursing Students and Service Learning: Research From a Symbiotic Community Partnership With Local Schools and Special Olympics. *Nurse Educ.* Jul/Aug 2018;43(4):215-218.
2. Mulder M. Competence: the essence and use of the concept in ICVT. *European Journal of Vocational Training.* 2007; 40: 5–21.
3. De Bruijn E. Authentic and self-directed learning in vocational education: challenges to vocational educators. *Teaching and Teacher Education,* 2011; 27: 694–702.
4. Taconis R. The development of professional competencies by educational assistants in school-based teacher education. *European Journal of Teacher Education,* 2004; 27: 215–240.
5. Epstein R. Defining and assessing professional competence. *JAMA.* 2002; 287(2): 226–235.

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ORIGINAL ARTICLE

HEMOSTATIC POTENTIAL ASSESSMENT OF PATIENTS WITH LIVER CIRRHOSIS AND ATRIAL FIBRILLATION BY LOW-FREQUENCY PIEZOELECTRIC THROMBOELASTOGRAPHY

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ABSTRACT

The aim: Our aim was to assess the hemostatic potential of patients with liver cirrhosis and atrial fibrillation by LPTEG global coagulation assay, to investigate changes in LPTEG parameters according to the stage of liver cirrhosis and compare results with liver cirrhosis group.

Materials and methods: We performed a prospective cross-sectional study including 70 patients with liver cirrhosis and atrial fibrillation, 36 patients with liver cirrhosis and 20 healthy individuals. LPTEG parameters were measured using ARP-01M "Mednord" in order to assess coagulation abnormalities.

Results: t1 and Intensity of contact coagulation didn't differ ($p > 0,05$), Constant of thrombin activity was increased (47.53 ± 0.8 vs. 34.51 ± 1.88 , $p < 0.001$), t3 was reduced ($5,0 \pm 0.1$ vs. 6.7 ± 0.36 , $p < 0.001$), Intensity of coagulation drive was increased (52.8 ± 1.8 vs. 38.55 ± 1.54 , $p = 0.001$), Intensity of clot polymerization was increased (19.66 ± 0.28 vs. 16.29 ± 0.28 , $p < 0.001$), time t5 was reduced (32.94 ± 0.36 vs. 36.8 ± 1.30 , $p < 0.01$), Maximum amplitude was increased (655.7 ± 9.19 vs. 547 ± 19.38 , $p < 0.001$), Intensity of total coagulation was increased (19.41 ± 0.34 vs. $15,09 \pm 0.56$, $p < 0.001$), Intensity of clot retraction and lysis was increased (4.1 ± 0.07 vs. 3 ± 0.15 , $p < 0.001$) and Coefficient of total anticoagulant activity was increased (2.81 ± 0.05 vs. 2.48 ± 0.06 , $p < 0.001$) compared to liver cirrhosis.

Conclusions: In patients with liver cirrhosis and atrial fibrillation the hemostatic potential is significantly shifted towards hypercoagulation with a gradual worsening of coagulation disorders, starting from the compensated stage of liver cirrhosis.

KEY WORDS: liver cirrhosis, atrial fibrillation, LPTEG, hypercoagulation

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INTRODUCTION

Liver cirrhosis and atrial fibrillation are advanced chronic diseases that occupy a leading position in the structure of mortality and morbidity in the world. [1,2] According to the WHO, the prevalence of liver cirrhosis in the world is approximately 4.5%-9.5% of the total population and increases every year, despite the improvement and spread of vaccination programs, use of new methods of diagnosis and treatment of chronic liver diseases. [3] The course, complications and mortality rate due to liver cirrhosis are significantly influenced by concomitant diseases of the cardiovascular system, among which one of the most important is atrial fibrillation (AF). AF occurs in 1-2% (33.5 million) of the population and is one of the most common cardiac arrhythmias in the world, affecting mostly the elderly. [4,5] According to statistical data, AF is observed in 5% (95% CI:2.8-8.6) patients with liver cirrhosis, which is higher than the prevalence of AF in the general population and is accompanied by a higher levels of hospitalization, mortality and more frequent occurrence of ischemic stroke and acute renal failure compared with liver cirrhosis. [6,7]

Traditionally patients with liver cirrhosis were thought to be "auto-anticoagulated" and prone to bleeding. This theory was supported by changes in standard coagulation parameters, par-

ticularly the international normalized ratio (INR), prothrombin time (PT), and clinically – by frequent episodes of bleeding. However, during the last 15 years, more detailed data have emerged that more accurately explain the hemostasis process in chronic liver disease. For a long time, it was not taken into account that along with procoagulant factors the synthesis of physiologic anticoagulants such as antithrombin III, protein S and C are reduced, which leads the hemostasis to a new rebalanced state. [8,9,10] The balance of the system may shift towards thrombosis or bleeding depending on various clinical factors – infection, systemic inflammation, renal failure. [11] Atrial fibrillation is a well-known clinical factor that increases the level of thrombotic complications and can theoretically shift the state of hemostasis in patients with liver cirrhosis towards hypercoagulation, provoking various thrombotic complications. [12]

The common laboratory coagulation parameters available in practice focus on the assessment of isolated stages of hemostasis, mainly procoagulant factors, and do not take into account the compensatory mechanisms that balance this process. These tests are performed on plasma, not the whole blood, and thus do not reflect vWF levels, platelet function and other factors that contribute to blood clot formation. Because these methods do not allow to assess the complex

Table I. Clinical characteristics of patients with liver cirrhosis and AF, liver cirrhosis and healthy donors, number (%) or mean±SD.

Parameters	Liver cirrhosis and AF	Liver cirrhosis	Healthy donors
Age, years	68,3±1,08	58,3±1,45	61,4 ± 2,35
Sex:			
Male	46 (65,71%)	22 (61,11%)	14 (70%)
Female	24 (34,29%)	14 (38,89%)	6 (30%)
Etiology:			
Alcohol	28 (40%)	16 (44,4%)	n.a
HCV	4 (5,71%)	5 (13,89%)	n.a
HBV	7 (10,01%)	4 (11,12%)	n.a
NAFLD	19 (27,16%)	7 (19,48%)	n.a
Cardiac cirrhosis	3 (4,26%)	n.a	n.a
Combined	9 (12,86%)	4 (11,1%)	n.a
Child-Pugh score:			
A	25 (35,7%)	13 (36,1%)	n.a
B	31 (44,3%)	16 (44,4%)	n.a
C	14 (20%)	7 (19,45%)	n.a
Liver cirrhosis duration:			
Currently diagnosed	14 (20%)	n.a	n.a
1-5 years	23 (32,86%)	20 (55,6%)	n.a
6-10 years	28 (40%)	14 (38,9%)	n.a
>11 years	5 (7,14%)	2 (5,5%)	n.a
Antiagregants use:			
Clopidogrel	2 (2,86%)	2 (5,56%)	n.a
Aspirin	15 (21,43%)	8 (22,2%)	n.a
Anticoagulants use:			
Warfarin	17 (24,3%)	n.a	n.a
Dabigatran	n.a	n.a	n.a
Rivaroxaban	4 (5,71%)	n.a	n.a
Apixaban	1 (1,43%)	n.a	n.a
History of thrombotic events:			
Thromboembolic (MI, IS)	7 (10%)	1 (2,78%)	n.a
Splanchnic vein thrombosis	9 (12,85%)	3 (8,34%)	n.a
History of hemorrhagic events:			
GI bleeding	6 (8,57%)	3 (8,33%)	n.a
Epistaxis	5 (7,14%)	3 (8,33%)	n.a
Gingival bleeding	2 (2,86%)	1 (2,76%)	n.a

* MI-Myocardial infarction, IS – Ischemic stroke.

overall picture of rebalanced hemostasis in patients with liver cirrhosis, global methods of hemostasis are becoming increasingly popular, the main principle of which is to assess the clot strength during formation and dissolution in whole blood. [13,14,15] They provide assessment of whole blood coagulation at a more global and clinically feasible level, as they can be performed quickly, in minutes, and therefore rapidly correct a variety of hemostasis disorders. One of such methods is low-frequency piezoelectric thromboelastography (LPTEG). The advantages of LPTEG compared to other VETs are the abilities to assess aggregation activity of thrombocytes, fibrinolytic system, physiological anticoagulant activity and total hemostatic potential of whole blood at any time during the process and specific sample without use of sodium citrate or other components that may affect the result. Also, LPTEG is a completely standardized test with a general sensitivity of all devices' measurements, validated by the manufacturer, which has a certain algorithm for assessing the hemostatic profile, which simplifies its use in clinical settings. [16] There are

currently no data on the effect of AF on hemostasis in patients with liver cirrhosis, assessed by global assays of coagulation.

THE AIM

In the present study, we aimed to assess the hemostatic potential of patients with liver cirrhosis and atrial fibrillation by LPTEG and to investigate changes in parameters depending on the severity of liver cirrhosis A, B, C according to Child-Pugh score compared to liver cirrhosis and control.

MATERIALS AND METHODS

PATIENTS AND STUDY PROCEDURE

We performed a prospective single-center cross-sectional study at the department of internal medicine №1 of Bogomolets National Medical University, Kyiv, Ukraine, using database from departments of Internal Medicine, Gastroenterology,

Table II. LPTEG parameters in patients with liver cirrhosis and AF, depending on the Child-Pugh score. (M ± m)

Parameters, units	Healthy donors, n=20	Total, n=70	Class A, n=25	Class B, n=31	Class C, n=14
t ₁ , min.	1,22±0,13	0,7±0,03*	0,9±0,03	0,6±0,03*#	0,4±0,04*#
ICC, cu.	23,63±1,0	34,58±0,77*	29,15±0,48	35,55±0,46*#	41,53±0,52*#
CTA, cu.	31,31±1,41	47,53±0,8*	42,41±0,68*	46,6±1,02*#	56,18±1,45*#
t ₃ , min.	6,72±0,28	5,0±0,1*	5,76±0,08	4,87±0,08*#	3,9±0,14*#♦
ICD, cu.	34,37±1,14	52,8±1,8*	46,06±1,06	54,18±1,0*#	73,38±1,63*#♦
ICP, cu.	17,08±0,45	19,66±0,28*	17,46±0,27	20,23±0,25*#	22,3±0,43*#
t ₅ , min.	36,82±1,26	32,94±0,36*	32,5±0,47*	33,56±0,33	32,34±0,53*
MA, cu.	536,3±11,92	655,7±9,19*	589,8±9,29	668,6±9,09	744,8±17,29
ITC, cu.	17,91±0,66	19,41±0,34*	18,15±0,16	19,96±0,29*#	22,94±0,55*#♦
ICRL, %	0,41±0,04	4,1±0,07*	3,73±0,13*	4,11±0,07*	4,74±0,1*#♦
CTAA, cu.	2,17±0,11	2,81±0,05*	2,65±0,07*	2,68±0,05*	3,39±0,08*♦

* - significance of statistical difference compared to healthy donors, p<0,05

- significance of statistical difference compared to class A, p<0,05

♦ - significance of statistical difference compared to class B, p<0,05

Table III. LPTEG parameters in patients with liver cirrhosis, depending on the Child-Pugh score. (M ± m)

Parameters, units	Healthy donors, n=20	Total, n=36	Class A, n=13	Class B, n=16	Class C, n=7
t ₁ , min.	1,22±0,13	0,7±0,04*	0,9±0,05	0,6±0,04*	0,3±0,06*#
ICC, cu.	23,63±1,0	34,25±0,84*	29,52±0,72	36,4±0,88*	41,29±0,97*#
CTA, cu.	31,31±1,41	34,51±1,88	30,29±1,48	31,89±2,21	48,34±5,45*#♦
t ₃ , min.	6,72±0,28	6,7±0,36	7,3±0,63	6,86±0,22	4,54±0,26*#♦
ICD, cu.	34,37±1,14	38,55±1,54	34,95±1,35	38,52±0,88	53,59±1,56
ICP, cu.	17,08±0,45	16,29±0,28	15,22±0,43	16,34±0,33	18,62±0,47*♦
t ₅ , min.	36,82±1,26	36,8±1,30	36,8±2,24	37,35±2,11	35,69±1,66
MA, cu.	536,3±11,92	547±19,38	537,2±11,78	547±34,89	607,7±40,99
ITC, cu.	17,91±0,66	15,09±0,56	14,95±0,91	14,4±0,86	19,05±1,89
ICRL, %	0,41±0,04	3±0,15*	2,34±0,11*	3,18±0,16*	3,78±0,49*
CTAA, cu.	2,17±0,11	2,48±0,06	2,36±0,09	2,38±0,07	2,89±0,13*#♦

* - significance of statistical difference compared to healthy donors, p<0,05

- significance of statistical difference compared to class A, p<0,05

♦ - significance of statistical difference compared to class B, p<0,05

Hepatology and Infectious Diseases of several city hospitals. Initially we screened database between July 2020 and December 2020 for patients with determined diagnose of AF assessed by experienced cardiologists and among them we searched for patients with established diagnosis of liver cirrhosis or signs of chronic liver disease, such as elevated liver transaminases more than 3 times and bilirubin level associated with history of chronic alcohol consumption, presence of viral hepatitis serologic markers and risk factors for NAFLD. All selected patients were investigated by transient liver elastography by Soneus P7 UltraSign, Ukraine device at our department and stage of fibrosis was determined according to METAVIR score. Finally, we included 70 patients with liver cirrhosis and AF (I group), 36 patients with liver cirrhosis (II group) as comparison group and 20 healthy persons as control group. All participants were assessed and distributed according to

severity of liver cirrhosis by Child-Pugh score. We excluded patients with hereditary or acquired coagulopathies of other etiologies, systemic connective tissue diseases, cancer and HIV infection. Participants who were included in this study gave their written informed consent. The study was approved by the local Ethical Committee (14.11.2019, protocol session №3) and conducted according to the Declaration of Helsinki. All patients were asked to stop taking any anticoagulants and antiagregants for 3 days before the examination. Patients baseline characteristics are described in Table I.

ASSESSMENT OF LPTEG PARAMETERS

LPTEG parameters were assessed by the portable device ARP-01M "Mednord". LPTEG is a global coagulation assay that measures changes of the viscoelastic properties of the blood clot

during the process of fibrin polymerization and formation of cross-molecular bonds, its retraction and subsequent lysis. The analysis of the LPTEG graphical image is based on the changes in the relative values of the viscoelastic properties of blood (Ai) that occur during coagulation. The dynamics of the studied process – the transition of blood during coagulation from liquid to viscoelastic state – is determined and recorded as an integrated curve LPTEG, each point of which (Ai) is determined by the system at a particular time (ti). [16,17] During the study, the following LPTEG parameters were measured and analyzed:

- t_1 , min – Reaction time (time in minutes from the beginning of the study to reaching the minimum amplitude of LPTG – A1). Reference values $t_1 = 0.8$ (0.6-1.3);
- Intensity of contact coagulation (ICC), conventional units (cu)
 - this parameter reflects mainly the aggregation activity of platelets and other blood cells, ICC reference values = 26 (16-36);
- Constant of thrombin activity (CTA), cu – a universal criterion for estimating the intensity of the proteolytic stage of fibrin formation and thrombin generation activity. Reference values of CTA = 30 (25-40).
- t_3 , min. – Blood clotting time (gel point). Reference values of $t_3 = 7.4$ (5.9-9.0).
- Intensity of coagulation drive (ICD), cu – the resulting parameter of the intensity of the proteolytic stage of blood clotting. ICD reference values = 38 (28-46).
- Intensity of clot polymerization (ICP), cu – characterizes the whole process of changing viscoelastic properties of the clot during polymerization of fibrin and formation of transverse intermolecular (covalent) bonds. Reference values of ICP = 18.5 (15.4-22.5) for 10 minutes.
- Maximum amplitude (MA), cu – describes the maximum clot density due to platelet activity, and quantitative / qualitative characteristics of fibrin polymerization. Reference values of MA = 510 (450-650)
- t_5 , min. – time to reaching the maximum amplitude of LPTEG. Reference values of $t_5 = 30.7$ (23.3-39).
- Intensity of total coagulation (ITC), cu – characterizes the general trend of coagulation due to the platelet aggregation capacity, activity of the proteolytic stage of coagulation and maximum clot amplitude. Reference values of ITC = 17.04 (14.68-20.12).
- Intensity of clot retraction and lysis (ICRL), %. – describes the activity of the fibrinolytic system. Reference values of ICLR = 0.29 (0.27-2.3) %.
- Coefficient of total anticoagulant activity (CTAA), cu – total anticoagulant activity of blood due to serine protease inhibitors, coenzyme inhibitors (proteins C, S, thrombomodulin), inhibitors of active complexes (TFPI), Reference values of CTAA = 2,2 (1,8-2,5).

Blood sampling was performed from a vein with a 1.0 ml three-component silicone syringe with a rubber cuff. The obtained blood sample was immediately placed in a 0.45 ml cuvette during 30 seconds and the study was started.

STATISTICAL ANALYSIS

Statistical analysis was performed using the Excel for Windows and IBM SPSS Statistics software package.

Methods of parametric and nonparametric statistics were used. The distribution of quantitative values was assessed using the Kolmogorov – Smirnov criterion. Student's t-test was used to compare the mean values of the parameters for 2 independent samples with normal distribution, and Mann-Whitney U test for not normally distributed values. The nonparametric Kruskal-Wallis test was used for multiple comparisons.

RESULTS

Parameters of LPTEG were obtained and analyzed in all patients with liver cirrhosis and AF depending on the severity of cirrhosis according to Child-Pugh score and compared to similar parameters of patients with liver cirrhosis and healthy individuals. (Table II. and Table III).

Reaction time (t_1) was significantly reduced compared to control, and ICC parameter was substantially increased ($p < 0.001$). There was a significant reduction in t_1 time and an increase in ICC between controls and Child-Pugh classes B, C, $p < 0.01$, as well as a gradual reduction in t_1 and an increase in ICC with worsening liver cirrhosis. The mean values of t_1 and ICC between 2 groups were at the same level and did not differ statistically ($p > 0.05$). The mean levels of CTA in patients with liver cirrhosis and AF were higher than in control group and group of liver cirrhosis ($p < 0.001$). A significant difference was found between healthy individuals and patients of classes A, B, C by Child-Pugh score ($p < 0.01$), with a gradual increase in CTA as the severity of liver dysfunction progresses. The mean Blood clotting time (t_3) was significantly reduced compared to healthy individuals and liver cirrhosis group ($p < 0.001$). T_3 of class A did not differ from the t_3 of normal individuals ($p = 0.823$) and gradually decreased with increasing severity of liver cirrhosis, $p < 0.01$. ICD was significantly increased compared to control ($p < 0.001$) and compared to liver cirrhosis ($p = 0.001$). The mean level of ICD had a tendency to increase with worsening liver dysfunction ($p < 0.05$). ICP parameter was substantially increased compared to healthy individuals and liver cirrhosis ($p < 0.001$) The ICP gradually increased, gaining a statistically significant difference between control and classes B, C, $p < 0.01$ and between classes A and C according to Child-Pugh score, $p < 0.01$. MA was significantly increased compared to control and liver cirrhosis ($p < 0.001$) There was a tendency to increasing of MA from class A to C, $p < 0.01$. T_5 time was slightly reduced compared to control and liver cirrhosis group ($p < 0.01$). t_5 differed statistically only between control and Child-Pugh classes A, C ($p < 0.01$). The general coagulation trend ITC was increased compared to healthy individuals ($p < 0.01$) and liver cirrhosis ($p < 0.001$) and exceeded the reference values, increasing with the progression of the severity of liver cirrhosis, indicating a state of hypercoagulation ($p < 0.01$). ICRL was significantly increased compared to control and liver cirrhosis ($p < 0.001$) Fibrinolysis activity increased with increasing severity of liver cirrhosis, obtaining a statistical difference between Child-Pugh classes A and C, $p < 0.01$. CTAA was significantly increased compared

to healthy individuals and liver cirrhosis ($p < 0.001$). There was a substantial statistical difference between the control and Child-Pugh classes A, B, C ($p < 0.01$), a slight difference between classes B and C ($p = 0.49$).

DISCUSSION

In this prospective cross-sectional study of patients with liver cirrhosis and atrial fibrillation we investigated LPTEG parameters and found out that all patients had obvious coagulopathy abnormalities at primary, secondary and fibrinolytic stages of hemostasis compared to healthy donors and liver cirrhosis. Particularly, at the primary stage we observed increased aggregation of platelets and decreased rheological blood stability. As parameters of aggregation activity t_1 and ICC were almost the same in patients of 2 groups, we made a conclusion that AF has no effect on platelet aggregation activity and such suggestion explains the low effectiveness of antiplatelet drugs for prevention of thrombotic complications in patients with AF. [18,19]

Significant activation of secondary stage of coagulation and thrombin generation was observed due to an increase in the CTA parameter. The intensity of coagulation is largely determined by the activity of thrombin, which is the main enzyme activator of the whole coagulation process, as it participates in the conversion of fibrinogen to fibrin, activates platelets, coagulation factors V, VIII, XIII, tissue plasminogen factor, and, furthermore, participates in systemic inflammation. [20] In patients with liver cirrhosis and AF intensive thrombin generation was observed at all stages according to Child-Pugh, the cause of which is currently unknown. However, AF alone may be associated with decreased ability to activate protein C due to decreased thrombomodulin expression on the background of structural changes in the left atrium. [21] Hyperfibrinolysis in patients with liver cirrhosis can be explained by the reduced synthesis of thrombomodulin and reduced activity of fibrinolysis inhibitors (TAFI), which inhibit the conversion of plasminogen to plasmin and is further exacerbated by atrial fibrillation. [22]

The existing evidence on coagulation process in patients with liver cirrhosis and AF is quite limited and we made first steps in understanding these complex hemostasis alterations.

Our study has limitations. The mean age of patients with liver cirrhosis and AF is not completely comparable with the age of patients with liver cirrhosis, because on average the I group of patients is older than II by 10 years (68.3 ± 1.08 vs. 58.3 ± 1.45). Also, in our study, we did not investigate differences in hemostatic potential depending on gender, age, etiology of liver cirrhosis. Therefore, we assume that these factors may have influenced the result.

CONCLUSIONS

Patients with liver cirrhosis have a normal hemostatic potential with a slight shift towards hypercoagulation at the stage of decompensation. When associated with AF, hemostatic

potential shifts significantly in the direction of hypercoagulation with a gradual worsening of coagulation disorders, starting from the compensated stage of cirrhosis severity. We showed that global coagulation assays can more precisely describe complex alterations in hemostasis in patients with liver cirrhosis and AF and should be commonly implemented in routine clinical practice along with conventional coagulation parameters. Some LPTEG parameters as CTA can be a promising biomarkers for identifying individuals with increased thrombotic risk and anticoagulant treatment should be considered as a benefit option for this population

REFERENCES

- Roth G.A., Abate D., Abate K.H. et al. Global, regional, and national age-sex-specific mortality for 282 causes of death in 195 countries and territories, 1980–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet*. 2018;392(10159):1736-1788
- Asrani S.K., Devarbhavi H. Burden of liver diseases in the world. *J Hepatol*. 2019; 70(1):151-171.
- Sarin S.K., Maiwall R. Global Burden Of Liver Disease: A True Burden on Health Sciences and Economies. *World Gastroenterology Organisation*. <https://www.worldgastroenterology.org/publications/e-wgn/e-wgn-expert-point-of-view-articles-collection/global-burden-of-liver-disease-a-true-burden-on-health-sciences-and-economies>.
- Munger T.M., Wu L.Q., Shen W.K. Atrial Fibrillation. *JBR*. 2014; 28(1):1-17.
- Chung M.K., Eckhardt L.L., Chen L.Y. et al. Lifestyle and Risk Factor Modification for Reduction of Atrial Fibrillation: A Scientific Statement from the American Heart Association. *Circulation*. 2020; 141 (16): 750-772.
- Darrat Y.H., Smer A., Elayi C.S. et al. Mortality and morbidity in patients with atrial fibrillation and liver cirrhosis; *World J Cardiol*. 2020; 12(7): 342–350.
- Chokesuwattanaskul R., Thongprayoon C., Bathini T. Epidemiology of atrial fibrillation in patients with cirrhosis and clinical significance: a meta-analysis. *Eur J Gastroenterol Hepatol*. 2019;31(4):514-519.
- Khoury T., Ayman A.R., Cohen J. et al. The Complex Role of Anticoagulation in Cirrhosis: An Updated Review of Where We Are and Where We Are Going. *Digestion*. 2016;93:149-159.
- Zermatten M.G., Fraga M., Moradpour D. et al. Haemostatic alterations in cirrhotic patients: from primary haemostasis to fibrinolysis. *Hepatology*. 2020; 71:2135-2148.
- Forkin K., Colquhoun D., Huffmyer J. The Coagulation Profile of End-Stage Liver Disease and Considerations for Intraoperative Management. *Anesthesia & Analgesia*. 2018;126 (1):46-61.
- Harrison M.F. The Misunderstood Coagulopathy of Liver Disease: A Review for the Acute Setting. *West J Emerg Med*. 2018;19(5): 863–871.
- Kaski J.C., Arrebola-Moreno A.L. Inflammation and Thrombosis in Atrial Fibrillation. *Rev. Esp. Cardiol*. 2011;64(7):551-553.
- Benes J., Zatloukal J., Kletecka J. Viscoelastic Methods of Blood Clotting Assessment. A Multidisciplinary Review. *Front Med (Lausanne)*. 2015;2:62.
- Hans G.A., Besser M.W. The place of viscoelastic testing in clinical practice. *BJHaem*. 2016;173(1):37-48.
- Shen L., Tabaie S., Ivascu N. Viscoelastic testing inside and beyond the operating room. *J Thorac Dis*. 2017;9(4):299–308.
- Tutrin I., Udut V. Nizkochastotnaya pyezetromboelastografiya tselnoy krovi: algoritmy diagnostiki i korrektsii gemostaziologicheskikh rasstroystv. [Low-frequency piezoelectric thromboelastography of whole blood: algorithms for diagnostics and correction of hemostasis disorders]. Tomsk: Publishing House of Tomsk State University. 2016:13-58. (In Russian).

17. Tarabrin O., Shcherbakov S., Gavrychenko D. et al. Low-Frequency Piezoelectric Thromboelastography Vs Platelet Aggregation Test, Standard Coagulation Tests and Thromboelastography. *Anesthesia & Analgesia*. 2016;123(3):173.
18. Sardana M., Hwang S.J., Puurunen M.K. et al. Association of platelet aggregation with atrial fibrillation: The Framingham Offspring Study. *J Am Coll Cardiol*. 2018;71 (11).
19. Manaktala R., Kluger J. Role of Antiplatelet Therapy in Stroke Prevention in Patients with Atrial Fibrillation. *J Am Osteopath Assoc*. 2017;117(12):761-771.
20. Crawley J., Zanardelli S., Chion A. The central role of thrombin in hemostasis. *Journal of Thrombosis and Haemostasis* 2007;1(1):95-101.
21. Cervero J., Montes R., Espana F. et al. Limited ability to activate protein C confers left atrial endocardium a thrombogenic phenotype. A role in cardioembolic stroke? *Stroke*. 2011;42(9): 10.1161/STROKEAHA.111.614420.
22. Colucci M., Binetti B.M., Branca M.G. et al. Deficiency of thrombin activatable fibrinolysis inhibitor in cirrhosis is associated with increased plasma fibrinolysis. *Hepatology*.2003;38:230–237.

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ORIGINAL ARTICLE

SUBSTANTIATION OF COMPONENTS OF AVAILABILITY AND INTEGRATION OF PRIMARY HEALTH CARE ASSOCIATED WITH AMBULATORY CARE SENSITIVE CONDITIONS IN UKRAINE

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ABSTRACT

The aim: Identifying the components of availability of Primary Health Care (PHC) and integration between PHC and secondary Health care (SHC) which need strengthening to reduce the rate of Ambulatory Care Sensitive Hospitalizations (ACSH) in Ukraine.

Materials and methods: The study was conducted in two stages: the focus of interviewing experts on the list of components of the availability of PHC and its integration with SHC; survey of our questionnaire is based on the results of the first stage of the study. The responses of 93 respondents – 20 experts and 73 general practitioners/family doctors – were analyzed using descriptive and analytical statistics.

Results: There were identified 14 components of PHC availability and 8 integration components of PHC with SHC, their quantitative value (in points) of impact on ACSH. The informativeness of components is confirmed by the agreement of opinions of experts on their list (concordance coefficient $W = 0.75-0.87$; $p < 0.01$) and the reliable correlations of scores of impact assessments of the identified components with overall values of the impact availability PHC and the integration between PHC and SHC on the ACSH.

Conclusions: The results of the study can be used to develop an action plan for reform of PHC, the implementation of which will reduce rates hospitalizations of Ambulatory care sensitive conditions and increase the efficiency use of limited resources of health care system of Ukraine.

KEY WORDS: Ambulatory care sensitive conditions, Ambulatory Care Sensitive Hospitalizations, Primary Health Care, Ukraine

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INTRODUCTION

At the present stage of development of health care systems, it is considered proven that strengthening primary health care (PHC) allows not only to have a positive impact on public health but also to reduce overall health care costs and increase its efficiency by reducing the number of hospitalizations [1].

An important direction in the development of policies to prevent hospitalization is the impact on ambulatory care sensitive conditions (ACSCs). According to the WHO, these are «conditions for which hospitalizations can be avoided by timely and effective care in ambulatory settings» [2], first of all, at the level of PHC.

Studies conducted in different countries indicate the possibility of some control over the hospitalization of patients with ACSC. Thus, in Canada for the period from 2006-2007 to 2011-2012, the level of hospitalization of the population aged 0-74 years from ACSCs decreased from 8.96‰ to 6.33‰ [3], in Brazil from 2001 to 2016. – from 12.0‰ to 6.6‰ [4].

The results of our previous studies show that in Ukraine, with the strengthening of PHC, it is possible to reduce the rate of Ambulatory Care Sensitive Hospitalizations (ACSH) for adult population by 28.2% – 32.9% [5].

However, the evidence for the effectiveness of interventions that reduce hospitalizations for ACSCs is rather

limited. Among the medical predictors of reduced hospitalizations for ACSH in international studies, the availability of PHC and the integration of primary and secondary care levels are highlighted [6]. In Ukraine, research on the components of the impact on these characteristics of medical services has not been conducted, which caused the relevance of this work.

THE AIM

The aim of the study is to identify the main components of the availability of Primary Health Care (PHC) and the integration between primary and secondary care levels which need to be strengthened to reduce the rates of Ambulatory Care Sensitive Hospitalizations or ACSH in Ukraine.

MATERIALS AND METHODS

There are two stages in the study. The first stage was to determine a set of main components of the availability of primary health care (PHC) and the integration of primary and ambulatory specialized – secondary health care (SHC) related to ambulatory care sensitive conditions (ACSCs); the second one – to assess the potential impact of identified components on the prevention of ACSHs. The list of main components (Stage 1) was developed using

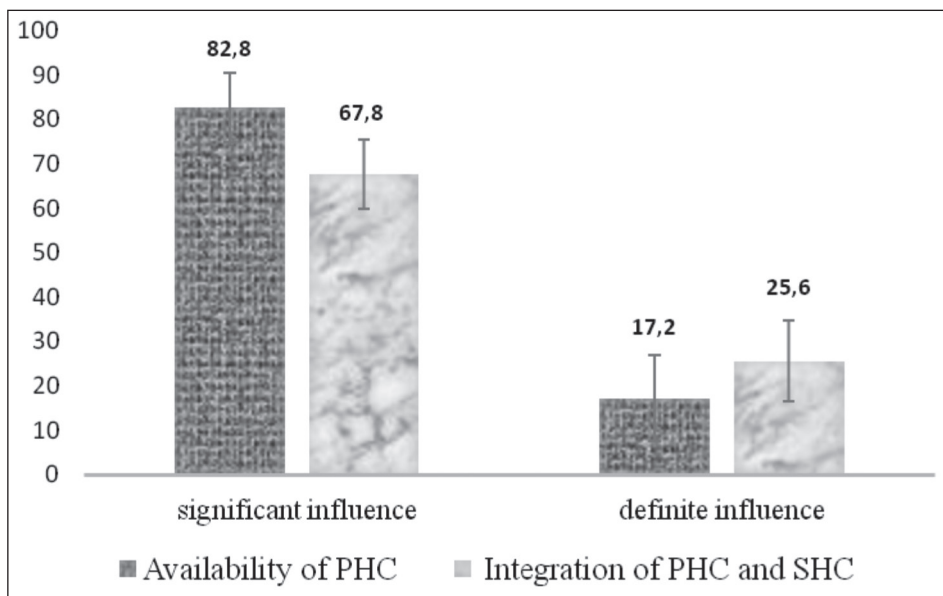


Fig. 1. Respondents' assessment of the significance of the impact of PHC availability and integration between primary and secondary care levels on prevention of ambulatory care sensitive hospitalizations (ACSH)

the focused interview method. First of all, based on the analysis of literature sources [7], we developed a list of 21 components to characterize the availability of PHC and 14 components – to assess the coordination between primary and secondary care levels. Further, there were some interviews conducted in 2 distance focus groups formed from the number of general practitioners/family doctors (GP/FD) and PHC managers, numbering 10 people each. The focus group participants were members of the board of the Ukrainian Family Medicine Association.

Inclusion in the focus groups took place after testing the competence of potential respondents for ACSHs according to the method of B.E. Grabovetsky [8]. Only respondents who received a threshold score of at least 0.8 were confirmed as those who demonstrated high compliance survey requirements and continued to be referred to in this study as experts. The interviews were conducted in several rounds until the experts agreed.

Materials for the second stage of the analysis were obtained from the responses to the survey based on our questionnaire, which proposed to assess on a 10-point scale the potential impact of selected components on prevention of ACSH. The survey was conducted among the most active members of the association of family doctors of Dnipropetrovsk region (73 answers from 90 doctors, 84% of the response) and 20 experts identified in the first stage of the study. A total of 93 people took part in the survey..

Involved physicians had an average work experience of 10 (Me 7.0; 25.0) years, 54.8% of those who work in the urban area, 45.2% – in rural settlements; experts had an average work experience of 15.0 (7.0; 25.0) years, 100% of respondents worked in urban settlements. There were no differences between the selected groups by work experience ($p > 0.05$), but at their place of work, there were statistically significant differences ($p = 0.001$). It was taken into account in the subsequent analysis of the results.

Statistical processing of data was performed with STATISTICA 6.1 (StatSoft Inc, serial number AGAR909E415822FA).

To describe the normal distribution of the sample data we used the arithmetic mean (M) with a 95% confidence interval (95% CI); for asymmetric distribution we used median (Me) with interquartile range (25%; 75%). For relative values, 95% CI was calculated using adjusted Wald method. Methods of statistical analysis included estimating the statistical significance discrepancies by Mann-Whitney test for unrelated samples; Wilcoxon test for related samples, and by Pearson's Chi-square (χ^2) test. For multiple comparisons of variables, we used a nonparametric Kruskal-Wallis analysis of variance.

The relationships between the variables were evaluated using rank correlation analysis with Spearman correlation coefficients (r_s). The concordance coefficient (W) was used as statistics of agreement of opinions. The critical value of statistical significance for all types of analysis was taken at the level of $p < 0.05$.

The study has a positive response on the use of research methods from the commission on bioethics (minutes of the meeting of the commission on biomedical ethics of the SI Dnipropetrovsk Medical Academy of Health Ministry of Ukraine №8 from 20.01.2021).

RESULTS

According to the total number of respondents, both characteristics – the availability of primary care (PHC) and their integration between primary and secondary care levels can significantly affect the prevention of ACSH (figure 1), however, the share of respondents who assessed the impact of PHC availability as significant was significantly higher ($p = 0.02$) than those who in such a way assessed the integration of PHC and SHC (82.8%). (CI 95%. 75.0; 90.0) and (67.7% (CI 95%. 58.0; 77.0) respectively)).

After two rounds of interviews, both groups of experts agreed on a list of 14 PHC accessibility components and 8 integration components between PHC and SHC (concordance coefficients $W = 0.87$ and $W = 0.75$; $p < 0.01$ respectively). The list of components for both characteristics and the values on a 10-point scale of their potential impact on

Table I. Assessment of the potential impact of PHC availability components by a 10-point scale (10 - maximum effect, 0 - no effect) on prevention of ACSH in points: (Me (25%; 75%))

Components of availability		Experts n=20	GP/FD n=73	Total n=93	p between groups
Title	Code				
Nearness of point of PHC care to community	C ₁ a	10.0 (8.5; 10)	9.0 (8.0; 10.0)	9.0 (8.0; 10.0)	0.37
Staffing of PHC facilities with GP/FD	C2a	9.0 (8.0; 10.0)	8.0 (8.0; 10.0)	8.0 (8.0; 10.0)	0.33
Staffing of PHC facilities with nurses	C3a	9.5 (8.5; 10.0)	10.0 (9.0; 10.0)	10.0 (9.0; 10.0)	0.55
Compliance with the requirements of the equipment of the PHC facility	C4a	9.0 (8.0; 10.0)	10.0 (8.0; 10.0)	10.0 (8.0; 10.0)	0.66
Normative regulation of ranking ACSC to prioritized	C5a	9.0 (8.0; 9.5)	10.0 (8.0; 10.0)	9.0 (8.0; 10.0)	0.17
Sufficient level of professional competence of PHC physician	C6a	9.0 (8.0; 10.0)	9.0 (7.0; 10.0)	9.0 (7.0; 10.0)	0.59
Sufficient level of professional competence of nurses	C7a	10.0 (9.0; 10.0)	10.0 (9.0; 10.0)	10.0 (9.0; 10.0)	0.63
Convenience for patients of fixing an appointment to PHC physician	C8a	10.0 (9.0; 10.0)	10.0 (9.0; 10.0)	10.0 (9.0; 10.0)	0.77
Convenience for patients of doctors' work schedule	C9 ^a	9.0 (8.0; 9.0)	9.0 (8.0; 10.0)	9.0 (8.0; 10.0)	0.39
Availability of timely emergency medical care	C10a	9.0 (8.0; 9.0)	10.0 (8.0; 10.0)	9.0 (8.0; 10.0)	0.67
Availability of medical care to the patient at home	C11a	10.0 (8.5; 10.0)	10.0 (8.0; 10.0)	10.0 (8.0; 10.0)	0.23
The possibility of conducting evidence-based screening studies for detection of ACSC	C12a	9.0 (8.0; 9.5)	9.0 (8.0; 10.0)	9.0 (8.0; 10.0)	0.41
Availability of active supervision and controlled treatment of ACSC	C13a	9.0 (9.0; 10.0)	10.0 (8.0; 10.0)	9.0 (8.0; 10.0)	0.16
Possibility to provide patients with ACSC with affordable medicines	C14a	9.5 (8.5; 10.0)	9.0 (8.0; 10.0)	9.0 (8.0; 10.0)	0.87
Availability of PHC on the whole	Ca	9.0 (8.0; 10.0)	9.0 (8.0; 10.0)	9.0 (8.0; 10.0)	0.22

Note: p – differences between estimates of experts and primary care physicians by Mann-Whitney criteria

prevention of ACSH according to GP/FDs, experts and in general are presented in Table I and Table II.

As no significant differences according to the Mann-Whitney criteria between the groups of respondents on any of the components were found, further analysis was performed for the total number of respondents (93 people).

With the help of rank correlation analysis, a significant weak or medium-strength relationship between the scores of the impact of all components of PHC availability (except for the technical possibility to undergo instrumental examinations prescribed by a family doctor or a doctor of SHC) with its general characteristics: $r_s = 0.23 \div 0.43$; $p < 0.01$). The presence of an association between the place of work of the respondents (urban or rural area) and assessments of individual components of accessibility regarding the prevention of ACSH was determined: according to the staffing of PHC facilities by nurses ($r_s = 0.43$; $p = 0.008$); compliance with the requirements of the equipment of the PHC facility – ($r_s =$

0.51 ; $p = 0.008$); the possibility of conducting evidence-based screening studies for the timely detection of ACSCs ($r_s = 0$, 25 ; $p = 0.008$); the possibility of providing patients with ACSCs with medicines (free of charge or with an acceptable level of co-payment) ($r_s = 0.21$; $p = 0.001$).

Regarding the coordination of PHC and SHC, significant correlations were found between the scores of all, without exception, the components of the impact of the integration of primary and secondary care with the overall assessment of its impact on the prevention of ACSH (figure 2). Besides, the connection of the territorial convenience of the location of SHC facilities with the place of work of the respondents was determined ($r_s = 0.25$; $p = 0.007$).

DISCUSSION

The study identified a set of 14 PHC accessibility components and 8 PHC and SHC integration components, the strength-

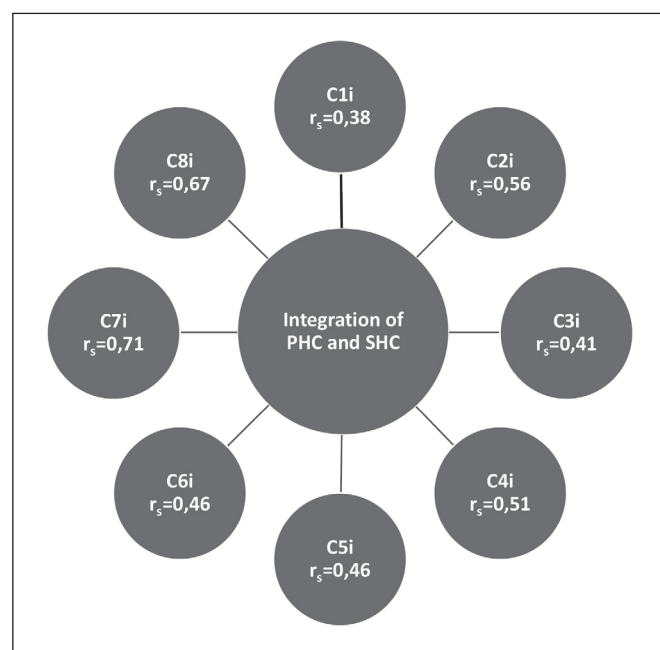
Table II. Assessment of the impact of PHC with SHC integration components by a 10-point scale (10 - maximum effect, 0 - no effect) on prevention of ACSH in points: (Me (25%; 75%))

Integration components		Code	Experts n=20	GP/FD n=73	Total n=93	P between groups
Title						
Territorial convenience of location	SHC facilities	C1i	8.0 (7.0; 9.0)	10.0 (8.0; 10.0)	9.0 (8.0; 10.0)	0.57
Possibility to give the patient a consultation with a specialist in the presence of a referral from a GP/FD		C2i	9.0 (8.0; 9.0)	9.0 (8.0; 10.0)	9.0 (8.0; 10.0)	0.49
Possibility to give the patient a consultation with a specialist in the absence of a referral from a GP/FD		C3i	8.0 (5.0; 9.0)	8.0 (5.5; 10.0)	8.0 (5.0; 10.0)	0.20
Possibility to undergo laboratory examinations appointed by a GP/FD at the minimum expenses of time of the patient		C4i	9.0 (9.0; 10.0)	9.0 (8.0; 10.0)	9.0 (8.0; 10.0)	0.36
Availability of laboratory tests prescribed by the GP/FD at minimal cost to the patient		C5i	9.00 (8.5; 10.0)	9.0 (7.0; 10.0)	9.0 (8.0; 10.0)	0.28
Technical ability to undergo instrumental examinations prescribed by the GP/FD		C6i	9.0 (8.5; 10.0)	9.0 (7.0; 10.0)	9.0 (8.0; 10.0)	0.49
Continuity between PHC and ambulatory SHC		C7i	9.0 (8.5; 10.0)	9.0 (8.0; 10.0)	9.0 (8.0; 10.0)	0.60
Exchange of medical information between PHC and SHC facilities		C8i	10.0 (9.0; 10.0)	9.0 (6.0; 10.0)	9.0 (7.0; 10.0)	0.09
Integration between PHC and SHC on the whole		C9i	8.5 (7.5; 10.0)	9.0 (8.0; 10.0)	9.0 (8.0; 10.0)	0.56

Note: p – differences between estimates of experts and primary care physicians by Mann-Whitney criteria

ening of which could potentially reduce the rates of ACSH in Ukraine, which corresponds to the authors' opinion on the need for identification and specification of factors associated with the possibility of ACSH prevention [9].

The informativeness of the identified components is confirmed by the high final agreement of opinions of experts


Fig. 2. Correlations between the components of the impact of PHC and SHC integration and the overall impact of integration on prevention of ACSH

on their list and the presence of statistical validity of the correlations of scores of impact all identified components, except one, with the overall values of the impact of PHC availability and integration between PHC and SHC on prevention of ACSH.

The study also proved that certain components are more important for rural areas, in particular the staffing of PHC facilities with nurses; their compliance with the requirements for the equipment of the facility; availability of opportunities for effective screening studies to identify ACSCs and provide patients with ACSCs with affordable medicines, territorial convenience of the location of SHC facilities. Such results are explained by the territorial features of the development of the PHC system in Ukraine, which are weaker in rural areas and have fewer opportunities for integration with secondary health care [5].

To strengthen the PHC system to reduce the rates of ACSH, respondents were proposed a set of organizational and economic measures. The most popular among them are: a) increasing the availability of PHC by ensuring the staffing of PHC facilities with doctors (76.7% of respondents; 95% CI 69.1 – 85.0) and improving their professional level (72.6%; 95% CI 64.3 – 81.2); scientific substantiation of workload standards for primary care physicians (69.9%; 95% CI 61.0 – 78.8), the formation of an adequate network of PHC facilities is differentially for urban and rural areas. (67.1%; 95% CI 58,2 – 76.1); b) improving the integration of PHC and SHC through the development of effective forms of cooperation between primary and secondary care facilities and physicians (72.6%; 95% CI 64.3 – 81.2), cre-

ation and implementation of end-to-end clinical protocols (68.5%; 95% CI 60.0 – 76.8).

In general, focusing on transformations on certain components of PHC availability and its integration with SHC that have a potential impact on the prevention of ACSH can significantly increase the effectiveness of primary health care and health care on the whole.

Our study has several limitations, including the following:

1. As our study is mainly based on the survey a significant number of respondents (primary care physicians) from one region of Ukraine, our analysis may have an ecological error.
2. A problem for the practical application of data on the components of accessibility of PHC and its integration with SHC that have a potential impact on the prevention of Ambulatory Care Sensitive Hospitalizations may be the need to raise additional funds for the implementation of structural changes, retraining and motivation of medical staff both in primary and ambulatory secondary health care sector.

Prospects for further research are to conduct an organizational experiment on a pilot site to determine the real impact of PHC availability components and its integration with SHC on prevention of ACSH.

CONCLUSIONS

The study lists and assesses the impact of the main components of primary care availability and its integration with secondary care associated with ambulatory care sensitive conditions that can be used for potentially preventable hospitalizations. The study showed the directions of prioritization of measures aimed at strengthening the primary health care system in Ukraine. The results of the study can be used to develop a specific action plan for further reform of primary health care, the implementation of which will reduce rates of ambulatory care sensitive hospitalizations and increase the efficient use of limited resources within a health care system of Ukraine

REFERENCES

1. Report of the Global Conference on Primary Health Care: From Alma-Ata towards Universal Health Coverage and the Sustainable Development Goals / World Health Organization. Geneva: WHO. 2019: 74.
2. Assessing health services delivery performance with hospitalizations for ambulatory care sensitive conditions. World Health Organization. WHO Regional Office for Europe: Copenhagen. 2016: 43.
3. Fransoo R. Hospitalization Rates for Ambulatory Care Sensitive (ACS) Conditions. In: Fransoo R., Martens P., Prior H. et al. The 2013 RHA Indicators Atlas. Winnipeg, MB: Manitoba Centre for Health Policy. 2013:203-206.
4. Pinto L.F., Giovanella L. The Family Health Strategy: expanding access and reducing hospitalizations due to ambulatory care sensitive conditions (ACSC). *Cien Saude Colet.* 2018; 23(6):1903-1914. doi: 10.1590/1413-81232018236.05592018.

5. Lekhan V.N., Kriachkova L.V., Doroshenko O.O., Gritsenko L.O. Estimates of potentially preventable hospitalizations for ambulatory care sensitive conditions in Ukraine. *Medicini perspektivi.* 2020;25(4):189-198. doi: <https://doi.org/10.26641/2307-0404.2020.4.221711> .
6. Santana R., Santos R.F., Sarmiento J. et al. Determinants of ambulatory care sensitive conditions hospitalizations – the patients' perspective. *International Journal of Integrated Care.* 2018;18(s2):376. <http://doi.org/10.5334/ijic.s2376>.
7. Nadutyi K.O., Lekhan V.M., Tolstanov O.K. *Metodychni pidkhody do standartyzatsii otsinky diialnosti zakladiv pervynnoi medychnoi dopomohy [Methodical approaches to standardization of assessment of primary health care facilities].* *Ukrainskyi medychnyi chasopys.* 2019; 3(2):131. doi 10.32471/umj.1680-3051.131.157991. (In Ukrainian).
8. Hrabovetskyi B.Ye. *Metody ekspertnykh otsinok: teoriia, metodolohiia, napriamky vykorystannia: monohrafiiai. [Methods of expert assessments: theory, methodology, areas of use: monography].* – Vinnytsia : VNTU. 2010: 171. (In Ukrainian).
9. Longman J.M., Passey M.E., Ewald D.P. et al. Admissions for chronic ambulatory care sensitive conditions – a useful measure of potentially preventable admission? *BMC Health Serv Res.* 2015;15:472. <https://doi.org/10.1186/s12913-015-1137-0>.

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USE OF MODERN CLOUD SERVICES IN RADIOLOGICAL DIAGNOSTICS TRAINING

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ABSTRACT

The aim: Is to present and substantiate approaches to the organization of radiation diagnostics training using cloud services.

Materials and methods: The experimental research was carried out at on 306 students of the Bogomolets National Medical University. To perform the set tasks, some theoretical and empirical methods of scientific research were used, namely: system analysis method, bibliosemantic method, statistical method, modeling method.

Results: The expediency of building a hybrid digital environment, which combines the capabilities of the corporate and public cloud service and allows one to create an information system of personalized access to electronic educational resources was justified. This environment is implemented within the cloud service Nextcloud.

The basic components of radiological diagnostics training by means of network technologies are considered and characterized. An experimental test of the effectiveness of the cloud services use is conducted in the process of training radiological diagnostics.

Conclusions: The expediency of creating a modern digital educational environment based on the Nextcloud service for training radiological diagnostics has been justified. Moreover, it is demonstrated that pedagogically balanced and reasoned introduction of cloud services in the educational process promotes increased efficiency of educational process of radiological diagnostics.

KEY WORDS: future physicians, radiological diagnostics, cloud services, training, teaching

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INTRODUCTION

FORMULATION OF THE PROBLEM

One of the priority areas for making positive qualitative changes in medical education is the use of digital and network technologies, which contain powerful information resources and provide multifunctional tools for improving almost all components of the whole educational process. At the same time, the problem of integrated and complex use of network technologies and cloud services in the methodology of teaching radiology to future doctors has not yet been studied. Despite the fact that radiology belongs to the most technological and rapidly changing medical fields, most educational information about radiology needs to be supplemented by visualisation: the series of medical images. Moreover, printed textbooks on radiology, illustrated manuals, and atlases also lack for content that can be quickly and systematically updated. In modern radiology, the processing of a series of medical images that are provided by modern diagnostic systems (e.g., multislice computed tomography, single-photon emission computed tomography, positron emission tomography etc.) is of particular importance.

The understanding of physical and technical bases of methods, the presence of abilities and skills of improving medical images quality, the optimization of radiation

exposure conditions provide an opportunity to receive a complex of details of the process prevalence, reaction of adjacent tissues, lymphatic system, and condition of remote organs. All these aspects play a crucial role in more specific modality for further differential diagnosis. Full understanding of the pathological process at the diagnosis stage is not enough to simply identify it in a single image – the requirements of modern medicine need more detailed radiological characteristics for further successful treatment. A combination of theoretical knowledge and skills in radiological diagnostics and therapy, normal anatomy, clinical disciplines, information technology, as well as the skills of visual perception of numerous medical images provide the necessary basis for the formation of future doctors' professional competence in terms of applying radiological methods in diagnoses and therapy. This leads to the search for mechanisms to effectively improve the quality of the radiology educational process and didactic potential of digital technologies analysis.

The problems of modern radiological diagnostics have been the subject of research by such scientists as: I. Bilous [1, 2], M. Tkachenko [2] and others. The studies of V. Bykov [3], V. Lapinsky [4], P. Mykytenko [5], O. Spirin [6], N. Stuchynska [7, 8] and others are devoted to the study of the potential of digital, including network, technologies for improving the quality of the educational process.

THE AIM

The aim of the article is to present and substantiate approaches to the organization of radiation diagnostics training using cloud services.

MATERIALS AND METHODS

To perform the set tasks, some theoretical and empirical methods of scientific research were used, namely: system analysis method, which is used for development of methodological support of teaching the radiological diagnostics basics in accordance with their functions and role in the system of professional training of a future doctor; bibliosemantic method, which is used for studying scientific literature; statistical method, which is used for systematization of theoretical and experimental data, analysis of trends within the methods of radiological diagnostics in modern medicine, processing the results of pedagogical experiments; modeling method, which is used to develop the structure of basic concepts of teaching radiological diagnostics methodology.

The experimental research was carried out at the Bogomolets National Medical University (Kyiv).

The methods of mathematical statistics (testing statistical hypotheses, Pearson's chi-squared test (χ^2), etc.) were used to establish the reliability of the positive impact and efficiency of the cloud services application in the process of teaching radio diagnostics. The sample is comprised of 306 medical students.

RESULTS

In radiological research, the use of a wide range of methods based on various physical phenomena, laws and principles, and their constant replenishment with new methods of diagnosis and treatment of socially important diseases significantly modernize and improve the diagnostic and treatment processes. Meanwhile, it reduces treatment time and improves complex and neglected cases. At the same time, it creates a daily challenge to the multimillion-dollar army of doctors whose professional competence must be commensurate with the transformational changes of modern medical theory and practice. The development of radiological methods is closely connected with the development of related fields: information technology, biological physics, medical physics, etc. Thus, the decisive role in the emergence of fundamentally new methods of visualization was played by information technology with the development of a method of layer-by-layer image acquisition (computed tomography).

The ability to conduct examinations using the whole range of available radiological diagnostics methods and choose the optimum way of identifying functional and morphological changes in pathology of various organs and systems and the ability to interpret research results for clinical diagnosis, as well as the ability to use radiation therapy for tumor and non-neoplastic diseases is an integral part of the professional competence of a modern doctor. According

to OECD (Organization for Economic Cooperation and Development), there is a growing trend in the number of medical equipment based on the use of X-ray methods for diagnostic purposes in almost all European and world countries including Ukraine.

The results of the data analysis interpreting the time history of the number of radiotherapy equipment (Figure. 1, 2) over the recent decade show that there is an equalization (smoothing) of differences in the amount of equipment per one million population due to different growth rates of radiotherapy tools. These data give grounds to predict a significant increase in the number of devices for CT and MRI examinations in Ukraine in the coming years, hence the need for competent specialists for their use. We selected the following countries for comparison: Japan, USA, Australia, Canada, France, Poland, Ukraine. The comparative analysis was carried out within the period of 2009–2019 (Table I).

The data for magnetic resonance imaging devices were collected, analyzed, and graphically represented in a similar way (Table II).

While comparing the statistics within a specific period of time, different rates of increase in the number of radiotherapy equipment become apparent. It can be argued that due to different growth rate of the number of radiotherapy equipment, there is an equalization (smoothing) of differences in the amount of equipment per one million population. These data give grounds to predict a significant increase in the number of devices for CT and MRI examinations in Ukraine in the coming years, hence the demand for competent specialists.

Consequently, mastering the physical and technical basics of radiological methods of diagnostics becomes more relevant and includes:

- knowledge of the physical essence of different phenomena and processes that form the basis of a certain radiological research method;
- understanding of physical and technical basics of designing devices for the needs of radiological research;
- knowledge of methods of image acquisition and its specifics.

Applying cloud services in the process of learning physical and technical basics of radiological diagnostics is both a learning tool and an object of a study because the advent of digital technology era in medical practice has created unprecedented conditions for the visualization of images, allowing to obtain the first computed tomography of brain tumors in 1972. Apparently, the use of new technological means, software products, network hardware and software determines the transformation of the processes related to the main principles of organizing teaching process, their form, content, educational technologies and requires proper didactic support. The substantial component of the educational process is based on the use of electronic and printed sources and aims to ensure shaped educational content. It includes the implementation of educational and methodological support of basic forms of educational activities: lectures, practical classes, independent work, etc.

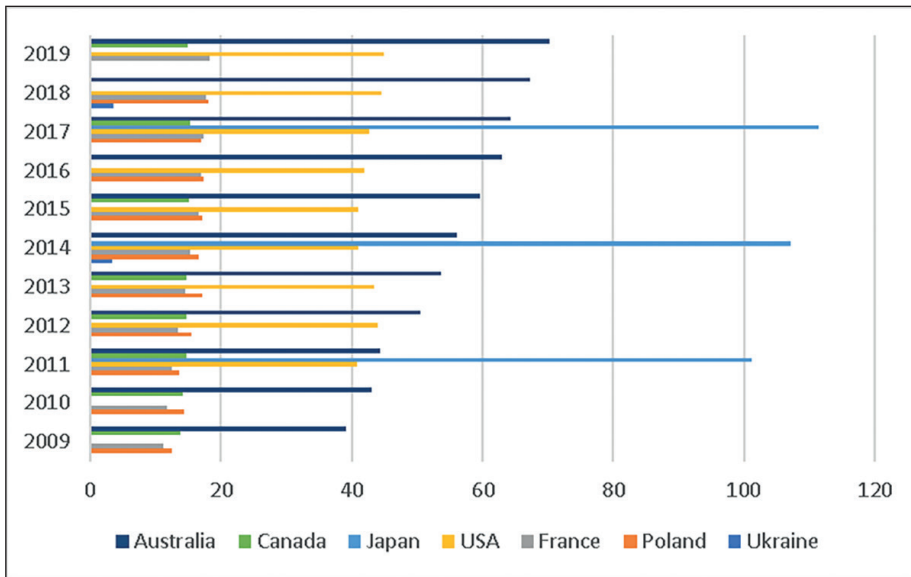


Fig 1. Time history of the number of CT equipment

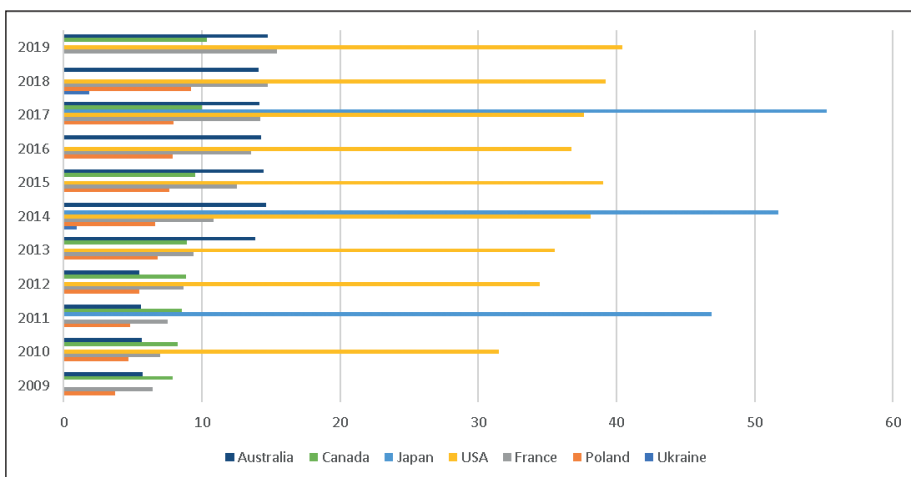


Fig 2. Time history of the number of MRI equipment

The organizational and methodological component includes: management systems for educational activities, means of information support, feedback, mechanisms of interaction. The management of educational activities involves the management of knowledge acquisition indirectly: a conscious perception of the purpose of educational activities, its subject, the means for its gradual implementation, as well as the knowledge and skills necessary for the work, which are provided by the information competence of a student. The effectiveness of educational activities is

largely determined by the conscious acceptance of educational goals and involves systematic monitoring as one of key tools within organizational and methodological component.

The technological component contains a set of hardware and software combined into a system that provides dealing with all types and forms of educational activities. In other words, digital educational environment is a learning environment supplemented by hardware, and software; content and information; methodological, electronic, and network

Table I. Time history of the number of CT equipment (according to data from [9, 11])

CT	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Ukraine						3,26				3,53	
Poland	12,4	14,38	13,61	15,4	17,09	16,63	17,16	17,33	16,88	18,14	
France	11,08	11,82	12,53	13,49	14,49	15,32	16,57	16,95	17,36	17,68	18,24
USA			40,89	43,89	43,5	41,05	41,01	41,88	42,74	44,55	44,99
Japan			101,3			107,2			111,5		
Canada	13,8	14,23	14,62	14,69	14,77		15,07		15,35		14,82
Australia	39,14	43,07	44,32	50,5	53,66	56,06	59,54	63	64,34	67,29	70,25

Table II. Time history of the amount of MRI equipment (according to data from [9, 11])

MRI	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Ukraine						0,92				1,88	
Poland	3,7	4,71	4,83	5,49	6,78	6,6	7,63	7,87	7,93	9,22	
France	6,43	6,96	7,51	8,65	9,4	10,86	12,56	13,55	14,21	14,77	15,43
USA		31,52		34,46	35,51	38,12	39,03	36,74	37,65	39,24	40,44
Japan			46,86			51,69			55,21		
Canada	7,91	8,26	8,53	8,87	8,89		9,52		10,02		10,35
Australia	5,72	5,67	5,6	5,5	13,84	14,65	14,49	14,3	14,15	14,09	14,78

Table III. Frequency distribution in control (CG) and experimental (EG) groups

№	Group	Quantity	Empirical frequency (p)				Theoretical frequency (p')				$\frac{(p - p')^2}{p'}$				Σ
			Elementary	Basic	Sufficient	Perfect	Elementary	Basic	Sufficient	Perfect					
1	CG	151	14	66	56	15	10	58	62	20	1,277	1,037	0,614	1,138	4,065
2	EG	155	7	52	70	25	11	60	64	20	1,244	1,010	0,598	1,108	3,960
	Σ	306	21	118	126	40								χ^2	8,025

resources and technologies; and cloud services. All the mentioned elements combined together create fundamentally new opportunities for organizing the learning process. The recommendations of the National Institute of Standards and Technology (NIST) [11] state that cloud services serve a model for providing ubiquitous and convenient on-demand access over a network to a common database of configurable computing resources that can be provided quickly with minimal management costs and with rare appealing to provider. The mentioned interpretation describes precisely what the true cloud services really are. One of the advantages of learning tools focused on the use of network and cloud services is the implementation of the principle of clarity in its modern sense. It should be noted that these technologies are exceptionally productive in academic disciplines, where visualization is an important component. Students learn to analyze the results of radiological studies and to assess the norms and pathologies of various organs and systems on their basis. Such knowledge and skills depend on visual perception of the educational material; and the skills of diagnosis, being an important component of professional competence, can be formed only by continuous repeating the same procedures. The indicators of the effectiveness of applying cloud services in the process of teaching of radiological diagnostics include:

- creation of the skills of diagnosing by means of radiological methods;
- assessment of educational achievements;
- organization of productive independent work;
- organization of cooperative training and work in groups;

- solving specific tasks;
- organization of blended learning and other innovative learning technologies;
- production of educational presentations and other visual materials;
- development of software applications to improve learning efficiency;
- organization of access to educational software.

The feasibility of choosing cloud services as a factor of improving the efficiency of teaching medical students, modernization of the educational process, professionally oriented content of the educational environment, diagnosis and monitoring of their educational achievements start to play a key role.

There are several cloud services for the organization of educational process to be distinguished among all the available ones in global network, namely GoogleDrive, Dropbox, Microsoft OneDrive, and Mega. However, these services do not allow to implement a system that would contain data on a local server without involving any third-party data centers and would have an integrated DICOM viewer of medical images.

One of the possible means of organizing the training process of radiological diagnostics is the Nextcloud service (open-source file synchronization system that enables to share content, software and applications with all registered users within a secure dedicated server).

Based on the Nextcloud service with such parameters as compatibility with equipment, ease of access, ease of use, utility, stability, content quality, and productivity for independent work, the functional characteristics of the cloud training resource on radiology was professionally assessed.

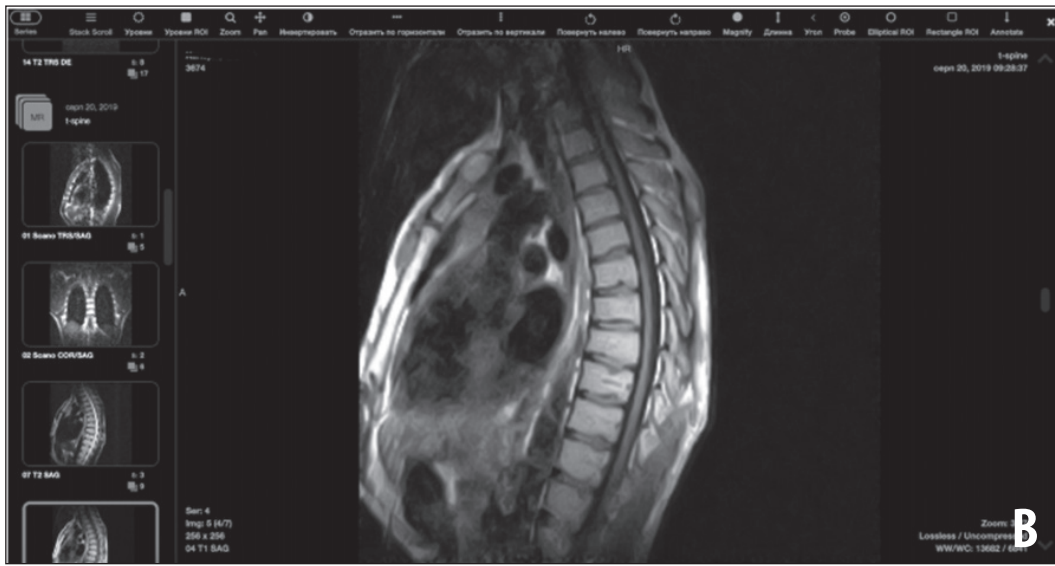


Fig. 3 (A,B). Nextcloud user interface (DICOM viewer tab)

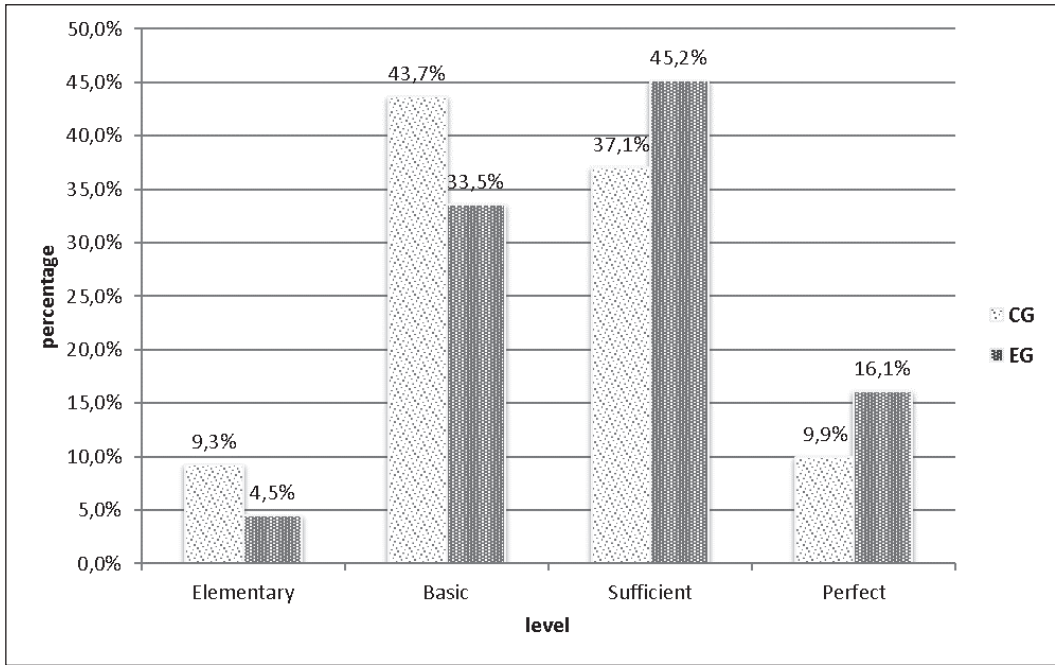


Fig. 4. Frequency distribution in control (CG) and experimental (EG) groups

The latter made it possible to establish a final score of 8.9 on a ten-point scale, which is a reason to recommend it for further implementation and use. There are the following advantages of the system designed on the basis of the Nextcloud service:

- the universal ability to connect to the server using any web browser (Mozilla Firefox 14+, Google Chrome/Chromium 18+, Safari 7+, Internet Explorer 11+, Microsoft Edge);
- the volume of the cloud file storage for an individual user is set by the administrator (teacher) and can be changed if necessary;

- the study groups are administered by a teacher who is able to block, restrict or expand access to the resources according to individual capabilities and needs of students (academic debt, research work, group projects, etc.);
- the shared use and processing one or more files on a computer and synchronizing them with the server;
- the ability to place files in local shared directories and synchronize them with the server and other devices using the Nextcloud Desktop Sync client or Android or iOS software, which are available for download in Google Play and AppStore;
- editing Microsoft Word documents, Microsoft Excel spreadsheets and Microsoft PowerPoint presentations with the built-in OnlyOffice application;
- demonstrating medical images in DICOM format (Digital Imaging and Communications in Medicine – medical industry standard for creation, storage, transmission, and visualization of digital medical images and documents of the examined patients) using the built-in DICOM viewer application, which provides basic tools for working with medical images and their series. Ultimately, it forms an unprecedented objective idea of the possibilities of modern methods of radiological diagnostics among students (Figure 3).

DISCUSSION

Thus, we managed to create a digital educational environment, which provided rather powerful tool for shaping professional competence of future doctors in radiological diagnostics: cloud-based educational information network for sharing; virtualized systems to support learning interaction, which contain publicly available online collections of electronic educational resources and services; cloud-oriented corporate information system, which provides selective access of various user groups to a flexibly organized pool of electronic educational resources; high-quality video and audio communications; instant messaging services; cloud-oriented systems of real-time interaction; personalized access of students to educational resources and software; information and analytical network systems; control systems for coordinating activities and interaction of users in the learning processes; specialized software (programs for visualization and transmission of medical images, statistical processing of results, etc.).

Since the study of medical imaging is one of the most effective methods of obtaining visual data on the internal structure and functions of the human body, and modern medical diagnostics is inextricably linked with the visualization of internal structures of biomedical objects, it becomes reasonable to use services that have applications for processing images in DICOM format. Students have the opportunity to know more and work with means of acquiring medical images, to learn how to interpret its methods, and to analyze samples and objects of medical images.

The personification of the educational environment made it possible to assess the usefulness of software

products and information resources, students' academic achievements, the level of their educational activity. It also helped to analyze the reasons for which learning outcomes are determined, to stimulate and organize educational activities because all the user actions (reviewing materials, dealing with tests, etc.) or inactivity are automatically fixed by the system and are observed by the teacher, which is an indirect imperative for the the orderliness and scrupulosity of students.

In order to establish the reliability of a positive impact of the use of cloud services in the process of learning radiological diagnostics in the experimental group (EG) and compare it with the control group (CG) (Figure 4), the Pearson's chi-squared test (χ^2) was applied.

The null hypothesis H_0 showed that the probability of students from control and experimental groups falling into each of t categories accidentally ($t = 1, 2, 3, 4$ for both samples) are equal, and the highest level of knowledge of radiological diagnostics in experimental group can be explained with random factors. Alternative hypothesis H_1 , in its turn, indicated that $p_{1i} \neq p_{2i}$ at least for one of the groups, and the higher level of knowledge cannot be explained with the peculiarities of sampling but can be determined by the use of innovative technologies in the process of teaching radiological diagnostics. To test the null hypothesis using the criterion χ^2 , the value of the criterion χ^2_{emp} statistics (Table III) is set at the accepted level of significance ($\alpha = 0.05$)

After the experiment, experimental and control groups had statistically significant differences because the critical value of $\chi^2_{cr} = 7,815$ for the number of degrees of freedom $n = C - 1 = 4 - 1 = 3$ at the level of significance $\alpha = 0.05$. In this case, $\chi^2_{emp} = 8.025$ and $\chi^2_{emp} > \chi^2_{cr}$, which gives grounds for rejecting the null hypothesis.

Thus, the analysis enables to test the hypothesis of the study and establish that the quality of teaching physical and technical basics of radiological diagnostics has improved among the students of medical institutions of higher education as a result of using the Nextcloud service.

CONCLUSIONS

Based on statistical data, there is a distinct trend towards increasing the number of medical equipment and research using radiological methods and the growing role of non-invasive technologies: ultrasound, CT and MRI, radionuclide methods – positron emission tomography. It challenges medical education as the physicians' professional competence must meet the needs of modern medical theory and practice.

The expediency of creating a modern digital educational environment based on the Nextcloud service for training radiological diagnostics has been justified. Moreover, it is demonstrated that pedagogically balanced and reasoned introduction of cloud services in the educational process promotes increased efficiency of educational process of radiological diagnostics.

REFERENCES

1. Belous I.V., Stuchynska N.V. Blended learning of the basics of radiological diagnosis by future doctors. *East European Scientific Journal*. 2019; 6(46):52–55.
2. Belous I.V., Stuchynska N.V., Tkachenko M.M. Learning the basics of radiation diagnostics using network technologies. Theoretical and methodological problems of raising children and students. *Collection of scientific works*. Kyiv: Gnosis. 2017; 1(75):17–32. (In Ukrainian).
3. Spuziak M.J., Kramnyi I.O. Actual problems of preparation of radiological diagnostics. *Problems of modern medical science and education*. 2010;2:7–8. (In Ukrainian).
4. Dutka I. Yu. Problems of radiological diagnostics in the context of medical services in various fields of health care. *Bulletin of Scientific Research*, 2017;2:165–169. (In Ukrainian).
5. Bykov V. Yu. Cloud technologies, ICT outsourcing and new functions of ICT units of educational and research institutions. *Information technology in education*. 2011;10:8–23. (In Ukrainian).
6. Lapynskyi V.V., Mykytenko P.V. Designing interdisciplinary integration of medical informatics Information technologies and Learning tools. 2020; 1(75):26–41. doi: <https://doi.org/10.33407/itlt.v75i1.3569>. (In Ukrainian).
7. Mykytenko P.V. Using cloud services in solving logical problems. *Information technologies and Learning tools*. 2017;1(57):104–114. doi: <https://doi.org/10.33407/itlt.v57i1.1503>. (In Ukrainian).
8. Spirin O.M., Vakaliuk T.A. Criteria for selection of open web-oriented technologies for teaching the basics of programming to future computer science teachers. *Information technologies and Learning tools*. 2017;4(60):275–287. (In Ukrainian).
9. Stuchynska N.V., Ostapovych N.V., Belous I.V. Game-based technologies in teaching professionally oriented natural sciences to the future doctors. *Revista tempos em spagos educacao*. 2020;31:160–175. doi: 10.32930/nuances.v31i0.8215.
10. Stuchynska N.V. Teaching medical and biological physics by ICT: analysis of the experience of implementing. *Information technologies and teaching aids*. 2012; 6(32). Access mode: <http://www.journal.iitta.gov.ua>. (In Ukrainian).
11. OECD, Computed tomography (CT) scanners (indicator) and magnetic resonance imaging (MRI) units (indicator). doi: 10.1787/bedece12-en.
12. Center for Medical Statistics of the Ministry of Health of Ukraine <http://medstat.gov.ua/ukr/statdan.html>.
13. The NIST Definition of Cloud Computing. Recommendations of the National Institute of Standards and Technology. <http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf>.

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ORIGINAL ARTICLE

COMPARATIVE ANALYSIS OF INCIDENCE AND MORTALITY FROM GASTRIC CANCER AMONG THE POPULATION OF EUROPE AND UKRAINE

DOI: 10.36740/WLek202103206

Tetiana I. Domanchuk, Zhanetta A. Chornenka, Mariana I. Hrytsiuk
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ABSTRACT

The aim: To study the incidence and mortality from gastric cancer in Europe and Ukraine.

Materials and methods: Using statistical and medico-epidemiological methods, the analysis of the database of the National Cancer Registry of Gastric Cancer and Global cancer statistics 2018.

Results: Gastric cancer remains an important cancer worldwide and is responsible for over 1,000,000 new cases in 2018 and an estimated 783,000 deaths, making it the fifth most frequently diagnosed cancer and the third leading cause of cancer death. Among men, it is the most commonly diagnosed cancer and the leading cause of cancer death in several countries of Europe, including Ukraine. Incidence rates are markedly elevated in Central/Eastern Europe, whereas the rates in Northern Europe are generally low. In the dynamics of the last decade, the primary incidence of gastric cancer has shown a tendency to decrease, as in Ukraine, from 25.5 per 100 thousand population in 2010 to 19.5 similar cases in 2019, which is -23.5% visibility) and in the Chernivtsi region (on -22.3% visibility). In Ukraine, as well as in Europe, the incidence and mortality of gastric cancer in men is 2 times higher than in women.

Conclusions: Incidence and mortality rates have declined in Europe in the past decades. Trends in the ten-year dynamics of reducing the incidence and mortality of gastric cancer in Ukraine prove the effectiveness and feasibility of introducing preventive measures at the state level in the future.

KEY WORDS: incidence, mortality, gastric cancer, survival, Europe, Ukraine

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INTRODUCTION

Gastric cancer (GC) is an important contributor to the global burden of cancer, [1] and less than a century ago it was the most common cancer in the world [2]. Since then, the incidence and mortality rates of gastric cancer have fallen [3]. However, this trend has shown signs of change; for example, some researchers suggest that in the USA, the rates of gastric cancer might be increasing among younger age groups (i.e., <50 years) and predict that this increase might reverse the overall decline in the incidence of GC [4]. The decreasing trend of gastric cancer incidence and mortality in most populations is due to the falling in *Helicobacter pylori* infection rates [5]. *H.pylori* is a known carcinogen for non-cardia GC, which probably once infected most adults during their life course [6]. Improved socio-economic status, hygienic practices, and widespread antibiotic use have led to a decrease in infection rates. Improved socio-economic status, hygienic practices, and widespread antibiotic use have led to a decrease in infection rates.

The prevention and treatment of stomach cancer is pivotal, since it is currently one of the most common malignancies around the world. Ukraine is one of the countries with a high level of cancer and is among the top ten countries in the world in this regard. Moreover, according to scientists, by 2020 the number of people who get cancer for the first

time in Ukraine will exceed 200 thousand people [7]. This emphasizes the importance of prevention of malignant neoplasms. Important indicators of the effectiveness of this area of the health care system are the levels and trends of morbidity and mortality, including early detection and survival of cancer patients [8]. Ukraine ranks 8-9 in the list of 49 countries with registered cancer (incidence of men – 39.5 per 100 thousand population, women – 22.4), annually the country registers 16-17 thousand new cases.

GC occupies one of the leading positions in the structure of morbidity and mortality. It is one of the most common human tumours and ranks 2nd in the structure of cancer. In economically developed countries, the proportion of GC reaches 50% of all tumours of the gastrointestinal tract and 10-15% of the total number of tumours [9]. Every year, 750-850 thousand new cases of GC are registered in the world and more than 600 thousand people die from this disease, despite the stabilization of the incidence in some developed countries [10].

GC is currently the fifth most common cancer and the third leading cause of cancer death in the world [11]. In 2018, the global incidence of GC was 12.1 / 100,000 [11]. The total number of newly diagnosed cases of GC was estimated at 952,000, which is 6.8% of all newly detected malignancies and is 8.8% of cancer-related deaths [11]. The incidence of GC is approximately twice as common in men

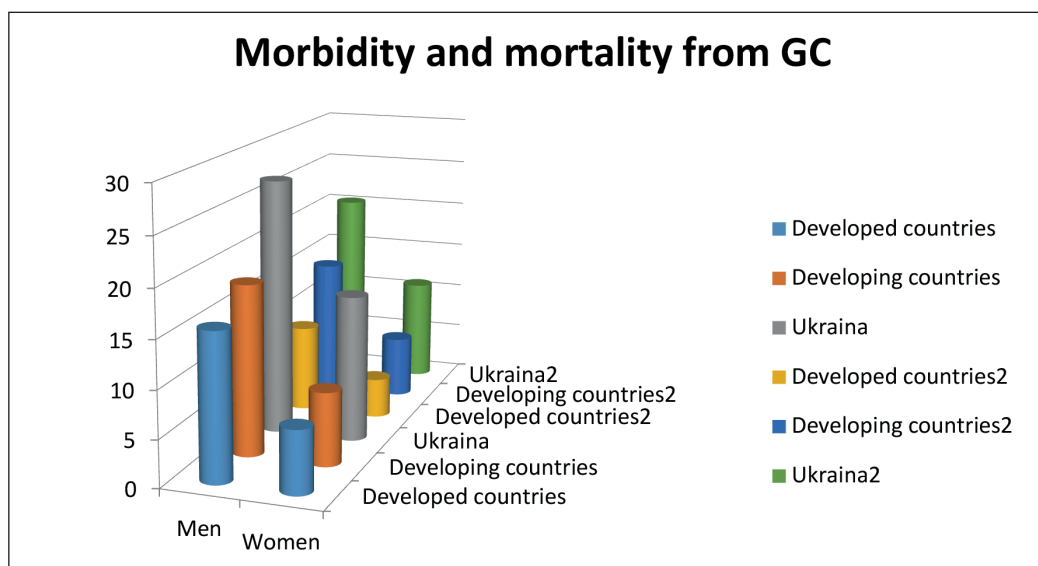


Fig.1. Comparative assessment of morbidity and mortality (2) from GC among men and women in developed countries, developing countries and Ukraine.

as in women, most cases occur after 60 years [12, 13]. Despite declining morbidity, gastric cancer still has a gloomy, 20%, 5-year survival rate [14, 15] and a high mortality rate in 74.5% in most countries [16]. Gastric cancer is a major factor influencing disability-adjusted life expectancy and early cancer mortality and has a significant impact on overall health and life expectancy worldwide [17].

According to the Cancer Registry of Ukraine, in 2018, the GC ranks fourth in morbidity (6.9%) and second in mortality (9.5%) from malignant neoplasms in men, second only to lung and prostate cancer. The incidence of gastric cancer in women is in seventh place (4.1% among all malignant tumours), and mortality is in third place (7.5% among all malignant tumours) after breast and colon cancer [7].

Morbidity and mortality can be considered as indicators of the level of socio-economic development of the state in general and the public health system in particular. After all, in the scientific literature it is proved that in the occurrence of pathology a significant role is played by general risk factors, such as: stress, poverty, unhealthy lifestyle, unsatisfactory social conditions, anthropogenic pollution, harmful working conditions, etc. [7, 9], so and special: smoking, alcohol and hot or too cold food and drink, chronic trauma, papillomavirus infection, and precancerous diseases [18]. Most of these factors are manageable and can be moderated through the organized efforts of society as a whole, i.e. they depend on the effectiveness of the public health system.

THE AIM

The aim is to study the ten-year trends in morbidity and mortality due to malignant neoplasms of the stomach in Europe and Ukraine (including Chernivtsi region).

MATERIALS AND METHODS

Analyzed the database of the National Cancer Registry of Ukraine for 2010-2019 [7] and Global cancer statistics 2018 [9]. Used methods: epidemiological, medical and statistical.

RESULTS

There are significant regional differences in current GC incidence and mortality. The highest rates are observed in East Asia, Eastern and Central Europe and South and Central America. Gastric cancer rates are also significantly lower in more economically developed regions of the world than in less developed ones (age-standardized incidence rate [ASIR] per 100,000: men = 15.6 vs. 18.1; ASIR women = 6.7 vs. 7.8 Age-standardized mortality rate [ASMR] per 100,000: men = 9.2 vs. 14.4; ASMR women 4.2 vs. 6.5) [9]. More developed countries, as defined by the UN, include all regions of Europe plus North America, Australia / New Zealand and Japan; less developed countries include all regions of Africa, Asia (except Japan), Latin America and the Caribbean, Melanesia, Micronesia and Polynesia (Fig.1). More than 70% of GC occurs in less developed countries.

As can be seen from the graph, both morbidity and mortality rates compared to European countries in Ukraine are much higher – for both men and women.

Central / Eastern Europe has the second highest rate of GC after East Asia, with an estimated ASIR of 13.5 / 100,000 and an ASMR of 10.9 / 100,000. Western Europe and Northern Europe have medium levels of gastric cancer (ASIR: 6.3 and 5.4 per 100,000, respectively). The main indicators of morbidity, mortality and survival in Europe and Ukraine, as of 2018 are presented in Table I.

Research in recent year's shows that incidence rates in most industrialized countries have declined and patterns emerging in immigrant groups move toward patterns in origin countries. These changes indicate that a close relationship gastric cancer with factors can be altered. Economic growth and life style changes are following by unhealthy nutritious diets, lack of physical activity, overweighting and obesity which are all the cancer risk factors and the reasons of increasing general health concern. On the other hand, the treatment and recovery methods including increasing of physical activity, healthy food consumption, and the proper screening can affect reducing deaths. The rate of infection-inducing cancer prevalence and deaths

Table I. Incidence, mortality and survival rates in Europe and Ukraine in 2018

European countries	New cases per 100 thousand population	Mortality per 100 thousand population	Incidence	Survival
Austria	1190	806	13,1	35,4
Belarus	2885	1723	30,5	-
Belgium	1577	788	13,8	37,5
Bulgaria	1318	1066	17,6	16
Croatia	865	763	20,0	20,0
Czech Republic	1399	987	13,6	20,6
Denmark	543	406	9,5	19,9
Estonia	328	275	24,6	29,2
Finland	585	429	10,0	25,7
France	7726	5326	11,5	26,7
Georgia	651	520	16,7	-
Germany	14773	9480	15,1	33,5
Greece	1908	1423	15,7	-
Hungary	2089	1523	22,1	-
Iceland	27	21	8,0	28,1
Italy	12803	9457	17,8	30,5
Latvia	564	448	28,0	28,0
Lithuania	869	722	29,5	27,0
Netherlands	1833	1341	10,9	25,0
Norway	472	318	10,0	26,5
Poland	6659	5779	18,9	20,9
Portugal	2885	2275	25,0	32,2
Romania	3530	3923	18,8	26,5
Russia	35213	29565	24,5	21,0
Slovenia	452	313	21,0	28,8
Spain	7684	5609	15,6	27,6
Sweden	776	557	7,7	24,8
Switzerland	1017	636	12,1	32,2
UK	6370	4484	9,9	20,7
Ukraine	9417	8307	21,4	15,9

would contribute to high costs among the majority of the countries. Infection-related cancers contain more than 26% of all cancers among low-income and middle-income countries while the rate of non-infectious cancers is increasing in all countries except for level of income. This desired increase is an indicative of higher prevalence of known risk factors such as obesity, lack of physical activity and smoking as well as higher usage of screening methods.

Evaluating these tables – the highest 5-year survival rates are observed in Austria, Belgium, Germany, Portugal and Switzerland – countries with high socio-economic living standards. Post-Soviet countries such as Belarus, Georgia, Hungary, Kazakhstan, Uzbekistan and others do not calculate this figure still. In Ukraine, the survival rate of various cancer sites began to be calculated only in the last few years.

GC has a poor prognosis. The EURO-CARE-5 survey, which estimates survival in Europe since 1999, reports a European relative survival over 5 years of 25%, the best in Southern Europe is close to 30%, and the worst in Eastern Europe is 19%.

According to the results of cancer records in 2018, [9] 133133 cases of GC were recorded among all European countries for both sexes. The highest incidence of GC 64482 cases (48.4%) was associated with Central / Eastern Europe, and the lowest – 11244 cases (8.4%) – with Northern Europe. The incidence of GC in Ukraine (7492 new cases) as well as in European countries shows a tendency to decrease over the last decade from 25.5 per 100 thousand population in 2010 to 19.5 similar cases in 2019, which corresponds to intermediate level. Also in our study, for comparison, we evaluated the incidence and mortality of GC in the

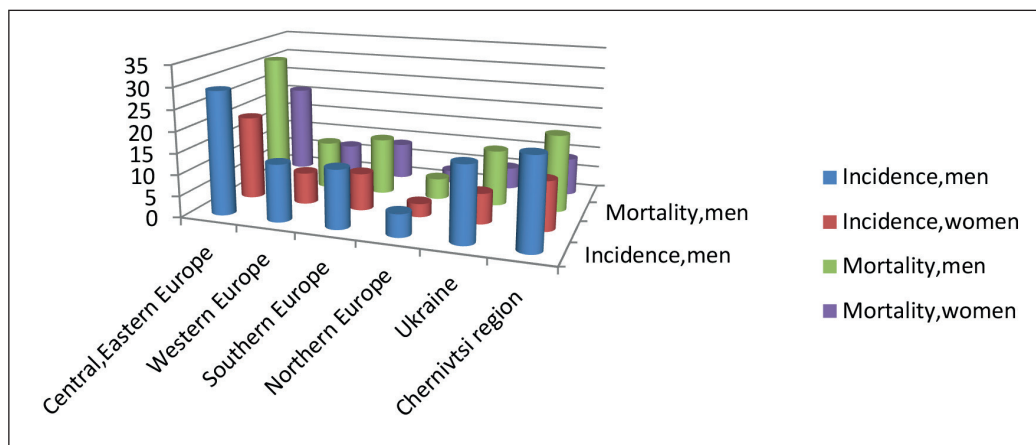


Fig.2. Incidence and mortality of gastric cancer among the population of Europe and Ukraine (per 100,000)

Table II. Survival of patients with malignant neoplasms of the stomach

Administrative region	Number of patients, n		1-year survival				5-year survival			
			Survival,%		Lost from supervision,%		Survival,%		Lost from supervision,%	
	m	w	m	w	m	w	m	w	m	w
Ukraine	30103	19768	34,8±0,4	36,7±0,5	2,5	3,3	14,8±0,4	16,9±0,5	5,2	6,6
Chernivtsi region	547	336	37,4±2,4	40,9±2,9	1,5	1,5	14,2±2,0	20,3±2,6	3,6	5,5

least region of Ukraine, namely Chernivtsi. Thus, in the Chernivtsi region, the incidence of GC decreased from 20.6 in 2010 to 16.0 in 2019 per 100 thousand population, respectively (Fig.2).

In our opinion, an important reason for such positive dynamics may be: promotion of a healthy lifestyle, smoking cessation and alcohol use at the state level (Ukraine's accession to the WHO Framework Convention on Tobacco Control and the implementation of a number of appropriate preventive measures at the state level [8]), modern possibilities of endoscopy and biopsy performed among the population at risk to assess the course of various diseases and precancerous conditions, which significantly increases the likelihood of early detection of GC and improves treatment outcomes.

The total number of deaths from gastric cancer in 2018 among all European countries was 102167 cases, indicating the second place of death due to GC, after lung cancer. The highest mortality rate, as well as morbidity, was observed in Central / Eastern Europe 54268 cases (53.1%), and the lowest mortality rate was in Northern Europe with 8014 cases (7.8%). Mortality from GC in Ukraine also decreased slightly from 19.2 to 14.0 per 100 thousand population during 2010-2019 (which is – 27% in terms of visibility). Similar to the incidence rates, gastric mortality rates in Chernivtsi region are also not significantly lower than similar rates for GC in Ukraine and showed approximately the same trends as in the primary incidence over the past ten years, fluctuated with varying intensity in the range of 18.3-13.2 cases per 100 thousand population, which is 27.9% showing a generally stable trend and equalization of indicators over the past five years to national values.

It should be noted that men suffer from GC several times more often than women (Fig.2).

No clear etiological factors for the occurrence of GC have been identified, although it is known that some conditions contribute to the development of gastric cancer. The role of nutrition is important: an unfavourable role is played by carbohydrate foods, lack of vitamins, especially vitamin A, ascorbic acid. Higher incidence of gastric cancer is observed in areas with excessive levels of nitrates in soil, water and food (Kyiv 23.6, Kharkiv 24.5, Khmelnytsky 25.0 and Chernihiv region 30.3 per 100 thousand population). Nitrates during interaction with amines in the stomach, especially with low acidity of gastric juice, form nitrosamines, the carcinogenic effect of which has been proven. Bacteria that promote the synthesis of nitrosamines die in the normal environment of the stomach. Foods high in benzopyrene (smoked, fried foods) also cause GC, which predominate in the diet of older men. Increased morbidity and mortality from gastric cancer among the male population of Ukraine can also be explained by the abuse of strong alcoholic beverages, smoking. Among smokers, the risk of the disease is four times higher than among non-smokers. Consumption of salty foods increases the risk of disease several times, and consumption of milk (as well as fresh vegetables and fruits) reduces the risk of disease by 30%. The disease is facilitated by a lack of cobalt, magnesium in the soil and food, an excess of zinc and copper. Vitamin A, carotene, synthetic retinoid, ascorbic acid, which have antioxidant properties, prevent the formation of nitrosamines in the digestive tract.

Also, one of the most adequate criteria for assessing the effectiveness of cancer care is survival. It should be noted that the study of this indicator at the population level in different countries is quite rare. The first international cancer survival studies were conducted in 1964 by the US National Cancer Institute and included patients from

Denmark, England, Finland, France, Norway and the United States with the most common nosological forms of cancer. Subsequently, such studies were conducted by the International Agency for Research on Cancer, using data from population cancer registries in some countries, provided that they meet quality standards and the level of traceability of patients, which should be 95% for statistical reliability. In Ukraine, population survival has not been studied in cancer epidemiological research; as a rule, the survival rate is used only for comparative evaluation of the effectiveness of different treatments in clinical trials.

Survival analysis in Ukraine was performed for patients with GC (C16) diagnosed in 2014–2019, except for patients with multiple tumours; the studied cohort included 23,991 men and 15,589 women. The values of relative survival by cumulative method for male and female population of both Ukraine in general and in Chernivtsi region in particular were calculated. The study uses personalized data from the National Cancer Registry of Ukraine and modern methods of statistical analysis adopted in oncology and descriptive epidemiology. Based on the principles and methods of medical informatics, quality control of primary information in the database was carried out.

The survival rate of patients with gastric cancer was studied in a cohort of 30,103 men and 19,768 women (Table 2) and compared with a similar incidence of cancer in the Chernivtsi region. It was found that the 1-year survival rate in Chernivtsi region among men and women of this cohort is significantly higher than the average Ukrainian (39,2 i 35,8% respectively). The difference in the 5-year survival of patients with malignant neoplasms of the stomach in men and women in Chernivtsi region in comparison with the average in Ukraine (16,1 i 15,9%) was not so significant.

The 5-year survival rate of patients with gastric cancer in the regions we studied is 2–2.5 times lower than the 1-year level. To find out the possible reasons for the low survival rate of patients with gastric cancer, the main indicators of the organization of cancer care for patients in this category were studied. It was found that in the Chernivtsi region the level of detection of gastric cancer in the abandoned stage is 1.2 times higher than in the all-Ukrainian.

The 1-year survival of this category of patients is almost 1.6 times less than the rate of detection of the disease in the I-II stage in Chernivtsi region and almost coincides with the corresponding indicators in Ukraine. In Chernivtsi region, 14.3% fewer patients survive within 1 year than were detected in stages I – II, which indicates a possible inadequacy of establishing the stage of the disease. It was also revealed that in Chernivtsi region half of patients with gastric cancer were covered by special treatment, and in Ukraine – 45.1%.

It is also important to analyse indicators of the quality of preventive work of medical institutions, which include indicators of neglect (detection of MN at stage III-IV and mortality up to a year from diagnosis), as well as the proportion of primary cases detected during preventive examinations. Correlation-regression analysis proved that there is a strong feedback between the last indicator

and the indicators of neglect: the higher the coverage of preventive examinations, the lower the frequency of late stages of cancer ($r_{xy} = -0.97$, $p < 0.05$) and mortality up to one year (-0.99). However, there is a strong direct relationship between the two indicators of neglect (0.98). In this regard, the best situation and dynamics are characteristic of indicators of early diagnosis of gastric cancer.

During the study period, only a small proportion of primary cases in Ukraine were detected during preventive examinations (9.3% and 6.6% in 2010 and 2019, respectively), which indicates an insufficient level of preventive work with the population. As the rates of neglect are quite high and do not show a positive trend in both late detection (30.8% and 36.5%) and mortality up to one year (62.2% and 59.7%), there is a need for in-depth study of medical -organizational causes of late detection of gastric cancer as a scientific basis for the development of effective prevention measures.

DISCUSSION

This article summarizes the epidemiological aspects of GC at the present stage in the global health care of European countries and Ukraine. An analysis of recent trends in GC morbidity and mortality has shown that there is a relatively permanent and steady decline in these rates in most other parts of the world, particularly in Europe. Worldwide, GC is more common in men than women (1.5-2.5: 1) [19]. The proportion of GC in the male population is 9.7% (4th place), in the female – 5.8% (5th place) [20]. In Japan, with a population of about 126 million, the incidence in men is 77.9 and in women – 33.3 per 100 thousand population [21]. To date, despite all advances in medicine, except Korea and Japan, where systematic screening programs are widely implemented, about 2/3 of patients with GC in the world are in the early stages [22]. According to studies in the United States [23] showed that about 60% of patients at the time of diagnosis had stage III or IV disease, and researchers in the Netherlands noted that from the early 90's to the present there has been an increase in the detection of stage IV cancer from 31% to 40%, such data are indicated by other authors [22]. At the same time, the literature presents data on the increase in early detection of GC in patients in many countries: from 14.5 to 20.8% – in Portugal, 14% – in Japan, 16-20% – in Germany, 40- 60% – in Poland, 9% – in the US and only 1% of patients – in the UK [23].

Despite declining incidence and mortality from GC worldwide in recent decades, mortality has declined slightly [23]. Over the past 10 years, mortality, in contrast to the incidence of GC, tends to increase due to an increase in the proportion of patients with stage IV [24]. In the world, the highest survival rate is registered in Japan – 53% [25], in other countries it does not exceed 15-20% [26]. It should be noted that the share of early GC in Japan is the largest and accounts for half of all cases, while in Europe, the United States and other countries it does not exceed 20%. In this regard, there have been suggestions that the GC in the Japanese is fundamentally different from the GC in the Europeans, but further research

in molecular biology has shown that this assumption is wrong, and progress in improving survival in Japan is due to adopted national programs to combat cancer and mass screening of the population. Decreases in morbidity and mortality have been observed in countries with very low rates, such as Sweden or Switzerland in Europe, the United States and Australia, and this has been particularly marked among young people, indicating that declining trends are likely to continue in the future.

As mortality from GC has long been declining, the absolute decline is now smaller and will be even smaller in the future. During the 1990s, GC, along with colorectal and lung cancer, was a major contributor to the decline in overall cancer mortality in Europe, with more than 30,000 deaths avoided each year since the late 1980s in 15 EU countries (defined as before 20045, [27]). In the same countries, the absolute decline corresponds to less than 20,000 deaths, which were avoided per year in the last years, due to lower mortality rates.

Among women aged 30–49, gastric cancer mortality has stopped declining in several European countries, including France, the United Kingdom and Australia, at around 1 / 100,000, in contrast to Ukraine. However, there were several parts of the world, including not only East Asia and South America, but most of Central and Eastern Europe [28,29], where higher rates of gastric cancer morbidity and mortality were still observed.

The stability of trends for any age and the reduction in the age of 35–64 years is an additional indicator of the reliability of the death certificate from GC. In any case, it is unlikely that any change in the diagnosis and certification of GC explains more than a small fraction of the widespread and significant trends in GC mortality observed in recent decades. [30, 31]

The reasons for the overall decline in GC are complex and not fully understood. It almost certainly includes a more varied and rich diet and better food preservation, including refrigeration, as well as control of *H. pylori* infection.

In conclusion, despite encouraging mortality trends, GC remains one of the leading causes of death worldwide, but is likely to decline further. Primary dietary prevention of gastric cancer is possible by encouraging high-risk populations to reduce the consumption of dried meat and foods stored in salt and increase the consumption of fruits and vegetables. [32, 33] Prevention may also be possible by eliminating *H. pylori* infection, especially in children and adolescents.

CONCLUSIONS

GC incidence has declined throughout the world largely as a consequence of economic improvements that have brought about improved food preservation, availability, improved sanitation, access to clean water, and improved household hygiene which further led to a fall in *H. pylori* acquisition and a decline in prevalence among subsequent generations. The epidemiological situation with gastric cancer remains threatening and is characterized by an increase in the primary incidence of the population of Ukraine, in half of the cases due to neglected stages. This

leads to low survival (over 40% die within a year) and increased mortality, mainly male.

The results indicate the urgent need to develop and implement a program for the prevention of gastric cancer at the state and regional levels.

REFERENCES

1. Van Cutsem E., Sagaert X., Topal B. et al. Gastric cancer. *Lancet*. 2016; 388: 2654–64.
2. Karimi P., Islami F., Anandasabapathy S. et al. Gastric cancer: descriptive epidemiology, risk factors, screening, and prevention. *Cancer Epidemiol Biomarkers Prev*. 2014; 23: 700–13.
3. Luo G., Zhang Y., Guo P. et al. Global patterns and trends in stomach cancer incidence: Age, period and birth cohort analysis. *Int J Cancer*. 2017; 141: 1333–44.
4. Anderson W.F., Rabkin C.S., Turner N. et al. The changing face of noncardia gastric cancer incidence among US non-Hispanic Whites. *J Natl Cancer Inst*. 2018; 110: 608–15.
5. Herrera V., Parsonnet J. *Helicobacter pylori* and gastric adenocarcinoma. *Clin Microbiol Infect*. 2009; 15: 971–76.
6. Rothenbacher D., Bode G., Berg G. et al. *Helicobacter pylori* among preschool children and their parents: evidence of parent-child transmission. *J Infect Dis*. 1999; 179: 398–402.
7. National Cancer Registry of Ukraine: short description of the database. *Cancer in Ukraine. Ukrainian cancer registry statistics, bulletin of national cancer registry of Ukraine – № 12-21*. [Elektronnyy resurs]. <http://www.ncru.inf.ua/publications/index.htm>. (In Ukrainian).
8. Dumanskyj Ju.V., Severyn Gh.K. Dorichna letaljnistj khvorykh na zlojakisni novoutvorenja. *Visnyk socialjnoji ghghijeny i orghanizaciji okhorony zdorov'ja Ukrainy*. [Annual mortality of patients with malignant neoplasms]. *Bulletin of social hygiene and health care organization of Ukraine*. 2014; 1(59):59–64. (In Ukrainian).
9. Ferlay J., Colombet M., Soerjomataram I. et al. Global and Regional Estimates of the Incidence and Mortality for 38 Cancers: GLOBOCAN 2018. Lyon: International Agency for Research on Cancer. World Health Organization. 2018.
10. Global Cancer Facts and Figures. 2nd Edition WHO. American Cancer Society. 2011:60 . <http://www.cancer.org/acs/groups/content/%40epidemiologysurveillance/documents/document/acspc-027766.pdf>.
11. Torre L.A., Bray F., Siegel R.L. et al. Global cancer statistics, 2012. *CA Cancer J Clin*. 2015;65(2):87–108. doi:10.3322/caac.21262.
12. Ferlay J., Soerjomataram I., Ervik M. et al. GLOBOCAN 2012 v1.0, Cancer incidence and mortality worldwide: IARC CancerBase No. 11. Lyon, France: International Agency for Research on Cancer. 2013.
13. Marques-Lespier J.M., Gonzalez-Pons M., Cruz-Correa M. Current perspectives on gastric cancer. *Gastroenterol Clin N Am*. 2016;45(3):413–28. doi:10.1016/j.gtc.2016.04.002.
14. Lui F.H., Tuan B., Swenson S.L., Wong R.J. Ethnic disparities in gastric cancer incidence and survival in the USA: an updated analysis of 1992–2009 SEER data. *Dig Dis Sci*. 2014;59(12):3027–34. doi:10.1007/s10620-014-3275-3.
15. Karimi P., Islami F., Anandasabapathy S. et al. Gastric cancer: descriptive epidemiology, risk factors, screening, and prevention. *Cancer epidemiology, biomarkers & prevention: a publication of the American Association for Cancer Research, cosponsored by the American Society of Preventive Oncology*. 2014;23(5):700–13. doi:10.1158/1055-9965.epi-13-1057.

16. Fock K.M. Review article: the epidemiology and prevention of gastric cancer. *Aliment Pharmacol Ther.* 2014;40(3):250–60. doi: 10.1111/apt.12814.
17. Soerjomataram I., Lortet-Tieulent J., Parkin D.M. et al. Global burden of cancer in 2008: a systematic analysis of disability-adjusted life-years in 12 world regions. *Lancet.* 2012;380(9856):1840–50. doi:10.1016/s0140-6736(12)60919-2.
18. Merabishvili V.M. Rak zheludka: epidemiologiya, profilaktika, otsenka effektivnosti lecheniya na populyatsionnom urovne. *Prakt onkologiya* [Stomach cancer: epidemiology, prevention, assessment of the effectiveness of treatment at the population level]. *Practice oncology.* 2001;7(3):3–8. (In Russian).

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The Authors declare no conflict of interest.

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ORIGINAL ARTICLE

ANALYSIS OF THE EFFECTIVENESS OF THE FUNCTIONAL ORGANIZATIONAL MODEL FOR KNOWN PROPHYLAXIS OF CHRONIC NONINFECTIOUS DISEASES BASED ON THE ASSESSMENT OF THE QUALITY OF LIFE OF PATIENTS AT THE MEDICAL INSTITUTION

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ABSTRACT

The aim: Study of the indicators of quality of life of patients served by a multidisciplinary health care institution with the functionally-organizational model of coded prevention of chronic noninfectious diseases is implemented.

Materials and methods: To evaluate the effectiveness of the model's use we used the assessment of the dynamics of QL indices, which was assessed according to the EUROHIS-QOL 8-item index methodology among 376 patients aged over 18 years.

Results: Most of the respondents (61.4%) were dissatisfied to varying degrees with their state of health and, on average, evaluated their QL (56.1%). The overall assessment of the quality of life of the surveyed population was on a 20-point scale of 13.5 (3.19) points in 2017 before the introduction of the program of managed prevention of CNCDS and 14.6 (3.48) points after its three-year operation, with an increase integrated indicator on average by 1.1 (95% CI 0.59 – 1.60) points ($p < 0.001$). Among the areas of QOL assessment, the assessments in the physical sphere and the environment increased at most ($p < 0.05$). It is determined that the overall level of QOL of patients with NCDs is 40% due to medical and social factors that can be positively influenced by medical care using a model of managed prevention.

Conclusions: The analysis of changes in the quality of life of patients of multidisciplinary institutions who have risk factors for CNCDS or suffer from chronic non-communicable diseases, showed that the introduction of a functional-organizational model of managed prevention at the health care institution level can improve integrated assessment of QOL and positively affect the overall complex of medical and social factors, including managed risk factors. This indicates the effectiveness of this model of managed prevention at the level of a multidisciplinary health care institution.

KEY WORDS: chronic non-communicable diseases (Noncommunicable diseases (NCDs)); quality of life related to health; functional and organizational model; managed prevention

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INTRODUCTION

The fight against chronic non-communicable diseases covers all levels of health care and requires active participation at all levels of health management.

At the global level, among the "Sustainable Development Goals", Goal 3 "Strong health and well-being" stands out, which provides "Ensuring a healthy lifestyle and well-being of people of all ages." Among the top goals of this goal is paragraph 3.4 – "By 2030, reduce by one third premature deaths from non-communicable diseases through prevention and treatment, as well as maintain mental health and well-being." [1].

At the level of the health care facility (HCF), the completeness of the coverage of patients with chronic non-communicable diseases (NCDs) by continuous medical care is crucial. [2].

At present, experts note that progress in fulfilling the commitments to reduce the burden of NCDs has been

insufficient at all possible points of influence [3], the issue was particularly acute in the absence of financial investment and resource constraints [4]. The problem became even more acute in the context of the COVID-19 pandemic [5, 6].

According to the World Health Organization (WHO), the proportion of deaths from noncommunicable diseases is 71% in 2018, which is significantly higher than in 2000, when it was 40%. It is noted that 85% of deaths from NCDs were premature. Regarding the profile of Ukraine, according to WHO estimates, despite some positive dynamics of the probability of premature death from non-communicable diseases, death from NCDs is 91% of all deaths in the country (63% from cardiovascular disease), and the risk of premature death between 30-70 years is 25%, while the share of primary care centers in which the stratification of the risk of cardiovascular disease ranges from 25% to 50% [7,8].

It is believed that chronic non-communicable diseases lead to a deterioration in health-related quality of life (HRQoL). However, to date, research has been conducted to determine the factors influencing HRQoL in NCDs and their relationship [9, 10].

In addition to studying the predictors of quality of life in patients with non-communicable diseases, the QOL indicator can be used to assess the performance of various parts of the health care system, to monitor the results of medical interventions [11].

Assessments of various aspects of the health care system have become widespread in various countries, including Ukraine. Measurement of activity is most often carried out by measuring the processes and results at different levels, including at the level of the medical institution [10]. However, comprehensive research to assess the effectiveness of the implementation of innovative organizational aspects of medical care in NCDs is lacking, which led to the relevance of the study.

THE AIM

Study of indicators of quality of life of patients served by a multidisciplinary health care institution, where a functional-organizational model of managed prevention of chronic non-communicable diseases has been introduced.

MATERIALS AND METHODS

The study was conducted on the basis of the State Institution of Science “Research and Practical Center of Preventive and Clinical Medicine” State Administrative Department, where a functional-organizational model of managed prevention was implemented. To assess the effectiveness of the model, we used the assessment of the dynamics of QOL indicators. The survey was conducted twice in 2017 – before the introduction of the model of managed prevention and in 2020 – after its introduction and operation.

The study involved 376 patients over 18 years of age who were served in the HCF during 2017 – 2020. In the second stage of the study, 342 people were interviewed, which is 9.0% less than the initial number of patients. It is the results of a survey of patients who were interviewed twice that formed the basis of this publication.

Among the surveyed were 42.4% men and 57.6% women, the age of the respondents ranged from 18 to 82 years, the average age was 52.3 (15.5) years M (SD).

The study of the quality of life of patients was conducted according to the WHO QOL method – 8 (EUROHIS-QOL 8-item index) which is an abbreviated modification of the WHO QOL questionnaire – 26 (WHOQOL-BREF) and showed satisfactory discriminant validity and is a suitable method for assessing the effectiveness of health care [12, 13].

The questionnaire has general questions on the assessment of QOL and questions related to various areas – the physical sphere, the psychological sphere, social relation-

ships, the environment (Physical, Psychological, Social relationship, Environment).

The analysis of questions related to the four areas of quality of life included a score of each area on the points of answers to the questionnaire (from 1 to 5) and their conversion to values in the range 0 – 20. The maximum total score (taking into account the direction of the answers) is the same for all areas. It cannot exceed 20 points and has set interpretation intervals for the assessment of quality of life: the range from 4 to 6 points corresponds to a very poor assessment, from 7 to 10 – bad, 11-13 – average, 14-17 – good, and 18-20 – very good [12]. The consequence of such assessment is the ability to quantify the respondent's satisfaction with different aspects of life and get a profile by area.

Information from the anamnestic questionnaires of patients collected during care at SIS RPCPCM was also used. Participation in the survey took place only with the informed consent of patients.

The research materials were processed using the Excel-2010 spreadsheet editor and the software package MedCalc Statistical Software trial version 19.6.4 (MedCalc Software bvba, Ostend, Belgium; <https://www.medcalc.org>; 2021). Statistical processing of the results was performed using the methods of descriptive and analytical statistics. Assessment of the reliability of differences was performed on the paired Student's t test (T) and the chi-square criterion (χ^2). Paired and partial correlation coefficients (r) were calculated to assess the relationship between the elements. The level of statistical significance $p < 0.05$ is considered critical.

RESULTS

Interviewed patients evaluate their health differently. Almost every fifth (18.4%) rated their health at the time of the survey as very good and good, the majority (50.6%) – as average, almost a quarter (22.8%) – as poor and very bad. This is primarily due to the fact that respondents were interviewed during a visit to a medical facility, which they carried out for different purposes. The cohort included both patients with acute and chronic illnesses, those who had recovered, and those who had visited a health care facility for a preventive examination.

The majority of respondents (61.4%) were to varying degrees dissatisfied with their own health, the rest were completely or partially satisfied. These estimates correspond to quality of life assessments. Estimates of the distribution of the overall level of quality of life are distributed approximately in half between negative (28.7%) and positive (15.2%). QOL rated as average – “not bad and not good” – more than half of respondents (56.1%).

Among the pathological conditions that act as risk factors and for which the examined patients suffer (Fig. 1), arterial hypertension is the most common – 36.17% (95% CI 31.31 – 41.03), elevated blood glucose – 30.59% (95% CI 25.93 – 35.24), malnutrition – 16.22% 95% CI (12.5-19.95) and others.

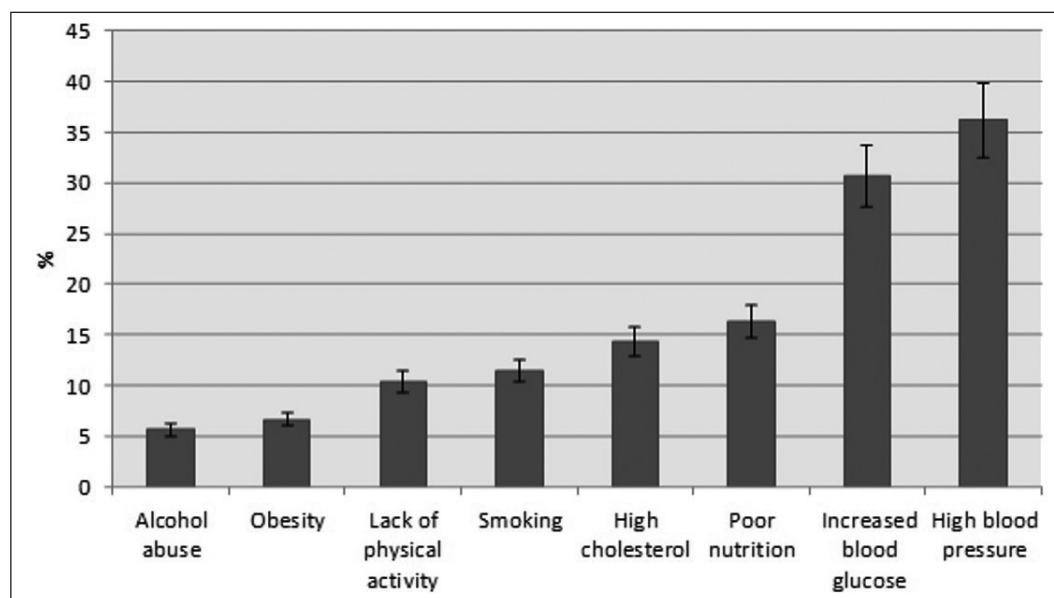


Fig. 1. Frequency of detection of the main risk factors for the development of the most common NCDs in the examined patients (% and 95% CI).

Table I. Dynamics of quality of life assessments by areas and in general in the examined patients with NCDs (M (SD) - average points on a 20-point scale EUROHIS-QOL 8-item)

EUROHIS-QOL 8-item domains	Before the introduction of the model of managed prevention (2017)	After the introduction of the model of managed prevention (2017)	Score difference M (95%CI)	Level
Physical	13,4 (3,32)	14,5 (4,13)	1,1 (0,62 - 1,58)	<0,001
Psychological	13,5 (3,17)	14,1 (3,68)	0,6 (0,08 - 1,12)	0,023
Social	14,1 (3,31)	14,6 (3,12)	0,5 (0,02 - 0,98)	0,043
Environment	13,6 (2,89)	14,1 (3,61)	0,8 (0,01 - 0,99)	0,046
EUROHIS-QOL 8-item index	13,5 (3,19)	14,6 (3,48)	1,1 (0,59 - 1,60)	<0,001

The overall assessment of the quality of life of the surveyed population was on a 20-point scale of NCDs and 14.6 (3.48) points after its three-year operation 0.001) (Table I).

Assessment of quality of life by areas of life showed that the most positive, both in the first and in the second survey, patients assess social relationships, i.e. most respondents do not have problems in the field of personal relationships and social support. To a lesser extent, in the first survey, patients were satisfied with the physical and psychological spheres of life, which indicates a decrease in vital activity, energy and positive emotions in the interviewed population.

Correlation analysis showed that the integrated assessment of QOL of the examined patients is largely formed due to the physical sphere (correlation coefficient $r = 0.79$; $p < 0.001$), in the second place – the environment ($r = 0.69$; $p < 0.001$), on the third – psychological sphere ($r = 0.66$; $p < 0.001$) and on the last place on influence of social communications ($r = 0.514$ $p < 0.001$). Thus, despite the high assessment of the social sphere, these aspects of life do not have a very large impact on the overall assessment of QOL. And a negative assessment of the environment, which includes elements such as physical security and safety, financial resources, the external environment, as well as elements of medical and social care, has a stronger impact and forms an average low level of QOL patients with NCDs.

The overall quality of life of the examined patients with NCDs is also influenced by various other factors. According to our research, these are such factors as age, marital status, nature of work, health status, nature of medical care, income level. The quality of life of patients with NCDs is more influenced by the state of health: the better the state of health, the higher the overall score of QOL ($r=0.54$, $p < 0.01$). In respondents with very good health, self-esteem, quality of life assessment was 27.2% higher than the average ($p=0.031$). Respondents who rated their health as very poor had a QOL level 17.6% below average ($p=0.043$).

The multiple correlation coefficient, which shows the degree of general influence of the above factors on QOL is $R=0.6$ and indicates the presence of an average bond strength; the coefficient of determination is $R^2=0.4$ ($p=0.020$), which indicates that the overall level of QOL in patients with NCDs by 40% is due to medical and social factors.

DISCUSSION

Although all countries are trying to strengthen their health care systems, no significant progress has been made in reducing the burden of chronic noncommunicable diseases [2, 3, 7].

During the COVID-19 pandemic, its negative impact on the process of providing medical services at the NCD was revealed, primarily due to the impact on health care financing and resource outflow. In such circumstances, experts call for the elimination of disruptions and continuity of medical care for this group of patients, to use non-standard approaches and tools of e-Health [5, 6].

In the context of the COVID-19 epidemic, like most countries, Ukraine is trying to improve the process of integrated multidisciplinary primary health care with NCDs. Of particular importance is the optimization of the organization of medical care for patients with chronic non-communicable diseases at the level of multidisciplinary health care facilities with a coordinating role of the primary care. Coordination and integration play a key role in the organization of patient-centered care with NCDs and the management of results [2].

To achieve positive results in the management of NCDs, it is important to manage risk factors, including modified: high blood pressure, smoking, diabetes, physical activity, obesity, high blood cholesterol, etc. [14]. It should be noted that the prevalence of such risk factors as high blood pressure, high blood sugar, tobacco use and lack of physical activity, our data (Fig. 1), largely correspond to the results of most international studies on NCDs [14].

Also, an effective strategy is to move to the provision of care for NCDs by larger multidisciplinary teams, in the form of a comprehensive package of preventive services, which expands the possibilities for combating the burden of chronic noncommunicable diseases [2].

Modern strategies for the management of NCDs should be focused on the individual level, when a person is responsible for their health, and HCFs play the role of its provider and regulator in this area [14].

More opportunities for the implementation of integrated management of patients with chronic non-communicable diseases have HCFs that are able to adequately develop the medical route of patients, taking into account the impact on patients of a number of existing risk factors.

A feature of the functional-organizational model of managed prevention, developed and implemented in is the distribution of the population by groups with certain risk factors and their combination, and their further distribution by individual prevention programs, supported by certain distribution of resources available to institutions, which is reflected in the cost of appropriate prevention programs.

The assessment of the quality of life of patients with NCDs, conducted before and after the implementation of the model of managed prevention, showed its effectiveness, as for three years of its operation there was an increase in the integrated indicator by an average of 1.1 (95% CI 0.59 – 1.60) points (Table I). Among the areas of QOL assessment, the highest increase was in the physical field, which describes the health and well-being of patients, and the field of the environment, which also includes elements of medical and social care. It should be noted that the increase in all estimates reached a statistically significant level ($p < 0.05$).

It was determined that the overall level of QOL in patients with NCDs by 40% is due to medical and social factors. Recent studies have shown that managed primary care can have a positive effect on the social determinants of NCDs [15]. Thus, adequate care at the primary level using a model of managed prevention can have a positive impact on both medical and social determinants of impact, and integrated indicators of individual health in terms of quality of life.

CONCLUSIONS

The analysis of changes in the quality of life of patients of multidisciplinary institutions with risk factors for NCDs or suffering from chronic non-communicable diseases showed that the introduction of a functional-organizational model of managed prevention at the HCF level can improve integrated assessment of QOL and positively affect the medical complex. social factors, including managed risk factors. This indicates the effectiveness of this model of managed prevention at the level of a multidisciplinary health care institution.

REFERENCES

1. Morton S., Pencheon D., Squires N. Sustainable Development Goals (SDGs), and their implementation: A national global framework for health, development and equity needs a systems approach at every level. *Br Med Bull.* 2017;124(1):81-90. doi: 10.1093/bmb/ldx031.
2. Jakab M., Farrington J., Borgermans L. et al. Health systems respond to NCDs: time for ambition. Copenhagen: WHO Regional Office for Europe. 2018: 278.
3. Nishtar S., Niinistö S., Sirisena M. et al.; Commissioners of the WHO Independent High-Level Commission on NCDs. Time to deliver: report of the WHO Independent High-Level Commission on NCDs. *Lancet.* 2018 ;392(10143):245-252. doi: 10.1016/S0140-6736(18)31258-3.
4. GBD 2019 Universal Health Coverage Collaborators. Measuring universal health coverage based on an index of effective coverage of health services in 204 countries and territories, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet.* 2020;396(10258):1250-1284. doi: 10.1016/S0140-6736(20)30750-9.
5. World Health Organization. The impact of the COVID-19 pandemic on noncommunicable disease resources and services: results of a rapid assessment. Geneva: World Health Organization. 2020: 24.
6. Katzmarzyk P.T., Salbaum J.M., Heymsfield S.B. Obesity, noncommunicable diseases, and COVID-19: A perfect storm. *Am J Hum Biol.* 2020;32(5):e23484. doi: 10.1002/ajhb.23484.
7. World Health Organization. Noncommunicable Diseases (NCD) Country Profiles. Geneva: World Health Organization. 2018:223.
8. Gruzjeva T.S., Diachuk M.D., Inshakova H.V., Zamkevych V.B. Modern demographic trends in Ukraine as a realization of preventative strategies. *Wiadomości Lekarskie.* 2019; 72(10):2033-2039.
9. Van Wilder L., Clays E., Devleeschauwer B. et al. Health-related quality of life in patients with non-communicable disease: study protocol of a cross-sectional survey. *BMJ Open.* 2020;10(9):e037131. doi: 10.1136/bmjopen-2020-037131.
10. Zhou T., Guan H., Yao J. et al. The quality of life in Chinese population with chronic non-communicable diseases according to EQ-5D-3L: a systematic review. *Qual Life Res.* 2018;27(11):2799-2814. doi: 10.1007/s11136-018-1928-y.

11. Smith P., Papanicola I. Health system performance comparison: an agenda for policy, information and research. Policy summary 4. UK. Maidenhead: Open University Press; 2013; 26 p.
12. Nosikov A., Gudex C. EUROHIS: developing common instruments for health surveys. Biomedical and health research. 2003;57:204.
13. da Rocha N.S., Power M.J., Bushnell D.M. et al. The EUROHIS-QOL 8-item index: comparative psychometric properties to its parent WHOQOL-BREF. Value Health. 2012;15(3):449-57. doi: 10.1016/j.jval.2011.11.035.
14. Budreviciute A., Damiati S., Sabir D.K. et al. Management and Prevention Strategies for Non-communicable Diseases (NCDs) and Their Risk Factors. Front Public Health. 2020;8:574111. doi: 10.3389/fpubh.2020.574111.
15. Allen L.N., Smith R.W., Simmons-Jones F. et al. Addressing social determinants of noncommunicable diseases in primary care: a systematic review. Bull World Health Organ. 2020;98(11):754-765B. doi: 10.2471/BLT.19.248278.

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ORIGINAL ARTICLE

ANALYSIS OF STUDENTS' SOMATIC HEALTH AND EMOTIONAL STATE DURING SPORTS GAMES CLASSES

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ABSTRACT

The aim: Is to investigate the impact of sports games (football) on the level of somatic health and emotional state of students in the process of studying.

Materials and methods: The study was conducted at Kharkiv State Academy of Physical Culture and Sumy State University (Ukraine) in 2018-2019. The study involved 87 male students of the main department. Two groups were formed: an experimental group (EG, n=42), the students of which were engaged in a sports-oriented form of physical education (in the class of football), and a control group (CG, n=45), the students of which were training according to the traditional methods of organizing physical education classes at higher education institutions. The somatic health of students was assessed according to the method of H. L. Apanasenko, which provided for the determination of body mass, life, power, and Robinson indexes, heart rate recovery time after a standard exercise. The emotional state of students was determined by the WAM (Well-being, Activity, Mood) methodology.

Results: At the end of the study, the EG students showed a significantly better level of somatic health than the CG students; the difference was significant and accounted for 3.18 points ($p < 0.001$). At the same time, during the study, the EG students had a more pronounced significant increase in all studied health indicators ($p < 0.001$). The best emotional state level of the students of both groups was recorded at the end of the study, but in the EG students it was significantly ($p < 0.05$) better than in the CG students by 0.55-0.73 points.

Conclusions: It was found that sports games classes, including football, had a positive effect on the level of somatic health and emotional state of students. Significant changes were observed in the performance of the respiratory and cardiovascular systems of students. The high level of somatic health and good emotional state of students will help to improve mastering academic disciplines at higher education institutions, provide preparation for active life and help to improve future professional activities.

KEY WORDS: somatic health, students, football

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INTRODUCTION

It is known that the current state of health and physical fitness of university students of Ukraine is unsatisfactory [1, 2, 3]. The works of many scientists [4, 5, 6] mention that the "biological" age of most students outruns the passport age by 10-15 years; from 50 % to 90 % of students (according to various authors) have health disorders; the health of most students is not improved during their studies at higher education institutions (HEI), but, on the contrary, it deteriorates; the number of students with low and below the middle levels of somatic health ranges from 60 % to 85 % at different HEI and is constantly increasing, according to various researchers. The scientists [7-11] consider this situation to be a consequence of the inefficient functioning of the existing system of physical education at educational institutions (schools, higher education institutions).

According to many scientists [12-15], one of the ways

to improve the health of students while they are studying at HEI is the introduction of a sports-oriented form of physical education – physical education with a sports focus, which takes into account students' choice of sports they would like to do during physical education classes.

One of the effective means of physical education, which can positively affect the health level of students and improve their emotional state is sports games, among which the most honorable place is occupied by football [16]. Football is quite a common sport in many countries around the world. In addition, according to scientists [17], nowadays football is one of the most effective mechanisms for mass involvement of young people in exercises and sports, the increase of their physical activity, which helps to strengthen their health and motivation to engage in physical education and sports. Football is a well-known game, especially attractive for boys, which plays a great educational role in developing

Table I. Dynamics of somatic health indicators of EG and CG students in the process of studying at higher education institutions (n=87)

Terms of study	EG (n=42)	CG (n=45)	Significance level
	X±m	X±m	
BMI, kg/m ²			
1st	22.73±0.52	22.75±0.48	p>0.05
2nd	22.77±0.50	23.08±0.46	p>0.05
3rd	22.78±0.48	23.51±0.47	p>0.05
4th	22.76±0.47	23.92±0.50	p>0.05
LI, ml/kg			
1st	57.28±0.61	57.31±0.65	p>0.05
2nd	58.62±0.60	57.14±0.62	p>0.05
3rd	59.97±0.59	57.02±0.60	p<0.01
4th	61.03±0.62	56.91±0.61	p<0.001
PI, %			
1st	58.85±0.62	58.90±0.65	p>0.05
2nd	59.07±0.65	59.05±0.67	p>0.05
3rd	59.92±0.66	59.24±0.69	p>0.05
4th	60.67±0.68	59.31±0.71	p>0.05
RI, c. u.			
1st	86.29±0.71	86.32±0.64	p>0.05
2nd	85.70±0.65	85.94±0.62	p>0.05
3rd	83.92±0.62	85.11±0.59	p>0.05
4th	81.83±0.58	84.79±0.57	p<0.01
Heart rate recovery time, s			
1st	128.4±2.21	129.0±2.32	p>0.05
2nd	122.1±2.15	125.8±2.27	p>0.05
3rd	115.5±2.10	121.4±2.22	p>0.05
4th	106.7±2.07	117.5±2.15	p<0.01
Somatic health level, points			
1st	2.08±0.25	2.11±0.21	p>0.05
2nd	3.14±0.23	2.89±0.22	p>0.05
3rd	5.87±0.20	3.51±0.22	p<0.001
4th	7.20±0.19	4.02±0.23	p<0.001

team play skills [18]. Regular football activities contribute to a significant increase in endurance, speed, and power, improve coordination and have a positive effect on all the systems and organs of the body by increasing the amount of oxygen consumed (which is especially important for the heart) [19]. In addition, playing football strengthens the bones, which significantly reduces the risk of fractures when falling [20]. Systematic sports games (football) help to improve the vital capacity of the lungs and maximum oxygen consumption in comparison with untrained individuals. Besides, playing football leads to the formation of a more economical version of the cardiovascular system functioning at rest [18]. According to scientists [16, 20], all sports games are associated with psychological loads different in nature and intensity, and football is no exception.

THE AIM

The aim of this study is to investigate the impact of sports games (football) on the level of somatic health and emotional state of students in the process of studying.

MATERIALS AND METHODS

The study was conducted at Kharkiv State Academy of Physical Culture and Sumy State University (Ukraine) in 2018-2019. The study involved 87 male students of the main department. Two groups were formed: an experimental group (EG, n=42), the students of which were engaged in a sports-oriented form of physical education (in the class of football), and a control group (CG, n=45), the students of which were training according to the traditional methods of organizing physical education classes at HEI. The number of hours for physical education was the same in both groups.

The somatic health of students was assessed according to the method of H. L. Apanasenko, which provided for the determination of body mass, life, power, and Robinson indexes, heart rate recovery time after a standard exercise. The emotional state of students was determined by the WAM (Well-being, Activity, Mood) methodology.

The research methods: theoretical (analysis, synthesis, and generalization of educational, scientific, and methodical literature, comparison); empirical (pedagogical observation, pedagogical testing, pedagogical experiment); statistical analysis.

The research was performed according to the requirements of the Regulations on Academic Honesty of Kharkiv State Academy of Physical Culture and Sumy State University, which were developed on the basis of Ukrainian and world experience of ethical rulemaking. The consent was obtained from participants in the scientific process and respondents who could refuse to participate in it at any time.

RESULTS

The analysis of body mass index (BMI) showed that in all terms of study, except for the 1st one, BMI was better in the EG in comparison with the CG, but no significant difference between them was recorded (p>0.05). BMI of students of both groups in all terms was within the norm for males (18.50-24.99 kg/m²). The difference between the BMI in the 1st and 4th terms in the EG accounted for 0.03 kg/m² and was insignificant (p>0.05). In the CG, the indicators of the 4th term were worse than those of the 1st one by 1.17 kg/m² (p> 0.05) (Table I).

The study of the Life index (LI) shows that no significant difference between the indicators of the EG and CG students was found in the 1st and 2nd terms (p>0.05). The LI of EG students was significantly better than that of CG students by 2.95 ml/kg in the 3rd term (p<0.01), and by 4.12 ml/kg in the 4th term (p<0.001) (Table I). The analysis of the LI dynamics during the experiment showed that the indicators significantly improved by 3.75 ml/kg in the EG (p<0.001), and, on the contrary, deteriorated by 0.4 ml/kg in the CG (p>0.05).

Table II. Dynamics of emotional state indicators of EG and CG students in the process of studying at higher education institutions (n=87)

Terms of study	EG (n=42)	CG (n=45)	Significance level
	X±m	X±m	
Well-being, points			
1st	6.95±0.17	7.01±0.19	p>0.05
2nd	7.41±0.16	7.25±0.18	p>0.05
3rd	7.88±0.14	7.48±0.16	p>0.05
4th	8.17±0.12	7.62±0.17	p<0.05
Activity, points			
1st	6.80±0.21	6.85±0.18	p>0.05
2nd	7.29±0.20	6.99±0.21	p>0.05
3rd	7.68±0.21	7.24±0.20	p>0.05
4th	8.08±0.20	7.46±0.22	p<0.05
Mood, points			
1st	6.47±0.19	6.60±0.17	p>0.05
2nd	6.95±0.18	7.01±0.21	p>0.05
3rd	7.26±0.18	7.19±0.20	p>0.05
4th	7.98±0.17	7.25±0.19	p<0.05

The Power index (PI) study showed that PI of the EG students was better by 1.36 % in the 4th term (Table I). During the experiment, the PI in both groups of students was improved (by 1.82 % in the EG and by 0.41 % in CG).

The analysis of the Robinson index (RI) showed that no significant difference between the EG and CG was found in the 1st – 3rd terms (p>0.05). In the 4th term, the RI of EG students was significantly better than that of the CG students by 2.96 c.u. (p<0.01) (Table I). The analysis of the RI dynamics showed a positive trend in both study groups, but the indicators were improved significantly by 4.46 c. u. in the EG (p<0.001), and by 1.53 c.u. in the CG insignificantly (p> 0.05).

The analysis of the heart rate recovery time after 20 squats in 30 s showed that in the 4th term, the indicators of the EG students was found to be significantly (p<0.01) better than that of the CG students by 10.8 s (Table I). The analysis of the somatic health level showed that the indicators of the EG and CG students did not differ significantly in the 1st and 2nd terms (p>0.05). The somatic health level of the EG students was significantly better than that of the CG students by 2.36 points in the 3rd term (p<0.001), and by 3.18 points in the 4th term (p<0.001) (Table I). The dynamics of the health level of the students of both groups was positive – the results of students in the 4th term were significantly better than in the 1st (p<0.001) by 5.12 points in the EG and 1.91 points in the CG. This confirmed the positive impact of football classes on the level of students' somatic health.

The analysis of the emotional state indicators of students according to the WAM methodology showed that a significant difference between the EG and CG was not found in the 1st – 3rd terms in terms of any studied characteristics (well-being, activity, mood) (p>0.05) (Table II).

In the 4th term, the indicators of well-being in the EG were significantly (p<0.05) better than in the CG by 0.55 points, activity indicators – by 0.62 points, mood – by 0.73 points. The analysis of the dynamics of the emotional state of students showed that the indicators were significantly improved in both groups, but the reliability of the difference between the indicators of the 4th and 1st terms was p<0.001 in the EG, and p<0.05 in the CG. This made it possible to state the positive impact of football classes on the emotional state of students in the process of studying at HEI.

DISCUSSION

Physical education associated with the process of educating, acquiring the appropriate knowledge and skills to use physical activity for comprehensive development, health-improvement, and readiness for professional activities, and active participation in the life of society [2, 8, 10]. The scientists [13, 15] argue that physical education at HEI should be a solid foundation for a high level of mental capacity of students in the learning process, involving them in regular exercises, creating the need for physical development and improvement to ensure the health and professional longevity.

The works of many scientists [3, 5, 9] have established a close relationship between the health, physical fitness of students, and the organization of physical education at HEI. The scientists [1, 4, 7] note that the existing system of physical education at Ukrainian HEI is not effective enough to improve the somatic health of students during their studies. The scientists [14, 15] distinguish the main shortcomings of the existing system of physical education at the Ukrainian HEI: a low level of somatic health and physical fitness of school graduates and, accordingly, HEI applicants; a decrease in the students' interest and motivation for the traditional physical education classes; a decrease in the prestige of health as the most important human value; insufficient health and training orientation of the forms and means of physical education; the lack of differentiated approach in the process of physical education, insufficient variety of the forms of physical education classes organization, etc.

The scientists [4, 8, 9] note that one of the ways to solve this problem is the introduction of physical education classes with a sports focus. Football is an effective way to promote good somatic health, fitness, and emotional well-being [17, 19]. Football is a sport that contributes to the most diverse physical development of a person and at the same time places extremely high demands on the organism. Playing football is associated with the need to maintain the high performance for a long time and perform work of maximum intensity against the background of significant general fatigue and stress. Football training produces the ability to master motor actions and restructure motor activity quickly in accordance with the changing environment. Football requires dexterity in movements with the ball, without the ball, in constantly changing game situations [18, 20].

Modern football has diverse and complex techniques. Systematic football classes, participation in competitions in this sport have a comprehensive impact on students: normal physical development is ensured, the functional activity of their body is improved. Playing sports also contributes to the development of some positive traits and qualities of character: the ability to subordinate personal interests to the interests of the team, mutual assistance, respect for rivals and partners, activity, conscious discipline, punctuality, sports ethics, responsibility. Thus, the results of our research confirm the conclusions of many scientists about the positive impact of football on the health and emotional state of students while studying at HEI.

CONCLUSIONS

It was determined that the level of somatic health was significantly ($p < 0.001$) better in the EG students than in the CG students at the end of the study, the difference accounted for 3.18 points. The analysis of the somatic health dynamics during the study at HEI showed that there was a more pronounced significant increase in the level of somatic health in the EG ($p < 0.001$). The best emotional state indicators of the students of both groups were recorded at the end of the study, but they were significantly better in the EG than in the CG by 0.55 points in terms of well-being, 0.62 points concerning activity, and 0.73 points – mood ($p < 0.05$).

It was found that football classes had a positive effect on the level of somatic health and emotional state of students in the process of physical education at HEI. Significant changes were observed in the indicators of the respiratory and cardiovascular systems of students (in the indicators of LI, RI, heart rate recovery, and somatic health). The high level of health and good emotional state of students will help to improve mastering academic disciplines in the educational process at HEI, provide preparation for active life and help to improve future professional activities.

REFERENCES

- Gruzieva T., Galiienko L., Pelo I. et al. Health and lifestyle of students' youth: status, problems and ways of solution. *Wiad Lek.* 2018; 71(9): 1753-1758.
- Mozolev O., Khmara M., Shorobura I. et al. Comparative analysis of the effectiveness of Polish and Ukrainian basic training programs in physical education for 9-10-year-old pupils. *Universal Journal of Educational Research.* 2019; 7(11): 2345-2351. doi: 10.13189/ujer.2019.071112.
- Prontenko K., Griban G., Dovgan N. et al. Students' health and its interrelation with physical fitness level. *Sport Mont.* 2019; 17(3): 41-46. doi 10.26773/smj.191018.
- Griban G., Lyakhova N., Tymoshenko O. Current state of students' health and its improvement in the process of physical education. *Wiad. Lek.* 2020; 73(7), 1438-1447. doi: 10.36740/WLek202007124.
- Prysiazniuk S., Tolubko V., Oleniev D. et al. The influence of physical activities on biological age parameters of the first-year female students from the special medical department. *Journal of Physical Education and Sport.* 2018; 18(2): 561-564. doi:10.7752/jpes.2018.02081.
- Griban G., Prontenko K., Zhamardiy V. et al. Professional stages of a physical education teacher as determined using fitness technologies. *Journal of Physical Education and Sport.* 2018; 18(2): 565-569. doi:10.7752/jpes.2018.02082.
- Mozolev O., Bloschynsky I., Aliexsieiev O. et al. Influence of modern fitness technologies on the state of health and development of motor abilities of 17–19-year-old female students. *Journal of Physical Education and Sport.* 2019; 19(3): 917-924. doi:10.7752/jpes.2019. s3132.
- Prontenko K., Griban G., Alohyna A. et al. The physical development and functional state as the important components of the students' health. *Wiad. Lek.* 2019; 72(12a): 2348-2353. doi: 10.36740/WLek201912115.
- Griban G., Kobernyk O., Terentieva N. et al. Formation of health and fitness competencies of students in the process of physical education. *Sport Mont.* 2020; 18(3): 73-78. doi: 10.26773/smj.201008.
- Zhamardiy V., Shkola O., Okhrimenko I. et al. Checking of the methodical system efficiency of fitness technologies application in students' physical education. *Wiad Lek.* 2020; 73 (2): 332-341. doi: 10.36740/WLek202002125.
- Griban G., Yavorska T., Tkachenko P. et al. Motor activity as the basis of a healthy lifestyle of student youth. *Wiad. Lek.* 2020; 73(6): 1199-1206. doi: 10.36740/WLek202006123.
- Prontenko K., Bloschynskyi I., Griban G. et al. Formation of readiness of future physical culture teachers for professional activity. *Universal Journal of Educational Research.* 2019; 7(9): 1860-1868. doi: 10.13189/ujer.2019.070903.
- Griban G., Tymoshenko O., Arefiev V. et al. The role of physical education in improving the health status of students of special medical groups. *Wiad. Lek.* 2020; 73 (3): 534-540. doi: 10.36740/WLek202003125.
- Prontenko K., Griban G., Bloschynskyi I. et al. Improvement of students' morpho-functional development and health in the process of sport-oriented physical education. *Wiad Lek.* 2020; 73(1): 161-168. doi: 10.36740/WLek202001131.
- Mozolev O., Bloschynskyi I., Prontenko K. et al. Influence of fitness techniques integration on the development of physical qualities and morpho-functional state of adult females. *Human Movement.* 2021; 22(1): 57-65. <https://doi.org/10.5114/hm.2021.98465>.
- Rago V., Pizzuto F., Raiola G. Relationship between intermittent endurance capacity and match performance according to the playing position in sub-19 professional male football players: Preliminary results. *Journal of Physical Education and Sport.* 2017; 17(2): 688-691.
- Castellano J., Blanco-Villasenor A., Alvarez D. Contextual variables and time-motion analysis in soccer. *International Journal of Sports Medicine.* 2011; 32(6): 415-421. doi: 10.1055/s-0031-1271771.
- Clemente F. M., Wong D. P., Martins F. M. L., Mendes R. S. Acute effects of the number of players and scoring method on physiological, physical, and technical performance in small-sided soccer games. *Research in Sports Medicine.* 2014; 22(4): 380-397.
- Da Silva J., Guglielmo L., Bishop D. Relationship between different measures of aerobic fitness and repeated-sprint ability in elite soccer players. *The Journal of Strength and Conditioning Research.* 2010; 24(8): 2115-2121. doi: 10.1519/JSC.0b013e3181e34794.
- Sampaio J., Lago C., Goncalves B. et al. Effects of pacing, status and unbalance in time motion variables, heart rate and tactical behavior when playing 5-a-side football small-sided games. *Journal of Science and Medicine in Sport.* 2014; 17(2): 229-233.

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THE MODIFYING ROLE OF TOXIC SUBSTANCES ON GENOTOXIC EFFECT IN THE BODY DURING COMBINED ADMINISTRATION WITH CARCINOGEN (BENZO[A]PYRENE)

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ABSTRACT

The aim: of this work was to experimentally study the modifying role of toxic substances (phenol) in the manifestation of genotoxic and immunological changes in the body when exposed to a carcinogen (benzo[a]pyrene).

Materials and methods: Investigations were carried out in the chronic experiment on white random-bred male mice. Genotoxic (micronucleus test), immunologic and pathomorphological methods were used.

Results: As a result of the experiment on white outbred mice during the isolated peroral administration of benzo[a]pyrene (a single dose of 0.1 mg) and in combination with phenol (single doses of 0.1 mg; 0.002 mg) a carcinogenic effect (forestomach papillomas) has been established as well as general patterns of the manifestation of genotoxic and immunological changes regarding carcinogenesis and their dependence on the dose and duration of the administration of the substances in the early stages of the experiment. The established patterns involved parallelism of development and unidirectionality of the genotoxic effect (increasing of micronucleus incidence) and suppression of the T-cell immunity by the end of the month as well as reliable negative correlation between them.

Conclusions: It has been established that phenol has a modifying effect on carcinogenesis, which was shown as an increase in the micronuclei frequency, intensification of immunosuppression in the early stages and an increase in the multiplicity factor of the development of forestomach tumors.

KEY WORDS: micronuclear test, immunosuppression, carcinogenesis, phenol

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INTRODUCTION

People nowadays are constantly affected by a complex of numerous chemical compounds of different types, which are characterized by a wide range of biological effects – from toxic to mutagenic and carcinogenic ones. According to the US National Toxicology Program, the total number of chemicals that a person is exposed to in the home, in the workplace or from an environmental source exceeds 100,000, of which 5-10% are carcinogenic compounds and the same number accounts for mutagenic ones [1].

One of the adverse impacts of chemical pollution on human health is the increase in the number of cancer cases. Today it has been proven that the development of malignant tumors is determined not only by the initiating action of carcinogenic agents, but also by the modifying effect of accompanying toxic compounds [2-4].

In these circumstances, the problem of early detection and evaluation of hazardous chemicals and their complexes in order to develop and implement appropriate preventive measures requires accelerated testing methods.

THE AIM

The aim of this work was to experimentally study the role of toxic substances (phenol) in modifying the manifestation of genotoxic and immunological changes in the organism in the early stages of carcinogenic action (benzo[a]pyrene).

The choice of indicators was based on modern views on carcinogenesis, according to which the realization of the carcinogenic effect is possible providing that apart from mutation there will be additional disorders in the body, particularly immunosuppression [5-7].

In addition, it is commonly known that a mutagenic effect does not always mean the presence of carcinogenic properties.

MATERIALS AND METHODS

For the purpose of this study, a chronic experiment was conducted on 290 white outbred mice from the animal facility of JSC "Phoenix", Kyiv. Benzo[a]pyrene (BaP) (company: Sigma–Aldrich, USA and well-known modifier of carcinogenesis – phenol (Ph) (company:Lach – Ner, Czech Republic) were used in the study.

The studies were conducted under conditions of isolated and combined peroral administration of these substances.

The animals were divided into 6 groups. Three groups of the mice were administered with the same single dose of BaP (0.1 mg) in triethylene glycol (TEG) separately (group 1) or in combination with phenol at single doses of 0.1 mg (group 3) and 0.002 mg (group 4). One group (group 2) was given only an aqueous solution of phenol at a dose of 0.1 mg. Two groups of the mice were control ones: solvent control (group 5, were given TEG at a dose of 0.2 ml) and intact (group 6). The substances were administered intragastrically through a probe, once a week at a dose of 0.2 ml.

6-7 mice from each group were sacrificed on different days – on days 9, 31, 95 from the beginning of the substance administration and during the developing of forestomach tumors (on days 182, 332, 423) and biomaterials were taken for the further research. The work with the animals was performed in accordance with the rules of local Committee for Bioethics. Genotoxicity was studied using the micronucleus (MN) test, taking into account its advantages over other genotoxic methods [1,8].

Considering mainly a local nature of the carcinogenic effect of BaP and the convergence of organospecificity of the mutagenic effect according to the MN test and carcinogenic one, only the target organ forestomach was taken for the study [1], which, flattened on thick paper, was fixed in 10% neutral buffered formalin. Half of a forestomach was used for the MN study, the rest -for the parallel study of pathomorphological changes. In this case, the pieces of a forestomach were treated according to the established techniques used in histopathology with creation of paraffin blocks. Histological sections were stained with hematoxylin and eosin.

At the same time, blood was collected for the immunotoxicity study, following the recommendations of WHO [9] and the Ministry of Health of Ukraine [10]. In this research the quantitative and qualitative composition of peripheral blood leukocytes, the number of killer cells, T and B lymphocytes, the spreading response of macrophages and polyethylene glycol 6000 precipitation of the circulating immune complex (CIC) were studied [11]. As a tissue antigen, forestomach and liver were used [11].

Cytogenetic effects were studied by using suspensions, which were prepared according to the recommendations [12]. The number of MN was counted per 1000 epithelial cells of each mouse's forestomach using Primo Star (ZEISS) and BIOLAM microscopes at 1000 and 900 magnification respectively using immersion lenses. MN detection was performed with the use of encoded medication, according to the criteria given in the cited literature [1].

The findings were evaluated with statistical methods traditionally used in biomedical research and Student's t-test. The relationship between the MN frequency and immunosuppression was determined using the Pearson correlation coefficient [13].

RESULTS

The results of the study of genotoxicity in mouse forestomach epithelium on different days from the beginning

of peroral administration of BaP and its combinations with phenol are illustrated in table I.

As can be seen from the data given, during isolated administration (group 1) BaP caused a genotoxic effect at each stage of the study (days 9, 31, 95 after injections 2, 5, 11 respectively), characterized by a significantly higher micronuclei frequency compared to that found in the control group. (groups 2, 5, and 6).

Second, the genotoxic effect increased with an increase in the frequency of the administration of the carcinogen. Thus, the number of micronucleated cells increased by a factor of 2.05 and 1.7 on days 31 and 95 after injections 5 and 11 respectively, compared to the same parameters on day 9 after 2 injections.

At the same time, regarding the dynamics of the genotoxic effect (Table II), it showed a decrease ($p > 0.05$) in the micronuclei frequency on day 95 compared to day 31, despite the continuous administration of the carcinogen.

This phenomenon supposedly indicates that the growth of cytogenetic effect during prolonged exposure to carcinogen occurs only within the values of a certain range, after which the further growth of the effect comes to a stop. This is obviously due to the fact that some doses of carcinogens are able to induce a certain micronuclei frequency, which is completely consistent with the experimental data and human observations as for the dependence of genotoxic effects on the dose of mutagenic carcinogens.

Similar dose-effect and time patterns of genotoxicity were also found during combined exposure to BaP simultaneously with phenol (Tables I, II).

However, in this case, phenol tends to increase the genotoxic effect ($p > 0.05$), which depends on its dose in the complex. At the same time, with the exposure to phenol at a dose of 0.1 mg (group 3), an increase in the micronuclei frequency was noticed as early as on day 9, whereas when exposed to a lower dose of phenol (0.002 mg) in combination (group 4), an increase was noticed later, on day 31 and 95 of the experiment and quantitative changes were more pronounced.

Unlike BaP, phenol (group 2) and TEG (group 5) did not cause genotoxic changes when administered separately.

Studies conducted at a later date of the experiment, – months 6, 11, 14 after the beginning of peroral administration of the substances, revealed a new substantial increase in the micronuclei frequency in the animals which were given the carcinogen alone or in combination with phenol. However, in this case, the increase in the number of micronucleated cells was less related to the total dose of BaP and the modifying effect of phenol, and more to the nature of morphological changes in the forestomach. Thus, in the presence of pre-tumor changes – diffuse and focal hyperplasia of the forestomach epithelium, the micronuclei frequency in some mice was 6-7 per 1000 cells analyzed. For the mice with visually detected and histologically confirmed diagnose of forestomach papillomas, accompanied by diffuse and focal epithelial hyperplasia, this index reached 12-16 cells per 1000 analyzed. At the same time, there was an increase in the number of multinucleated cells,

Table I. MN frequency (%) in the forestomach of white outbred mice after peroral intragastric administration of benzo[a]pyrene separately and in combination with phenol on different days of the experiment

Group	Substances	Single dose, mg, ml	MN frequency		
			day 9	day 31	day 95
1	BaP	0.1	1.33±0.21*	2.83±0.31*	2.33±0.33*
2	Phenol	0.1	0.33±0.21	0.50±0.22	0.33±0.21
3	BaP+Ph	0.1+0.1	1.67±0.21*	3.17±0.40*	2.83±0.31*
4	BaP+Ph	0.1+0.002	1.33±0.21*	3.50±0.22*	3.00±0.26*
5	TEG	0.2	0.50±0.022	0.50±0.022	0.67±0.21
6	control		0.33±0.21	0.33±0.21	0.50±0.22

Notes: * - the difference is significant within the intact control: day 9 (P <0.01); 31, 95 day (P <0.001)

Table II. Dynamics of the change in MN frequency (%) in the forestomach of white outbred mice after peroral intragastric administration of benzo (a) pyrene separately and in combination with phenol on different days of the experiment

Compared terms of the experiment. days (number of applications)	Substances. single doses. mg								
	BP 0.1			BP 0.1+Ph 0.1			BP 0.1 + Ph 0.002		
	Statistical parameters			Statistical parameters			Statistical parameters		
	M±m	t	p	M±m	t	p	M±m	t	p
9 (2)	1.33±0.21			1.67±0.21			1.33±0.21		
31 (5)	2.83±0.31	4.07	<0.01	3.17±0.40	3.32	<0.01	3.50±0.22	7.13	<0.001
9 (2)	1.33±0.21			1.67±0.21			1.33±0.21		
95 (12)	2.33±0.33	2.57	<0.01	2.83±0.31	3.09	<0.01	3.00±0.26	4.99	<0.001
31 (5)	2.83±0.30			3.17±0.40			3.50±0.22		
95 (12)	2.33±0.33	1.86	>0.05	2.83±0.31	0.67	>0.05	3.00±0.26	1.47	>0.05

up to 34-37 per 1000 cells, mainly 2-nucleus, sometimes with 2 – 4 nuclei, as well as nuclei with protrusions-tailed.

The parallel study of immunological responses also showed different response of the animal body to the separate and combined administration of the carcinogen and toxic substances as to quantitative and qualitative composition of the indexes. The latter depending on the dose and duration of administration included components of the body's nonspecific defense, cellular and humoral immunity, allergy symptoms.

Thus, isolated administration of BaP (group 1) on days 9 and 31 did not cause any significant deviations in hematological and immunological parameters compared to those in the control group (group 6) (Table III).

At the same time, chemical carcinogens had a usual suppressive effect on the immune system, which was showed by a significant (p <0.05) decrease in the relative number of T-lymphocytes compared to the control and indicated the suppression of the cellular immunity, although the total number of T-lymphocytes as well as B-cell population did not change significantly.

With continued exposure to BaP up to 3 months no great difference in hematological parameters compared to the control group was found (Table IV).

At the same time, immunosuppression was intensified, which was shown by the suppression of both cellular and humoral immunity, with a significant (p <0.05) decrease in the relative and absolute numbers of T and B lymphocytes.

Additional administration of phenol on day 9 did not cause any serious immunological changes compared with the isolated effect of BaP. Meanwhile, with the increase in the duration of phenol intake (on day 31), suppression of the immune system considerably strengthened. This was manifested by the fact that in addition to the suppression of the T component of the immune system (significantly lower (p <0.05) percentage of T lymphocytes than in the control group), inhibition of the body's nonspecific defense was also observed: significant (p <0.05) decrease in the relative number of segmented neutrophils (SNF) was found in the animals of both groups 3 and 4 compared to the control, and the total number of neutrophils decreased when exposed to the combination of BaP with a higher dose of toxicant (group 3).

As further studies confirmed, the latter was caused by the toxicity of phenol. Thus, the isolated administration of phenol (group 2) on day 9 (Table III) did not cause any serious immunological changes. However, the inhibition of nonspecific protective factors of an organism was found on day 31, which was shown as a significant (p <0.05) decrease compared to the control regarding the relative number of neutrophils, including segmented neutrophils (SNF), and phagocytic activity of neutrophilic granulocytes. The other hematological indices did not differ considerably from the control values. At the same time, there was also cellular immunity suppression, as evidenced by the significantly

Table III. Immunological parameters of the mice on the 31st day of peroral administration of benzo[a]pyrene and phenol, separately and in combination

Values	Experimental groups of animals					
	group 1	group 2	group 3	group 4	group 5	group 6
Leukocytes, $\times 10^9/\mu$	17.38 \pm 1.52	17.08 \pm 1.39	17.97 \pm 2.24	19.63 \pm 0.77	15.28 \pm 1.13	18.67 \pm 2.41
Natural killers, %	0.83 \pm 0.17	0.67 \pm 0.21	0.67 \pm 0.21	0.67 \pm 0.21	0.67 \pm 0.21	1.17 \pm 0.17
Band neutrophils, %	4.17 \pm 0.31*	3.33 \pm 0.42	3.00 \pm 0.45	3.67 \pm 0.67	3.00 \pm 0.37	2.83 \pm 0.31
Segmented neutrophils, %	19.50 \pm 0.81	17.50 \pm 0.72*	17.17 \pm 0.75*	16.67 \pm 1.45*	16.17 \pm 0.79*	21.00 \pm 0.82
Eosinophils, %	3.00 \pm 0.63	4.00 \pm 0.77	4.83 \pm 0.48	4.17 \pm 0.48	4.50 \pm 0.85	3.17 \pm 0.48
Monocytes, %	1.00 \pm 0.00	1.00 \pm 0.00	1.00 \pm 0.00	1.00 \pm 0.00	1.00 \pm 0.00	1.00 \pm 0.00
Lymphocytes, %	71.50 \pm 1.12	73.50 \pm 1.06	73.33 \pm 0.80	73.83 \pm 1.47	74.67 \pm 1.17*	70.83 \pm 0.87
Lymphocytes, $\times 10^9/l$	12.48 \pm 1.20	12.54 \pm 0.99	13.19 \pm 1.69	14.51 \pm 0.70	11.36 \pm 0.72	13.30 \pm 1.84
Neutrophils, %	23.67 \pm 0.88	20.83 \pm 0.87*	20.17 \pm 1.01*	20.33 \pm 1.52	19.17 \pm 0.70*	23.83 \pm 0.83
Neutrophils, $\times 10^9/l$	4.06 \pm 0.29	3.52 \pm 0.23	3.62 \pm 0.48	3.96 \pm 0.26	2.95 \pm 0.28	4.39 \pm 0.49
T-lymphocytes, %	17.83 \pm 0.70*	19.67 \pm 1.05*	19.33 \pm 0.67*	24.00 \pm 0.89*	27.50 \pm 0.89	30.00 \pm 0.55
T-lymphocytes, $\times 10^9/l$	2.23 \pm 0.23	2.49 \pm 0.29	2.52 \pm 0.30	2.87 \pm 0.22	3.10 \pm 0.15	3.85 \pm 0.68
B-lymphocytes, %	24.33 \pm 0.42	32.00 \pm 1.29*	33.67 \pm 0.99*	32.33 \pm 0.88*	30.17 \pm 0.79*	25.50 \pm 0.92
B-lymphocytes, $\times 10^9/l$	3.04 \pm 0.30	4.02 \pm 0.38	4.36 \pm 0.46	4.69 \pm 0.26	3.44 \pm 0.28	3.46 \pm 0.57
Number of phagocytising cells	% 81.83 \pm 3.26	% 81.83 \pm 2.01*	% 88.83 \pm 2.15	% 85.50 \pm 2.55	% 88.83 \pm 3.15	% 90.33 \pm 2.39
	$\times 10^9/l$ 3.28 \pm 0.17	$\times 10^9/l$ 2.86 \pm 0.15	$\times 10^9/l$ 3.20 \pm 0.40	$\times 10^9/l$ 3.37 \pm 0.20	$\times 10^9/l$ 2.65 \pm 0.34	$\times 10^9/l$ 3.97 \pm 0.48

Note. * - Significant differences compared to control group 6 ($p < 0.05$)

($p < 0.05$) lower percentage of T lymphocytes compared to the intact mice. On the contrary, the percentage of B-lymphocytes increased, which indicated the activation of the humoral immunity. At the end of month 3, there was a recovery of T- and B-lymphocytes as well as the other parameters with further approaching the control values.

DISCUSSION

Thus, the findings indicate that the earliest sensitive immunological indicator of the body's response to the exposure to BaP and its combinations with phenol is the T-cell component of the immunity, whose changes according to the type of suppression corresponded to carcinogenesis and were found as early as on day 31. At a later date, on day 95, the suppression of the T-cell component was accompanied by the suppression of the humoral immunity against the background of lymphocytopenia, leukopenia, when exposed to combination with phenol.

During the pathomorphological study, the development of pre-tumor changes and forestomach tumors was found only in the mice which were given BaP or BaP in combination with phenol, which confirms carcinogenicity of the experimental dose of the carcinogen for all ways of administration. Pre-tumor changes were diffuse and focal hyperplasia of the forestomach mucosa (carcinogenesis stages I, II by L.M. Shabad), tumors were papillomas and were first found in a few cases 6 months later after the beginning of the administration [14]. 14 months later, the same 100% tumor development was observed after both isolated administration of BaP and in combination with the toxicant.

However, after adding phenol to the carcinogen (combined effect), a dose-dependent increase in the multiplicity factor (M) of forestomach papillomas was observed, which is considered as one of the indicators of carcinogenic activity in the early stages of tumor development. During the administration of BaP in combination with phenol at doses of 0.1 mg; 0.002 mg it was 5.0 and 3.2 respectively, compared to 1.8 when exposed to BaP alone. This indicates that phenol triggers carcinogenesis at the stage when forestomach tumors occur. It should be noted that the modifying effect of the toxicant coincides with its action in the early period, which was shown as a tendency towards intensification of the genotoxic effect and immunosuppression through additional suppression of the components of the body's nonspecific defense, lymphocytopenia, leukopenia.

When comparing the dynamics of cytogenetic and immunotoxic changes, it was found that the increase in the micronuclei frequency during the first month of the experiment occurred in parallel with the decrease in the number of T-lymphocytes, i.e. with the development of immunosuppression. These patterns occurred during both isolated administration of BaP, and in combination with phenol.

To sum up, the studies have shown parallelism of development and unidirectionality of changes in mutagenicity and immunotoxicity indicators as to carcinogenesis, the presence of a reliable correlation between them, and convergence with the final effect – the development of tumors. However, the intensity of carcinogenesis both in the early stage (genotoxic, immunological changes) and later (development of pre-tumor morphological changes and tumors) increases when exposed to the carcinogen together with accompanying modifiers – toxic substances.

Table IV. Immunological parameters of the mice on the 95th day of peroral administration of benzo[a]pyrene and phenol, separately and in combination

Values	Experimental groups of animals						
	group 1	group 2	group 3	group 4	group 5	group 6	
Leukocytes, $\times 10^9/l$	13.22 \pm 1.08	12.98 \pm 1.61	15.02 \pm 0.51	*12.83 \pm 0.90	15.90 \pm 1.15	17.55 \pm 1.61	
Natural killers, %	0.67 \pm 0.21	0.50 \pm 0.22	0.67 \pm 0.21	0.67 \pm 0.21	1.00 \pm 0.26	0.50 \pm 0.22	
Band neutrophils, %	3.50 \pm 0.34	3.33 \pm 0.33	4.00 \pm 0.45	4.00 \pm 0.37	3.67 \pm 0.21	4.33 \pm 0.49	
Segmented neutrophils, %	18.00 \pm 0.63	21.00 \pm 1.51	18.50 \pm 0.89	*21.67 \pm 0.89	*18.00 \pm 1.06	16.00 \pm 1.51	
Eosinophils, %	3.50 \pm 0.56	5.00 \pm 0.63	4.50 \pm 0.56	4.17 \pm 0.60	4.17 \pm 0.48	5.00 \pm 0.68	
Lymphocytes, %	73.33 \pm 1.15	69.17 \pm 1.70	71.36 \pm 1.15	*68.50 \pm 0.89	72.17 \pm 1.51	73.17 \pm 1.17	
Lymphocytes, $\times 10^9/l$	9.72 \pm 0.89	9.07 \pm 1.27	10.71 \pm 0.39	*8.75 \pm 0.53	11.47 \pm 0.86	12.87 \pm 1.24	
Neutrophils, %	21.50 \pm 0.85	24.33 \pm 1.33	22.50 \pm 0.99	*25.67 \pm 0.84	*21.67 \pm 1.20	20.33 \pm 1.31	
Neutrophils, $\times 10^9/l$	2.81 \pm 0.18	3.09 \pm 0.30	3.37 \pm 0.18	3.32 \pm 0.31	3.43 \pm 0.29	3.50 \pm 0.24	
T-lymphocytes, %	*18.67 \pm 0.76	19.33 \pm 0.84	20.83 \pm 0.31	*17.17 \pm 0.60	*14.67 \pm 0.56	21.83 \pm 0.91	
T-lymphocytes, $\times 10^9/l$	*1.81 \pm 0.17	1.98 \pm 0.38	2.23 \pm 0.08	*1.50 \pm 0.10	*1.68 \pm 0.15	2.83 \pm 0.33	
B-lymphocytes, %	*26.50 \pm 1.34	30.33 \pm 0.76	28.83 \pm 1.19	*23.50 \pm 1.09	*25.83 \pm 1.25	31.67 \pm 0.76	
B-lymphocytes, $\times 10^9/l$	*2.58 \pm 0.27	2.74 \pm 0.37	3.08 \pm 0.16	*2.05 \pm 0.14	2.99 \pm 0.34	3.09 \pm 0.45	
Number of phagocytosing cells	%	94.67 \pm 1.43	94.17 \pm 1.49	90.00 \pm 2.48	92.50 \pm 1.59	92.33 \pm 1.89	93.17 \pm 1.01
	$\times 10^9/l$	2.66 \pm 0.19	2.73 \pm 0.27	3.06 \pm 0.22	3.06 \pm 0.28	3.18 \pm 0.31	3.26 \pm 0.24

Note. * - Significant differences compared to control group 6 ($p < 0.05$)

The importance of such a conclusion should be taken into account in the process of hygienic assessment of the state of the environment, which real impact on a person is connected with the simultaneous intake of carcinogenic and toxic compounds.

CONCLUSIONS

1. According to the findings of the parallel studies, a carcinogenic effect (development of forestomach tumors) and common patterns of the manifestation of genotoxic and immunological changes in the animals regarding carcinogenesis during isolated and combined administration of BaP and phenol and their dependence on the dose and duration of the exposure to the substances have been determined.
2. Carcinogenesis intensification by phenol has been established, which was shown by the increase in the micronuclei frequency and intensification of immunosuppression in the early stage as well as an increase in the multiplicity factor of the development of forestomach tumors (papillomas) at a later date compared to isolated BaP effects.
3. The results obtained indicate an oncological danger from combined administration of carcinogenic and toxic compounds, the formation of which begins in the early stages and manifests as a genotoxic effect in combination with immunosuppression, which must be taken into account during hygienic assessment of the state of the environment.

REFERENCES

1. Rakhmanin Yu.A. Poliorgannyy mikroyadernyy test v ekologo-gigienicheskikh issledovaniyakh [Multiorgan Micronucleus Test in the Ecological and Hygienic Studies]. *Genius*. 2007: 2-95. (In Russian).
2. Bogovski P. Modulators of experimental carcinogenesis. Ed. Turusov V.S., Montesano R. Lyon: JARC. 1983: 305.
3. Wilson H. K., Buckeridge S.A., Yau W. et al. Investigating the toxic effects of 2-aminoanthracene ingestion in pregnant Sprague Dawley dams. *J Environ Sci Health B*. 2018;4:53(5):283-289. doi: 10.1080/03601234.2017.1421837.
4. Sonoda J., Seki Y., Hakura A. et al. Time course of the incidence/multiplicity and histopathological features of murine colonic dysplasia, adenoma and adenocarcinoma induced by benzo[a]pyrene and dextran sulfate sodium. *J Toxicol Pathol*. 2016;29(1):74. doi: 10.1293/tox.2014-0061.
5. Wen H., Yuan L., Wei C. et al. Effects of combined exposure to formaldehyde and benzene on immune cells in the blood and spleen in Balb/c mice. *Environ Toxicol Pharmacol*. 2016;45:265-73.
6. Alegbeleye O.O., Opeolu B.O., Jackson V.A. Polycyclic aromatic hydrocarbons: a critical review of environmental occurrence and bioremediation. *Environ Manage*. 2017;60(4):758-783. doi: 10.1007/s00267-017-0896-2.
7. Kaur G., Pinkston R., Mclemore B. et al. Immunological and toxicological risk assessment of e-cigarettes. *Eur Respir Rev*. 2018;28:27(147):170119. doi: 10.1183/16000617.0119-2017.
8. Sycheva L., Zhurkov V., Rahmanin Yu. et al. Novyyiy podhod k diagnostike mutagennyih i kantserogennyih svoystv okrujayushey sredy [A new approach to the diagnosis of mutagenic and carcinogenic properties of the environment]. *Hygiene and Sanitation*. 2003;6:87-91. (In Russian).
9. Principles and methods for assessing direct immunotoxicity associated with exposure to chemicals. Geneva: WHO. 1996: 390.
10. Prodanchuk M.H., Zhminko P.H., Zinchenko D.V. Doslidzhennia imunotoksychnoi dii potentsiino nebezpechnykh khimichnykh rehovyn pry yikh hihienichnyi rehlyamentatsii: Metodychni rekomendatsii [The research of immunotoxic action of potentially dangerous substances during their hygienic regulation: Methodical recommendations]. *Book of normative documents for health protection*. Kyiv. 2003:149-168. (In Ukrainian).

11. Oczenka vliyaniya faktorov okruzhayushhej sredey' na immunologicheskuyu reaktivnost' organizma: Metodicheskie rekomendaczii [Assessment of the influence of environmental factors on the immunological reactivity of the organism: Methodical recommendations]. Marzeev A. N. Research Institute of General and Communal Hygiene. Kyiv. 1988:3-23. (In Ukrainian).
12. Otsenka mutagennoy aktivnosti faktorov okrujayuschey sredey v kletkah raznyih organov mlekopitayuschih mikroyadernym metodom: metodicheskie rekomendatsii [Evaluation of mutagenic activity of environmental factors in the cells of various organs of mammals with micronucleus method: the guidelines. methodological recommendations]. Interdepartmental Scientific Council for Human Ecology and Environmental Health of the Russian Federation. 2001: 22. (In Russian).
13. Peter J. Costa. Statistical pattern recognition and classification. Peter J. Costa. Applied mathematics for the analysis of biomedical data: models, methods, and MATLAB. In: John Wiley & Sons. New Jersey: 2017: 93-141.
14. Shabad L.M. Predrak v eksperimentalno-morfologicheskome aspekte [The precancer in the experimental morphological aspect]. Moscow. 1967: 384. (In Russian).

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SURGICAL TREATMENT OF PERIPHERAL NERVES COMBAT WOUNDS OF THE EXTREMITIES

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ABSTRACT

The aim: Improving the effectiveness of patients' treatment with combat injuries of the peripheral nervous system, which consists in the application and development of new methods of reconstructive interventions, optimizing a set of therapeutic and diagnostic measures for the most effective management of this category of patients with peripheral nerve injury.

Materials and methods: The research is based on the results of surgical treatment of 138 patients with combat injuries of peripheral nerves for the period from 2014 to 2020. The mean age was 33.5 ± 2.1 years. Patients were treated for 1 to 11 months after injury (median – 8 months). Damage to the sciatic nerve was observed in 26.1%, ulnar – in 20.3%, median – in 18.8%, radial – in 15.9%, tibial – in 10.9%, common peroneal nerve – in 8% of cases.

Results: It was shown that in all patients was significantly improved the recovery of all nerves. In the period from 9 to 12 months, the degree of recovery of motor function to M0-M2 was observed in 40.6%, to M3 – in 35.5%, to M4 – in 16.7%, to M5 – in 7.2%. The degree of recovery of sensitivity to S0-S2 was observed in 36.2%, to S3 – in 42.8%, to S4 – in 17.4%, to S5 – in 3.6%. Regression of pain syndrome after surgery was observed in 81.2% of patients.

Conclusions: The results of surgical treatment of peripheral nerves gunshot injury are generally worse than other types of nerve injuries. The best results of surgical treatment of combat trauma of peripheral nerves are obtained in patients with sciatic nerve damage.

KEY WORDS: surgery, peripheral nerve injury, combat trauma, electrostimulation

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INTRODUCTION

Combat injuries of peripheral nerves differ significantly from injuries of peripheral nerves in peacetime in the severity of the lesion, the nature of the restoration processes of the nerve trunks structure and function, require the use of more complex differentiated surgical approaches.

Mine-blast and gunshot wounds to the extremities are an extremely pressing problem in both wartime and peacetime. The main type of damage in wartime is a mine-blast injury, which accounts for about 75%, of which 70% have limb injuries [1]. Current data from 9% to 25% when mine-blast trauma existing damage peripheral nerves (PN) and the actual combat injuries make up 12 to 25% of all causes damage to the brachial plexus structures [2]. The severity of the patient's injury is determined by the caliber and type of wounding projectile, the presence of combined damage to blood vessels, nerves, bones of the extremities and soft tissues, which are up to 80% [3].

Gunshot wounds remain one of the most common causes of fractures and the leading cause of disability in the world. According to the Centers for Disease Control, intentional gunshot wounds are the seventh most violent accident in the United States. [4, 5].

That is, this type of injury is not uncommon in peacetime. In the United States, 300,000 people receive gunshot wounds each year, 24,000 of whom die [6].

In the structure of traumatic injuries, injuries of the upper and lower extremities are about 6%, but in terms of disability take first place. It is the damage to the extremities that causes significant both moral and material damage, as patients become incapacitated. According to studies by some scientists [7], gunshot wounds to peripheral nerves in peacetime account for 7.1% of the total structure of their injuries.

Combat damage to peripheral nerves leads to loss of motor, sensory, autonomic functions of injured limbs, which is also manifested by hyperalgesia, hyperpathy, neuropathic pain and more.

These patients are among the areas of interest of neurosurgeons, neurologists, traumatologists, psychologists and psychiatrists, rehabilitation specialists etc.

Given the current armed conflicts in the world, solving the problem of effective and adequate care for the wounded with combat injuries of peripheral nerves is urgent and necessary.

THE AIM

Improving the effectiveness of patients' treatment with combat injuries of the peripheral nervous system, which

consists in the application and development of new methods of reconstructive interventions, optimizing a set of therapeutic and diagnostic measures for the most effective management of this category of patients with peripheral nerve injury.

MATERIALS AND METHODS

The research is based on the results of surgical treatment of 138 servicemen and civilians with gunshot and mine-explosive injuries of peripheral nerves for the period from 2014 to 2020. The age of patients ranged from 18 to 62 years, the mean age was 33.5 ± 2.1 years ($M \pm \sigma$). Male patients predominated – 98.6%, women among patients were only 2 people (1.4%). Patients were treated for 1 to 11 months after injury (median – 8 months). Damage to the nerves of the upper extremities accounted for 55% of cases, the lower – 45%. Damage to the sciatic nerve was observed in 26.1%, ulnar – in 20.3%, median – in 18.8%, radial – in 15.9%, tibial – in 10.9%, common peroneal nerve – in 8% of cases (Fig. 1).

The degree of movement recovery was assessed by the MRC (Medical Research Council) scale from M0 to M5, sensitivity – from S0 to S5 [8].

The severity of the pain syndrome was assessed by the Visual Analogue Scale VAS (1-10) [9].

Approximately 20% of victims have damage to several nerve trunks, 45% have severe concomitant lesions of muscles, blood vessels, internal organs.

Among the examined 138 patients, in 83 cases (60.1%) partial nerve damage was detected, in 55 (39.9%) – complete. The causes of nerve damage were: debris (Fig. 2), bullet, mine-explosive injuries, nerve rupture as a result of bone fractures, damage by sharp objects, iatrogenic nerve damage.

Among the etiological factors that caused partial nerve damage, mine-explosive and bullet wounds were most often noted (Fig. 3) – 67 people (80.7%), less often nerves were injured in fractures of limb bones – 7 observations (8.4%), in 4 cases (4.8%) there was damage to nerves during the operation, as well as there were harness injuries to the extremities, injuries with sharp objects (metal objects) – 3 cases (3.6%), in 2 cases (%) the cause of nerve damage was compression damage to the extremities.

The analysis of short-term and long-term results of treatment of patients with combat trauma of the PN was performed by assessing motor and sensory function, the severity of pain using a scale assessment and additional objective research methods (neurophysiological and neuroimaging). The neurophysiological included EMG (electromyography) and ENMG (electroneuromyography). Neuroimaging methods – X-ray, CT (computed tomography), MRI (magnetic resonance imaging), ultrasound examination of the extremities.

The neurophysiological complex of preoperative diagnostics consisted of the following methods: ENMG with assessment of motor and sensory functions of peripheral nerves, F – wave and H – reflex parameters; Intramuscular

EMG with assessment of spontaneous muscle fiber activity and calculation of motor unit parameters.

Electromyographic studies were performed on a Neuro-MVP Copyright NeuroSoft device (Russian Federation). Stimulation was performed from the cathode (in some cases from the anode) with pulses lasting 0.05 ms, frequency 1 per second, the intensity of stimulation was selected individually, often at the level of 20-35 mV (10-30 mA), based on the level at which achieved maximum amplitude of nerve action potential (AP) and muscle AP. They were recorded simultaneously for each stimulus using two lead channels. Deployment speed 10 ms / division, amplifier sensitivity – from 100 to 2000 μ V for nerve AP, 100 to 10,000 μ V – for muscle AP. Frequency pass band from 10 to 10,000 Hz. Averaged 4 responses to calculate each of the AP.

The examination used three main EMG techniques: the study of M-response and the rate of propagation of excitation on the affected and symmetrical nerves, the study of sensory conduction, needle electromyography with analysis of spontaneous muscle fiber activity and study of motor unit potential. Additionally, a modified method of studying the M-response was used in the removal of the needle electrode from the denervated muscle.

Intraoperative diagnostics was performed using a the Miorhythm-021 electrical stimulator (Ukraine, Kyiv). Pulsed current stimulation assessed the ability of the muscles innervated by the studied nerve to contract.

The period of follow-up – 12 – 18 months.

Statistics. The analysis of the study results was performed using the package EZR v. 1.35 (R statistical software version 3.4.3, R Foundation for Statistical Computing, Vienna, Austria) [10, 11]. In groups with small samples, the following nonparametric methods were used: when comparing changes in rank quantitative traits after treatment, the T-Wilcoxon test was used for related samples; when comparing the results in more than two groups, the Kruskal-Wallis criterion was used, and the Dunn multiple comparison criterion was used to perform pairwise posterior comparisons. The analysis used criteria from the bilateral critical area, the critical level of significance is taken to be equal to 0.05.

RESULTS

According to the results of surgical treatment of 138 wounded, there was performed, depending on nerve damage, nerve decompression (neurolysis) (in 72.7% of cases, including in combination with implantation of electrical stimulation systems), nerve suture (in 19.3%), and in the case of large defects – nerve grafting with the use of sural nerve (in 8% of cases) – Fig. 4.

Conditions for surgical treatment of combat injuries of peripheral nerves: intervention by a specialist who has the skills of microsurgical techniques with a thorough knowledge of the topographic anatomy of peripheral nerves, able to provide accurate diagnosis of the nature, degree and level of nerve damage; the presence of an operating microscope;

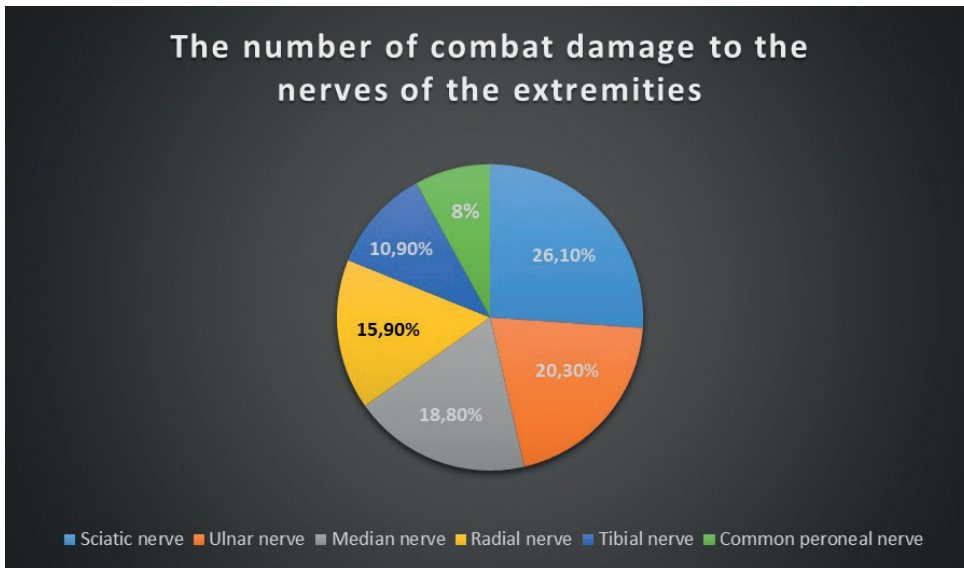


Fig. 1. Distribution diagram of the combat damage frequency to the nerves of the upper and lower extremities

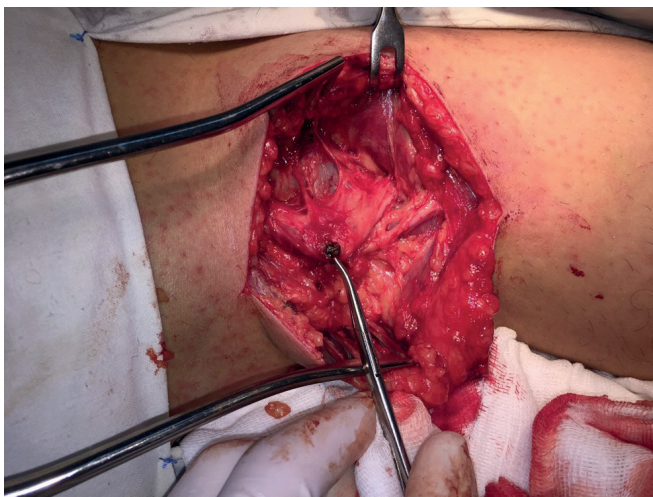


Fig. 2. Removal of a fragment from the tibial nerve

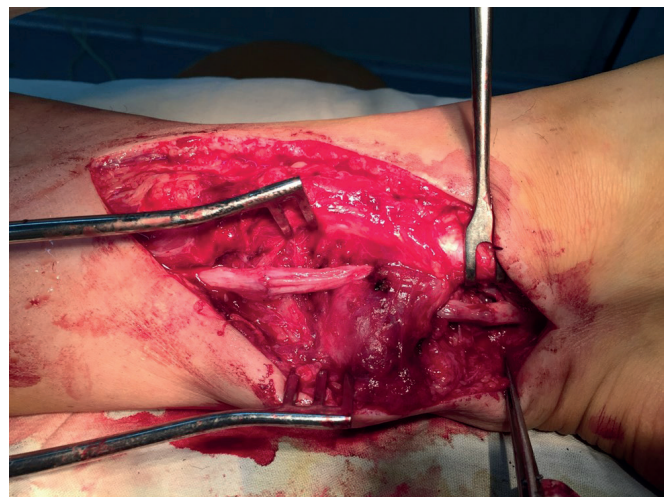


Fig. 4. Tibial nerve grafting

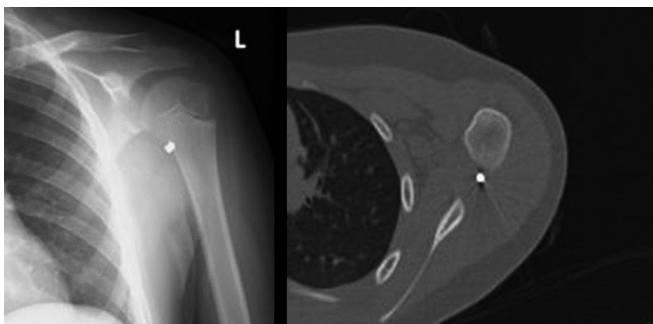


Fig. 3. Bullet damage to the radial nerve in the upper third of the shoulder

availability of microsurgical instruments, suture material, equipment for intraoperative electrodiagnostics; adequate anesthesia.

All surgeries were performed using a microscope (under X 12 optical magnification), appropriate microsurgical instruments, and microsuture material. Evaluated the immediate and long-term results of treatment. The immediate results of treatment were evaluated in the

period from 3 to 6 months, long-term – in the period from 9 to 12 months.

The indicators of nerve recovery on the MRC scale to M0-M2, S0-S2 were considered unsatisfactory; satisfactory – up to M3, S3; good – up to M4-M5, S4-S5.

In the period from 3 to 6 months, the degree of recovery of motor function to M0-M2 was observed in 52.3%, to M3 – in 40.6%, to M4 – in 6.5%, to M5 – in 0,6%. The degree of recovery of sensitivity to S0-S2 was observed in 45.7%, to S3 – in 46.8%, to S4 – in 5%, to S5 – in 2.5%.

In the period from 9 to 12 months, the degree of recovery of motor function to M0-M2 was observed in 40.6%, to M3 – in 35.5%, to M4 – in 16.7%, to M5 – in 7, 2%. The degree of recovery of sensitivity to S0-S2 was observed in 36.2%, to S3 – in 42.8%, to S4 – in 17.4%, to S5 – in 3.6% (Table I).

We also answered the question of whether the treatment rates significantly improved before and after surgery in groups according to the damaged nerve.

In each group we compared the degree of nerve dysfunction on the MRC scale (movements and sensitivity) before and after surgery – in the long term – 9-12 months).

Table I. Indicators of nerve recovery in 9-12 months.

Nerves	Surgery	Degree of recovery, points								Total
		Movements				Sensitivity				
		0-2	3	4	5	0-2	3	4	5	
Ulnar	Nerve suture	6	2	-	-	5	2	1	-	8
	Nerve grafting	2	3	-	-	2	3	-	-	5
	Nerve decompression	7	2	2	4	4	8	2	1	15
Median	Nerve suture	5	2	3	-	4	4	2	-	10
	Nerve grafting		3	-	-		3	-	-	3
	Nerve decompression	5	6	2	-	4	4	5	-	13
Radial	Nerve suture	2	4	-	-	2	4	-	-	6
	Nerve grafting	4	3	-	-	5	2	-	-	7
	Nerve decompression	4	2	2	1	2	3	3	1	9
Common peroneal	Nerve suture	-	2	1	-	-	2	1	-	3
	Nerve decompression	5	3	-	-	5	3	-	-	8
Tibial	Nerve grafting	2	1	-	-	2	1	-	-	3
	Nerve decompression	6	3	2	1	6	4	2	-	12
Sciatic	Nerve suture	-	2	2	-	-	1	3	-	4
	Nerve decompression	8	11	9	4	9	15	5	3	32
Total		56	49	23	10	50	59	24	5	138

Table II. Pairwise comparisons of treatment results after surgery separately according to the damaged nerve

Pair of Variables	Wilcoxon Matched Pairs Test Marked tests are significant at p <0,05		
	Valid	T - Z	p-value
Sciatic nerve: MRC-scale, movements and sensitivity (before surgery) & MRC-scale, movements and sensitivity (after 9-12 months post-op)	36	0,00	<0,001
Ulnar nerve: MRC-scale, movements and sensitivity (before surgery) & MRC-scale, movements and sensitivity (after 9-12 months post-op)	28	0,00	<0,001
Median nerve: MRC-scale, movements and sensitivity (before surgery) & MRC-scale, movements and sensitivity (after 9-12 months post-op)	26	0,00	<0,001
Radial nerve: MRC-scale, movements and sensitivity (before surgery) & MRC-scale, movements and sensitivity (after 9-12 months post-op)	22	0,00	<0,001
Tibial nerve: MRC-scale, movements and sensitivity (before surgery) & MRC-scale, movements and sensitivity (after 9-12 months post-op)	15	0,00	<0,001
Common peroneal nerve: MRC-scale, movements and sensitivity (before surgery) & MRC-scale, movements and sensitivity (after 9-12 months post-op)	11	0,00	0,004

The analysis was performed using the Wilcoxon Matched Pairs Test, which is used to test two related samples, such as before and after surgery, to determine whether repeated measurements are the same on separate observations (Table II).

The same indicators were obtained for the improvement of motor and sensory function in 5 groups at the level of significance p <0.001 and in 1 group at the level of p = 0.004. Thus, we can conclude that in all patients was significantly improved the recovery of all nerves.

The analysis revealed a statistically significant ($p < 0.05$ by Kruskal-Wallis test) difference in treatment outcomes between the group where the sciatic nerve was damaged and between the groups where other nerves were injured. At the same time, the indicators of motor function on the MRC scale after treatment in all groups were statistically significantly worse ($p < 0.05$ according to the Dunn's test) than in the group where the sciatic nerve was damaged. Other statistically significant differences in motor function on the MRC scale after treatment between groups (ulnar, median, radial, tibial, common peroneal nerves) were not detected ($p > 0.05$) by Dunn's test. Also, no statistically significant differences were obtained between all groups of damaged nerves in terms of recovery of sensitivity on the MRC scale ($p > 0.05$) according to the Dunn's test. Thus, the best indicators of recovery of motor function are observed in patients who underwent surgical treatment of the sciatic nerve.

When comparing the recovery of lost nerve function in patients who received only nerve decompression with the methods of nerve decompression and long-term electrical stimulation, statistically significant differences were obtained at the level of $p < 0.05$ by Kruskal-Wallis and $p < 0.05$ by Dunn's test. Thus, we can assume that the use of long-term electrical stimulation gives better results in the restoration of motor and sensory function in patients with combat trauma of peripheral nerves compared with the classical method of nerve decompression.

Regression of pain syndrome after surgery was observed in 81.2% of patients at the level of evidence using the non-parametric criterion Wilcoxon Matched Pairs Test ($p < 0.05$). Of these, in 59.4% of patients, there was a decrease in the manifestations of pain for VAS from 8-10 to 4-5, which can be regarded as a satisfactory result of treatment.

The analyzed data of patients' medical histories during 2014-2020 show that the peculiarities of gunshot wounds of servicemen and civilians are:

- significant predominance of fragmentary lesions (59.8%) over bullet lesions (14.9%), injuries of various localizations in 17.5%, thermal lesions in 2.3%, combined injuries – in 5.5% of cases;
- approximately 1/4 of the victims have damage to several nerve trunks and plexuses;
- 50% have severe concomitant lesions of muscles, blood vessels, internal organs;
- the presence of more than 90% of purulent-inflammatory complications;
- the presence of persistent pain (more than 80%, especially in the presence of foreign bodies);

DISCUSSION

The effectiveness of surgical treatment of peripheral nerves surgical trauma of the extremities is worse compared to classical nerve injury, which is mainly due to the extent of nerve trunk damage, its nature, the presence of intraneural scars, violation of vascular microcirculation in the nerve structure [12, 13] due to the existing injury of the main vessels and significant damage to the surrounding soft

tissues. The availability of modern equipment and means of microsurgical treatment also has a significant impact on the results of surgical treatment, as well as the level of doctor's training skills.

While the use of microsurgery techniques in the surgical treatment of peripheral nerve damage (including gunshot) is widely represented in the literature [14, 15], the use of long-term epineural electrical stimulation to restore nerve function is represented mainly by experimental work [16–19]. Our experience with the use of implantable neurostimulators in clinical practice to restore nerve function after its decompression indicates the prospects of long-term epineural electrical stimulation in the treatment of combat trauma to peripheral nerves.

CONCLUSIONS

The results of surgical treatment of peripheral nerves gunshot injury are generally worse than other types of nerve injuries.

The best results of surgical treatment of combat trauma of peripheral nerves are obtained in patients with sciatic nerve damage.

The use of long-term electrical stimulation improves the prognosis of treatment of gunshot wounds of peripheral nerves.

REFERENCES

1. Champion H.R., Holcomb J.B., Lawnick M.M. et al. Improved characterization of combat injury. *J Trauma*. 2010; 68: 1139-1150.
2. Samadian M., Rezaee O., Haddadian K. et al. Gunshot injuries to the brachial plexus during wartime. *Br J Neurosurg*. 2009; 23(2): 165-9. doi: 10.1080/02688690902756686. PubMed PMID:19306172.
3. Guriev S.O., Kukuruz Ya.S., Yalovenko V.A. et al. Analiz dosvidu likuvannia vognepal'nyh poranen' kintsivok [Analysis of the experience of treatment of gunshot wounds of the extremities]. *Ekstrena medytyna: vid nauky do praktyky*. 2014;2:25-32. (In Ukrainian).
4. Omid R., Stone M.A., Zalavras C.G. et al. Gunshot Wounds to the Upper Extremity. *J Am Acad Orthop Surg*. 2019;27(7):e301-e310. doi: 10.5435/JAAOS-D-17-00676.
5. Centers for Disease Control and Prevention: National Center for Injury Prevention and Control Web-based Injury Statistics Query and Reporting System (WISQARS). 2017. <http://www.cdc.gov/ncipc/wisqars>. Accessed September 7,
6. Oberlin C., Rantissi M. Gunshot injuries to the nerves. *Chir Main*. 2011; 30(3): 176-82. doi: 10.1016/j.main.2011.04.010. Epub 2011 May 10. PubMed PMID: 21621447.
7. Pushkar Yu.V. Deyaki aspekty diahnozyky ta khirurhichnoyi taktyky pry vohnepal'nykh poshkodzhennyakh peryferychnykh nerviv verkhnikh ta nizhnikh kintsivok myrnoho chasu [Some aspects of diagnosis and surgical tactics for gunshot wounds of peripheral nerves of the upper and lower extremities in peacetime]. *Byuletin' Ukrayins'koyi Asotsiatsiyi Neyrokhirurhiv*. 1999;1(8):14-16. (In Ukrainian).
8. Compston A. Aids to the investigation of peripheral nerve injuries. Medical Research Council: Nerve Injuries Research Committee. His Majesty's Stationery Office: 1942; pp. 48 (iii) and 74 figures and 7 diagrams; with aids to the examination of the peripheral nervous system. By Michael O'Brien for the Guarantors of Brain. Saunders Elsevier: 2010; pp. [8] 64 and 94 Figures. *Brain*. 2010;133(10):2838-44. doi: 10.1093/brain/awq270.

9. Thong I.S.K., Jensen M.P., Miró J. et al. The validity of pain intensity measures: what do the NRS, VAS, VRS, and FPS-R measure? *Scand J Pain*. 2018;18(1):99-107. doi: 10.1515/sjpain-2018-0012. PMID: 29794282.
10. Kanda Y. Investigation of the freely available easy-to-use software 'EZR' for medical statistics. *Bone Marrow Transplant*. 2013;48:452–458. doi: 10.1038/bmt.2012.244.
11. Gurianov V.G. Posibnyk z biostatystyky. Analiz rezul'tativ medychnykh doslidzhen' u paketi EZR (R–statistics): navchal'nyy posibnyk. K.: Vistka; 2018: 59–78.
12. Strafun S.S., Borzykh N.O., Tsybaliuk Ya.V. Otsinka efektyvnosti likuvannya poranenykh iz vohnepal'nyy polistrukturny uškodzhennyamy verkhnykh kintsivok [Estimation of the treatment efficacy in the wounded persons with the gun–shot polystructural damages of upper extremities]. *Klinichna khirurgiia*. 2018;85(7):62-66. doi: 10.26779/2522-1396.2018.07.62. (In Ukrainian).
13. Strafun S.S., Borzykh N.O., Gaiko O.G. et al. Priorytetni napryamy khirurhichnoho likuvannya poranenykh z ushkodzhennyamy peryferychnykh nerviv verkh'oyi kintsivky pry polistrukturnykh travmakh [Priority areas of surgical treatment of wounded with damage to peripheral nerves of the upper extremity in polystructural injuries]. *Trauma*. 2018;19(3):85-90. doi: http://dx.doi.org/10.22141/1608-1706.3.19.2018.136410. (In Ukrainian).
14. Korus L., Ross D.C., Doherty C.D. et al. Nerve transfers and neurotization in peripheral nerve injury, from surgery to rehabilitation. *J Neurol Neurosurg Psychiatry*. 2016;87(2):188-97. doi: 10.1136/jnnp-2015-310420.
15. Dvali L., Mckinnon S. The role of microsurgery in nerve repair and nerve grafting. *Hand Clin*. 2007;21:73-81.
16. Willand M.P., Nguyen M.A., Borschel G.H. et al. Electrical Stimulation to Promote Peripheral Nerve Regeneration. *Neurorehabil Neural Repair*. 2016;30(5):490-96. doi: 10.1177/1545968315604399.
17. Gordon T., Chan K.M., Sulaiman O.A. et al. Accelerating axon growth to overcome limitations in functional recovery after peripheral nerve injury. *Neurosurgery*. 2009; 65 (4):A132–A144. doi:10.1227/01.NEU.0000335650.09473.D3.
18. Koo J., MacEwan M.R., Kang S.K. et al. Wireless bioresorbable electronic system enables sustained non-pharmacological neuroregenerative therapy. *Nature Medicine*. 2018. DOI: 10.1038/s41591-018-0196-2.
19. Tretiakova A.I., Kovalenko I.V., Tretiakov R.A. et al. Diagnostics and Treatment of Proximal Tunnel Neuropathies of the Upper Limbs. *Novosti Khirurgii*. 2020; 28 (1): 62-73.

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BIOCHEMICAL MARKERS OF ENDOTHELIAL DYSFUNCTION, THEIR CHANGES UNDER THE INFLUENCE OF TREATMENT WITH VARIOUS BETA-ADRENOBLOCKERS IN YOUNG MEN WITH MYOCARDIAL INFARCTION

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ABSTRACT

The aim: Is to determine the levels of markers of endothelial dysfunction in young men with myocardial infarction and their changes during the treatment with beta-blockers with different pharmacological properties.

Materials and methods: 112 male patients of Caucasian race of the Ukrainian population under the age of 50 with MI. Group I received Nebivolol, group II – bisoprolol.

Results: During the 6-month follow-up, positive dynamics of NOS-2 and ET-1 was observed. The level of NOS-2 in groups I – II was 4272.3 ± 162.7 , 4629.7 ± 161.2 pg/mL, respectively ($p < 0.05$). The dynamics of ET-1 showed significant decrease of its level in all groups

Conclusions: Significant changes in markers of endothelial dysfunction, namely NOS3/eNOS, NOS2/iNOS and ET-1, are observed in young male patients of the Ukrainian population with MI. During 6 months of treatment, positive changes were observed in the form of an increase in NOS-3 levels and a significant decrease in ET-1 and NOS-2 levels. The inclusion of Nebivolol in the basic therapy for this group of patients is associated with an additional positive effect on the normalization of levels NO synthase and the reduction of ET-1.

KEY WORDS: myocardial infarction, nebivolol, NO synthase, endothelin-1

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INTRODUCTION

Despite advances in the treatment of cardiovascular diseases, the prevalence and availability of endovascular interventions, the issue of treatment of myocardial infarction (MI) in Ukraine remains relevant. Diseases of the circulatory system are the most common pathology in the structure of the general morbidity of the population of Ukraine and take a leading place in the structure of primary disability and total mortality (23.7% and 65%, respectively). Coronary heart disease ranks first in the structure of mortality in diseases of the circulatory system, the proportion of which was 69%. 16 to 19.5% of patients die of MI and its complications at working age. A separate part is MI in men of working age in terms of disability.

Regulation of myocardial function by NO synthase (NOS) is important for maintaining myocardial homeostasis, relaxation (diastolic function) and protection against arrhythmia. However, lesions of the cardiovascular system lead to NOS dysfunction with the synthesis of superoxide instead of NO. Another important marker is endothelin-1 (ET-1). ET-1 is a potent coronary vasoconstrictor peptide. ET-1 plasma levels increase after MI and reperfusion in humans. This apparently contributes to the narrowing of the

coronary vessels, which at the time underlies myocardial ischemia and ventricular dysfunction. Studies have shown that elevated levels of ET-1 are a poor prognostic marker after reperfusion [1].

To date, there are a large number of studies that indicate significant changes in endothelial function in MI. Therefore, the search for drugs for its correction is an urgent task. The advance technique is a racemic mixture of d- and l-nebivolol, a selective third-generation b1-adrenoceptor blocker with NO-mediated vasodilator and antioxidant properties. It reduces superoxide in endothelial cells to increase the bioavailability of NO [2] and can inhibit NADPH oxidase activity. This leads to a net increase in NO production with increasing NOS3 activity. Such activity is observed in both the endothelium and the heart, although activation of NOS3 was not observed in end-stage heart failure in humans. The effect of Nebivolol on the heart is associated with stimulation of b3-AR, which enhances NO synthase and promotes angiogenesis, suggesting its possible use in ischemic injury and reperfusion [3]. To date, there have been only a few controlled clinical trials. The SENIORS trial (Study of the Effects of Nebivolol in the Elderly With Heart Failure) demonstrated that Nebivolol

Table I. Clinical characteristics of the examined patients

		Patients (n=112)	CG (n=35)	p
1.	Age, years M±m	41,9±2,8	41,4±2,9	>0.05
2.	Smoking, abs. (%)	73 (65.2%)	17 (48.6%)	>0.05
3.	Hypertension, abs. (%)	9 (8,0%)	0	<0.05
4.	Family history, abs. (%)	32 (28.6%)	6 (17.1%)	>0.05

Table II. Clinical characteristics of patients of groups I, II and III who took BAB

		I group (n=37)	II group (n=44)	III group (n=31)	p1	p2	p3
1.	Age, years M±m	42,1±2,9	41,7±3,0	42,2±2,7	>0.05	>0.05	>0.05
2.	Smoking, abs. (%)	23 (62.2%)	28 (63.6%)	22 (71,0%)	>0.05	>0.05	>0.05
3.	Hypertension, abs. (%)	3 (8,1%)	2 (4,6%)	4 (12,9%)	>0.05	>0.05	>0.05
4.	Family history, abs. (%)	10 (27.0%)	12 (27.3%)	10 (32,3%)	>0.05	>0.05	>0.05
5.	BMI> 30kg / m ² abs. (%)	4 (10.8%)	3 (6.8%)	5 (16,1%)	>0.05	>0.05	>0.05

Note: P1 value for differences between the indicators of groups I and II

P2 value for differences between the indicators of groups I and III

P3 value for differences between the indicators of groups II and III

Table III. Characteristics of coronary artery disease and endovascular interventions in patients

		Group I (n=37)	Group II (n=44)	Group III (n=31)	p1	p2	p3
1.	Single-vessel disease, abs. (%)	7 (18.9%)	9 (20.5%)	9 (29,0%)	>0.05	>0.05	>0.05
2.	Two-vessel disease, abs. (%)	12 (32,4%)	16 (36,4%)	9 (29,0%)	>0.05	>0.05	>0.05
3.	Three-vessel disease, abs. (%)	18 (48.7%)	19 (43.2%)	13 (42,0)	>0.05	>0.05	>0.05
4.	1 stent, abs. (%)	34 (91,9%)	40 (90,9%)	26 (83,9%)	>0.05	>0.05	>0.05
5.	2 stents, abs. (%)	1 (2,7%)	3 (6,8%)	3 (9,7%)	>0.05	>0.05	>0.05
6.	3 or more stents, abs. (%)	2 (5,4%)	1 (2,3%)	2 (6,4%)	>0.05	>0.05	>0.05

Note: P1 value for differences between the indicators of groups I and II

P2 value for differences between the indicators of groups I and III

P3 value for differences between the indicators of groups II and III

caused a moderate reduction in all causes of death or hospitalization due to cardiovascular disease [4].

However, the patients of young age were not taken into account separately or performed in experimental animal models. There are no studies on the effect of drugs with the existing mechanism of NO activity on the biochemical parameters of endothelial dysfunction in MI in men of working age.

THE AIM

Aim of the study is to determine the levels of markers of endothelial dysfunction in young men with myocardial infarction and their changes during the treatment with beta-blockers with different pharmacological properties.

MATERIALS AND METHODS

112 male patients of Caucasian race of the Ukrainian population under the age of 50 (mean 43.21±2.8 years)

who have had MI and underwent rehabilitation and treatment in the rehabilitation department of the Alexander Clinical Hospital in Kyiv in 2015-2018 were examined. The diagnosis of MI was established on ESC criteria (2012).

The study did not include patients with concomitant diabetes mellitus, valvular heart disease, familial hyperlipidemia and NYHA class III-IV heart failure. Patients with grade II/III arterial hypertension were also excluded. The patients with the presence of grade I hypertension in the anamnesis were admitted (see Table I). To obtain normative indicators, 35 men of the appropriate age without diseases of the cardiovascular system were examined according to clinical and anamnestic data along with the results of instrumental examinations – control group (CG). All the patients, including CG, signed an informed consent before participating to the study in accordance with the requirements of the GCP. The study has the approval of the local ethics commission (№ 3 from 01.02.18).

Table IV. Drug therapy of patients of the studied groups

		Group I (n=37)	Group II (n=44)	Group III (n=31)	p1	p2	p3
1.	Rosuvastatin, abs. (%)	21 (56,8%)	27 (61,4%)	23 (74,2%)	>0.05	>0.05	>0.05
2.	Atorvastatin, abs. (%)	16 (43,2%)	17 (38,6%)	8 (25,8%)	>0.05	>0.05	>0.05
3.	Acetylsalicylic acid, abs. (%)	37 (100%)	37 (100%)	37 (100%)	>0.05	>0.05	>0.05
4.	ACE inhibitor, abs. (%)	32 (86,5%)	40 (90,9%)	29 (93,6%)	>0.05	>0.05	>0.05
6.	Clopidogrel, abs. (%)	19 (51,4%)	20 (45,5%)	17 (54,8%)	>0.05	>0.05	>0.05
7.	Ticagrelor, abs. (%)	18 (48,6%)	24 (54,5%)	14 (45,2%)	>0.05	>0.05	>0.05

Note: P1 value for differences between the indicators of groups I and II

P2 value for differences between the indicators of groups I and III

P3 value for differences between the indicators of groups II and III

Table V. Changes in endothelial dysfunction in the study groups of patients, pg/mL ($M \pm \sigma$)

№		Group I		p	Group II		p	Group III		p	CG
		baseline	6 months		baseline	6 months		baseline	6 months		
1	NOS - 2	4851,1±166,5*	4272,3±162,7*#	<0.05	4837,7±159,3*	4629,7±161,2 ^{8*}	<0.05	4853,4±165,4*	4634,2±163,5 ^{8*}	<0.05	4095,1±161,9
2	NOS - 3	3088,1±153,1*	3428,9±154,3*#	<0.05	3093,4±157,4*	3212,4±149,7 ^{8*}	<0.05	3086,3±152,3*	3248,7±155,1 ^{8*}	<0.05	3545,0±159,8
3	ET - 1	62,1±5,4*	54,7±6,1*#	<0.05	63,1±3,9*	59,6±3,3 ^{8*}	<0.05	62,3±4,8*	60,2±4,2 ^{8*}	<0.05	50,6±5,7

Note: p – the accuracy of the difference between the indicators at the beginning and after 6 months of treatment

* - p<0.05 in comparison with CG

&- p<0.05 in comparison with the corresponding indicators of group I

- p<0.05 in comparison with the corresponding indicators of group II

Upon admission, all examined patients underwent urgent coronary angiography (CAG) and primary percutaneous angioplasty with stenting according to the time terms according to the recommendations of ESC (2012).

All patients and CG underwent a general clinical examination, complete blood count, plasma glucose, biochemical parameters according to the recommendations of ESC (2012) and the local protocol of management of patients at the Alexander Clinical Hospital in Kyiv. All patients regularly underwent ECG at rest using the hardware and software complex Mortara R-scribe (Mortara Instrument, Inc., USA). The parameters of heart rate, intervals R-R, QRS, QT, PQ were measured, the dynamics of focal changes was estimated.

Determination of NOS-2, NOS-3 and ET-1 levels was performed on the basis of the Research Institute of Experimental Therapy of the Bogomolets National Medical University by the enzyme-linked immunosorbent assay using the ELABSCIENCE test system (USA) on a photometric system with a digital control system Rayto RT-2100C (PRC). All examinations were performed on days 10-14 of MI and after 6 months of treatment.

Two groups of patients were singled out to determine the effect of beta-blockers (BAB) on endothelial function. Group I (37 patients) received Nebivolol («Nebilet» by Berlin-Chemie AG), group II (44 patients) received bisoprolol («Concor» by Merck Ltd). Both groups were comparable according to clinical and anamnestic data (see Table II).

31 patients (group III) had contraindications to the administration of BAB, mainly due to initial bradycar-

dia or severe bradycardia to the minimum dose of BAB (26 patients). 5 patients were not prescribed for other reasons.

Microsoft Excel (Microsoft Corporation, USA), IBM SPSS Statistics 22 for Windows (IBM SPSS Statistics, USA) were used for data management and analysis. *F*-test was used to compare categorical variables between the study groups. Nonparametric statistics were used to compare continuous variables: the Wilcoxon test for related sets and the Mann - Whitney U-test for unrelated sets.

RESULTS

No fatal outcomes were observed in the study and control groups during the entire follow-up period. When prescribing BAB no adverse effects (side effects) were observed, which would require the discontinuation of the drug. The dose of BAB was selected individually to a heart rate of 55-60/min. calculated on a 10-second ECG recording at rest or the maximum tolerance. Monitoring of ECG data did not reveal a negative effect of BAB on atrioventricular conduction and QT interval.

Analysis of CAG records showed complete comparability of groups I and II in the number of affected vessels and, accordingly, endovascular revascularization – the number of stents installed (see Table III).

Patients in all study groups had no differences in baseline therapy, primarily in drugs and statin doses (see Table IV).

In all study groups, the vast majority of patients received angiotensin-converting enzyme inhibitors.

As shown in Table V, in patients with MI there are significant shifts in endothelial function. Thus, the level of NOS-2 was in groups I – III 4851.1 ± 166.5 , 4837.7 ± 159.3 , 4853.4 ± 165.4 pg/mL, respectively, without a significant difference (all $p > 0.05$) against 4095.1 ± 161.9 pg/mL in CG ($p < 0.05$ compared to groups I, II and III). Similar changes are observed in the study of ET-1 levels (initial levels in groups I – III 62.1 ± 5.4 , 63.1 ± 3.9 , 62.3 ± 4.8 pg/mL, respectively, without significant difference (all $p > 0.05$) against 50.6 ± 5.7 pg/mL in CG ($p < 0.05$ compared to groups I, II and III). The data correspond to the results of V. Wilmesetal (2020) [5] obtained in an experiment on small cohort

During the 6-month follow-up, positive dynamics of NOS-2 and ET-1 was observed. The level of NOS-2 in groups I – III was 4272.3 ± 162.7 , 4629.7 ± 161.2 , 4634.2 ± 163.5 pg/mL, respectively (all $p < 0.05$ compared to baseline). Such dynamics can be explained by constant intake of statins and ACE inhibitors in these groups, which have pleiotropic effects and reduce endothelial dysfunction. However, in group I the decrease in NOS-2 was significantly ($p < 0.05$ compared with indicators of groups II and III) more pronounced, which can be explained by the additional positive effect of nebivolol, a drug with NO activity. Analysis of the dynamics of ET-1 showed that within 6 months there was a significant decrease (all $p < 0.05$ compared to baseline) of its level in all groups (group I – 54.7 ± 6.1 , II – 59.6 ± 3.3 and in group III – 60.2 ± 4.2 pg/mL). The use of Nebivolol is associated with an increase in the effectiveness of basic treatment – there is a significant decrease ($p < 0.05$) compared with indicators of groups II and III. However, no normalization of NOS-2 and ET-1 to the CG level was observed in any group, which may be due to the relatively short follow-up period in combination with significant initial changes.

Significant changes are observed when assessing the level of NOS-3 (see Table V). Thus, the level was in I group – 3088.1 ± 153.1 , in II – 3093.4 ± 157.4 and in III group – 3086.3 ± 152.3 pg/mL without a significant difference (all $p > 0.05$) against 3545.0 ± 159.8 pg/mL in CG ($p < 0.05$ compared with groups I, II and III). The level increased in patients of I group to 3428.9 ± 154.3 , in II group – 3212.4 ± 149.7 and III group – 3248.7 ± 155.1 pg/mL (all $p < 0.05$ compared to baseline). Similarly to other indicators, Nebivolol in patients is associated with a more pronounced increase in NOS-3 levels ($p < 0.05$ compared with groups II and III).

DISCUSSION

The level of NOS-3 is determined by genotype, the gene expression depends on many factors [6]. This may explain its changes during the treatment of MI, which indicates new opportunities in the treatment of such patients. This accounts the widespread use of new drugs, such as Nebivolol, which have an effect on NO synthase. It is possible that the proven effectiveness of such BAB in

the group of elderly patients will be useful in a group of young men. Moreover, there are indications of a positive effect on erectile function of Nebivolol, compared with other BAB [7]. This expands the need for further study of NO exchange and the opportunities to influence it in this group of patients.

Conclusions. Significant changes in markers of endothelial dysfunction, namely NOS3/eNOS, NOS2/iNOS and ET-1, are observed in young male patients of the Ukrainian population with MI. During 6 months of treatment, positive changes were observed in the form of an increase in NOS-3 levels and a significant decrease in ET-1 and NOS-2 levels. The inclusion of Nebivolol in the basic therapy for this group of patients is associated with an additional positive effect on the normalization of levels NO synthase and the reduction of ET-1.

REFERENCES

- Eitel I., Nowak M., Stehl C. et al. Endothelin-1 release in acute myocardial infarction as a predictor of long-term prognosis and no-reflow assessed by contrast-enhanced magnetic resonance imaging. *Am Heart J.* 2010;159(5):882-90. doi: 10.1016/j.ahj.2010.02.019.
- Sorrentino S.A., Doerries C., Manes C. et al. Nebivolol exerts beneficial effects on endothelial function, early endothelial progenitor cells, myocardial neovascularization, and left ventricular dysfunction early after myocardial infarction beyond conventional β -blockade. *J Am Coll Cardiol.* 2011;57(5):601-11. doi: 10.1016/j.jacc.2010.09.037.
- Aragon J.P., Condit M.E., Bhushan S. et al. Beta3-adrenoreceptor stimulation ameliorates myocardial ischemia-reperfusion injury via endothelial nitric oxide synthase and neuronal nitric oxide synthase activation. *J Am Coll Cardiol.* 2011;58(25):2683-91. doi: 10.1016/j.jacc.2011.09.033.
- van Veldhuisen D.J., Cohen-Solal A., Bohm M. et al. Beta-blockade with nebivolol in elderly heart failure patients with impaired and preserved left ventricular ejection fraction: Data From SENIORS (Study of Effects of Nebivolol Intervention on Outcomes and Rehospitalization in Seniors With Heart Failure). *J Am Coll Cardiol.* 2009;53(23):2150-8. doi: 10.1016/j.jacc.2009.02.046.
- Wilmes V., Scheiper S., Roehr W. et al. Increased inducible nitric oxide synthase (iNOS) expression in human myocardial infarction. *Int J Legal Med.* 2020;134(2):575-81. doi: 10.1007/s00414-019-02051-y.
- Nasyrova R. F., Moskaleva P. V., Vaiman E. E. et al. Genetic Factors of Nitric Oxide's System in Psychoneurologic Disorders. *Int. J. Mol. Sci.* 2020;21:1604. doi:10.3390/ijms21051604.
- Sharp R., Gales B. Nebivolol versus other beta blockers in patients with hypertension and erectile dysfunction. *Ther Adv Urol.* 2017; 9(2): 59–63. doi:10.1177/ 1756287216685027 .

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ORIGINAL ARTICLE

RELATIONSHIPS BETWEEN THE SOURCE OF HEALTH INFORMATION AND THE BEHAVIOR OF MOTHERS OF CHILDREN UNDER 5 YEARS OLD: CROSS-SECTIONAL STUDY ANALYSIS

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ABSTRACT

The aim: Is to investigate relationships between trusted sources of health information and people's behavior, including their attitudes toward vaccination and their willingness to seek medical care.

Materials and methods: The responses of 4,354 mothers of children under 5 years of age from all regions of Ukraine, who participated in the Multi-Indicator Cluster Household Survey (MICS-2012) were analyzed. The respondents were divided into separate groups using two-step cluster analysis.

Results: 6 clusters of respondents were identified, depending on the trusted source of health information identified by them, including those who trust only physicians (50.0%), friends (15.3%), all information channels (15.2%) or do not trust anyone (6.0%). The most important statistically significant differences in the level of vaccination coverage and willingness to seek medical care were found for a group of people who do not trust any source of information about health or trust only information from the Internet. People who trust information from physicians or pharmacy workers were the most active in vaccinating and seeking medical care.

Conclusions: Communication with patients who do not trust anyone through social networks seems to be a promising way to raise awareness of this group of people about health and increase the level of trust in physicians or certain medical services.

KEY WORDS: Information Seeking Behavior, Communication Barriers, Vaccination, cluster analysis

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INTRODUCTION

WHO names credibility as one of the six most important principles for effective communications in health [1]. Physician's role in the implementation of communication on health is indispensable, which is confirmed by data from Ukrainian and foreign studies: health care workers are not only the most common and authoritative source of health information [2–3] but also play an important role as experts in disseminating health information via other channels of communication, incl. the Internet [4]. At the same time, usage of the Internet as an additional source of information for the patient can have a positive effect on further communication with the physician [5].

Previous studies have identified the relationships between considering different channels of health information as trustworthy and demographic or social characteristics [6] or determinants of NCD development [7].

At the same time, high incidence rates of non-communicable diseases, a lot of mistrust of vaccination, etc. indicate that considering physicians as a source of reliable information does not always lead to a practical result – taking actions at maintaining health.

To gain a more holistic view of the factors and manifestations of a physician's credibility, the data of the Multi-Indicator Cluster Survey of Households (MICS-2012) [8] were

analyzed to investigate relationships between trusted sources of health information and people's behavior, including their attitudes toward vaccination and their willingness to seek medical care.

THE AIM

The aim is to investigate relationships between trusted sources of health information and people's behavior, including their attitudes toward vaccination and their willingness to seek medical care.

MATERIALS AND METHODS

In 2012 Multi-Indicator Cluster Household Survey (MICS-2012) was conducted with the assistance of UNICEF, the Swiss Cooperation Office, and the United States Agency for International Development. In this article responses of 4,354 mothers of children under 5 years of age from all regions of Ukraine, who participated in the MICS-2012 were analyzed.

Rates of usage of health information sources, willingness to seek medical care under threatening life or health condition of a child, attitudes to vaccination, vaccination records obtained from children's vaccination cards were analyzed.

Table I. Clusters of Respondents by Trusted Information Sources about Health

Nº, Name	Number of people	Fraction (%)	Trusted Sources (Support Rate in the Cluster, %)
I, do not trust anyone	262	6	Noone (49.6), the Internet (27.9) ¹
II, trust everyone	661	15.2	Health care professionals (75,2), TV (49,5), books (26,6), pharmacies (26,3), friends (24,2), the Internet (19,4), journals (16,0), magazines (9,8), the Internet (8,0), the radio (6,5), other (3.2)
III, trust friends	666	15.3	Friends (100), health care professionals (80,3), the Internet (11,1),
IV, trust the Internet	191	4.4	The Internet (100), health care professionals (100)
V, trust pharmacies	396	9.1	Pharmacies (100), health care professionals (100), friends (23,2)
VI, trust physicians	2178	50.0	Health care professionals (100)
Total		100	

¹ This cluster also includes individuals who for any reason did not answer questions about trusting health information sources.

Table II. Demographic and Social Characteristics of Clusters

Cluster	Age (Ratio 20-24 / 35-39)	Higher Education Rate, %	Urban Population, % Region	Computer Usage, %	Number of children
I, do not trust anyone	(21.7 / 4.9 ^{II,VI})	46.0 ^{IV}	75.2 ^{II,III,VI} North	86.7 ^{IV}	1.8
II, trust everyone	(18.9 / 14.5) ^{III}	42.2 ^{IV,VI}	59.8 ^{I,IV} Center	84.0 ^{IV}	1.8
III, trust friends	(23.6 ^V / 11.6) ^{II}	38.9 ^{IV}	64.9 ^{I,IV} East, West	86.8 ^{IV}	1.6 ^{V,VI}
IV, trust the Internet	(18.3 / 12.0)	58.1 ^{I,II,III,V,VI}	79.1 ^{II,III,VI} North	99.5 ^{I,II,III,V,VI}	1.6 ^{V,VI}
V, trust pharmacies	(15.2 ^{III} / 13.9)	33.1 ^{IV}	65.4 ^{IV} East	80.1 ^{IV}	1.9 ^{III,IV}
VI, trust physicians	(18.9 / 13.1) ^I	36.4 ^{IV}	60.5 ^{I,IV} South	83.3 ^{IV}	1.89 ^{III,IV}
Total	19.4 / 12.7	38.7	63.2	84.5	1.8

I, II, III, IV, V, VI – indicate the number of the cluster (within one characteristic) from which statistically significant difference was shown (p<0,05)

To identify typical patterns in the credibility of information sources, the respondents were divided into separate groups using cluster analysis. With the help of the Two-Step cluster analysis algorithm, six clusters were formed, containing from 191 (4.4%) to 2,178 (50.0%) individuals. The Silhouette index is 0.7, the share of accordance of subgroups during the verification by the k-means method was 87%, which indicates the sufficient adequacy of the proposed cluster solution.

For each cluster, the rates of receiving health information from different information sources, the willingness to seek medical care under threatening life or health condition of a child, vaccination coverage (following to the vaccination calendar) and attitudes to vaccination, as well as demographic characteristics were calculated. The probability of the obtained differences was assessed using Bonferroni's method for pairwise comparisons with correction for relative values and one-way analysis of variance (ANOVA) for means. Statistical processing was performed using the SPSS v. 23 package.

RESULTS

As a result of the analysis, six clusters were created, the core of each was formed by people who trust the certain information source. Representatives of most clusters trust physicians. For respondents in Cluster VI it is the only credible source of information, the representatives of other clusters combine it with one or more other sources.

The presence of relatively large groups of people who have the same set of trusted information sources about health has become the basis for clustering. Depending on the most distinct characteristics, clusters were given short names (Table I).

Statistically significant differences in the demographic parameters of the clusters were found: cluster IV mostly represented by more educated and computerized citizens with the smallest number of children. The second cluster includes older people who live more often in rural areas in the Center of Ukraine (Table II).

At least one-third of the representatives of each cluster receive health information from television. In cluster V

Table III. Rates of Obtaining Information about Health from Different Sources (by Clusters)

Cluster	Rates, %									
	Television	Newspapers	Friends	Journals	Radio	Health Care Professionals	Internet	Pharmacies	Books	Others
I, do not trust anyone	38.5 ^{II,V}	7.6 ^{II,V}	24.0 ^{II,III,V}	5.3 ^{II,V}	2.7 ^{II}	47.3 ^{I,III,IV,V,VI}	42.4 ^{IV,V,VI}	18.3 ^{II,V}	7.3 ^{II}	1.5
II, trust all	68.2 ^{I,III,IV,VI}	23.8 ^{I,III,IV,VI}	38.1 ^{I,III,IV,VI}	24.7 ^{I,III,IV,VI}	11.5 ^{I,III,IV,VI}	83.7 ^{I,IV,VI}	38.4 ^{IV,VI}	34.3 ^{I,III,IV,VI}	30.0 ^{I,III,IV,VI}	2.0
III, trust friends	33.6 ^{II,V}	9.0 ^{II,V}	96.7 ^{II,IV,VI}	10.5 ^{II}	3.2 ^{II}	88.7 ^{I,VI}	33.0 ^{IV,VI}	17.3 ^{II,V}	5.1 ^{II}	0
IV, trust the Internet	30.9 ^{II,V}	8.9 ^{II}	19.9 ^{II,III,V}	13.1 ^{II}	3.7 ^{II}	95.3 ^{I,III}	95.3 ^{I,III,IV,VI}	12.0 ^{II,V}	7.3 ^{II}	0
V, trust pharmacies	51.0 ^{I,III,IV,VI}	16.2 ^{I,III,IV,VI}	46.7 ^{I,III,IV,VI}	14.6 ^{I,III,V}	6.8 ^{VI}	93.9 ^{I,II,VI}	28.5 ^{I,II,IV}	85.9 ^{I,II,III,IV,VI}	5.8 ^{II}	0
VI, trust physicians	35.9 ^{II,V}	9.0 ^{II,V}	26.9 ^{II,III,V}	8.4 ^{II,V}	2.3 ^{II,V}	97.8 ^{I,II,III,V}	24.6 ^{I,II,III,IV}	18.1 ^{II,V}	6.7 ^{II}	0.1

I, II, III, IV, V, VI – indicate the number of the cluster (within one characteristic) from which statistically significant difference was shown (p<0,05)

Table IV. Rates of the Willingness to Seek Medical Care Under Threatening Life or Health Condition of a Child

Cluster	Rate, %							
	The child cannot drink or breastfeed	The child getting sicker	Fever	Frequent breathing	Difficulty breathing	Blood in the stool	Disturbances in fluid intake	Others
I, do not trust anyone	16.4 ^{III,V}	30.5 ^{II,III,IV,VI}	68.3 ^{II,III,IV,VI}	21.0 ^{II,III,IV,VI}	34.0 ^{II,III,IV,VI}	23.7 ^{II,III,IV,VI}	8.8 ^{III,VI}	29.8 ^{II,IV,VI}
II, trust all	23.9	53.6 ^I	84.6 ^I	34.9 ^{I,IV}	60.1 ^I	49.0 ^{I,IV,V}	15.9	24.4 ^{I,III,V}
III, trust friends	29.3 ^{I,VI}	52.1 ^I	87.8 ^I	40.5 ^{I,VI}	64.1 ^{I,VI}	48.8 ^{I,IV,V}	19.2 ^I	29.4 ^{II,IV,VI}
IV, trust the Internet	27.2	49.7 ^I	92.7 ^I	32.5 ^V	61.8 ^I	36.1 ^{II,III,V}	15.7	26.2 ^V
V, trust pharmacies	31.8 ^{I,VI}	60.4 ^{I,VI}	85.9 ^I	47.2 ^{I,II,IV,VI}	65.9 ^{I,VI}	58.3 ^{I,II,III,IV,VI}	16.7	18.2 ^{I,II,III,IV,VI}
VI, trust physicians	21.3 ^{III,V}	48.2 ^{I,V}	86.9 ^I	34.1 ^{I,III,V}	54.0 ^{I,III,V}	46.8 ^{I,V}	16.3 ^I	25.9 ^{I,III,V}

I, II, III, IV, V, VI – indicate the number of the cluster (within one characteristic) from which statistically significant difference was shown (p<0,05)

16.2% of respondents receive health information from newspapers, and 46.7% from friends and relatives, etc. This information can be used to increase the effectiveness of information campaigns through the combined impact of messages from different sources.

The answers about the willingness to seek medical care under threatening life or health condition of a child and the information on carrying out preventive vaccinations according to the vaccination calendar were analyzed to assess the relationship between considering physicians as a trusted source of information about health and the real activities of respondents.

Respondents assessed the likelihood of seeking medical care in case of fever, difficulty or acceleration of the breathing, the presence of blood in the stool, if a child was getting sicker or has disturbances in fluid intake.

There is a strong correlation between the rates of seeking medical care among respondents from the different clusters (Table IV) (r=0.78 between cluster I and cluster V and r>0.89 for other combinations of clusters). This shows the similarity of the hierarchy of threats to children's health among those who prefer different channels of information. This fact, however, reflects parents' perception of the likelihood of facing the problem (fever, if a child was getting sicker – among leaders) than the level of threat it poses (blood in the stool,

disturbances in fluid intake – among outsiders).

Statistically significant differences in the rates of the willingness to seek medical care (Table IV) indicate peculiarities of clusters' members: people of cluster V most often seek medical attention for most reasons (vigilant), except for the item «Other». Instead, the representatives of the first cluster demonstrate opposed beliefs: a relatively high level of requests for medical care due to «other» reasons and the lowest among the clusters – due to the symptoms indicated in the questionnaire.

Respondents of Cluster III seek medical care relatively intensively for both major and other reasons, and of Cluster IV – selectively: quite intensively due to fever or difficulty breathing, but significantly less than other clusters due to blood in the stool or frequent breathing.

Thus, three groups of clusters could be distinguished: cluster I showing negative attitude to health care, cluster V showing positive attitude (its members seek medical care even more often than Cluster VI, whose members choose physicians as the only trusted source of information) and a group of clusters showing moderately positive mood, the most skeptical of which is the third cluster (those who chose friends and relatives as the trusted source of information).

Table V. The Coverage by the Vaccination, %

Cluster	Rate, %					
	BCG	DTaP	Polio	HepB	Hib	MMRV ¹
I, do not trust anyone	78.2 ^{II,III,V,VI}	65.3 ^{II,III,V,VI}	63.0 ^{II,III,V,VI}	55.0 ^{II,V,VI}	58.8 ^{II,III,V,VI}	46.6 ^{II,V,VI}
II, trust all	89.4 ^I	78.5 ^I	77.5 ^I	71.1^{I,III}	69.9 ^I	59.0 ^I
III, trust friends	88.4 ^I	76.3 ^I	76.0 ^I	62.9 ^{II,V,VI}	69.8 ^I	55.1
IV, trust the Internet	88.0	73.3	73.3	66.5	67.0	53.4
V, trust pharmacies	90.4 ^I	81.8 ^I	81.8 ^I	75.3 ^{I,III}	75.8 ^I	62.4 ^I
VI, trust physicians	90.1^I	78.8^I	78.2^I	70.2 ^{I,III}	72.9^I	59.6^I

I, II, III, IV, V, VI – indicate the number of the cluster (within one characteristic) from which statistically significant difference was shown ($p < 0,05$)
 BCG – Bacillus Calmette–Guérin vaccine; DTaP – Diphtheria, tetanus, & pertussis; Polio – Inactivated poliovirus, HepB – Hepatitis B; Hib – Haemophilus influenzae type b; MMRV – Measles, mumps, rubella

¹ Significantly less coverage of all clusters by MMRV vaccination is due to the presence of children under 1 year. The share of children under 1 year in the clusters is from 16.8 to 18.7%, the difference is not statistically significant.

Table VI. Attitude to Certain Vaccination Factors

Cluster	Rate, %					
	Effectiveness	Safety	Readiness to follow Vaccination Calendar	Refusal to Vaccinate	of them, permanent refusal	Adverse reactions
I, do not trust anyone	70.1 ^{II,III,VI}	34.3 ^{II,III,VI}	68.1 ^{II,III,VI}	47.8^{II,III,VI}	35.0 ^{II}	18.3 ^{III}
II, trust all	79.8 ^I	48.8 ^I	79.5 ^I	34.2 ^I	15.0 ^I	19.1 ^{III}
III, trust friends	81.5^I	55.1^{I,IV}	82.4^I	32.4 ^I	25.5	29.3^{I,II,VI}
IV, trust the Internet	79.6	41.4 ^{III}	80.1	38.2	25.4	21.5
V, trust pharmacies	78.7	51.9^I	81.3 ^I	33.4 ^I	18.9	19.2 ^{III}
VI, trust physicians	81.8^I	48.6 ^I	81.8^I	32.5 ^I	23.1	20.8 ^{III}

I, II, III, IV, V, VI – indicate the number of the cluster (within one characteristic) from which statistically significant difference was shown ($p < 0,05$)

Analysis of the coverage of children with preventive vaccinations showed (Table V) that clusters II, III, V, VI mostly do not have statistically significant differences in the vaccination rates. The exception is hepatitis B vaccination, where clusters II, V, and VI form a group of highly vaccinated, and I and III – low-vaccinated. Those who trust the Internet (cluster IV) do not show any statistically significant differences from any other cluster and are moderately vaccinated, and cluster I, accordingly, demonstrates significantly lower levels of vaccination than other clusters (except for cluster IV).

The analysis of respondents' assessment of the effectiveness and safety of vaccination (Table VI), readiness to follow the vaccination calendar confirmed the trends. Respondents from cluster I expressed low support for all three criteria, respondents from III, V, and VI – high, and IV – average support. When asked whether the respondents had the experience of refusing vaccination, 47.8% of the first cluster and 32.4%–38.2% of the remaining clusters answered affirmatively. At the same time, respondents in cluster III reported a significantly higher incidence of adverse reactions in their children (29,3).

DISCUSSION

The analysis shows that half of the mothers of young children consider physicians to be the only reliable source of health information (cluster VI). In terms of social and

demographic characteristics, the group of respondents who trust information from the Internet and physicians (4.4% of the population) is the most different from other groups: they mostly have a higher education, are residents of cities, and have a lower average number of children.

Respondents from clusters III (trust friends), IV (trust the Internet) and VI (trust physicians) mostly receive information from the source they trust, and clusters I (trust no one), II (trust everyone), and V (trust pharmacies) receive information about health from a wider range of channels. For example, people who trust pharmacies also receive health information from television (51%) and friends (46.7%).

COVID-19 may change the information need of people, for example, a study [9] shows in 2020 92.6% of Italians trust scientists, 89,6% – official websites, and only 4.3% social media. Health care professionals are remaining as a trusted source of health information because people seek practical information, which is appropriate and validated in their communities [10]. Even one health intervention could cause a prolonged protective effect [11].

Representatives of the first cluster (do not trust anyone) show statistically significantly lower levels of seeking medical care, vaccination coverage, expressed the least support for the points about the safety and effectiveness of vaccination. Almost half of them had the experience of rejecting the

vaccination. Since this cluster represents approx. 6% of the population and also includes people, for whom the only trusted source of health information is the Internet, it is important to inform them about health through the information channels they do use (even if people declare do not to trust them), for example, physicians, the Internet, television.

Communicating with people of this cluster also important is to promote and facilitate regular direct communication between respondents and their family physicians. One of the possible options for such interventions is the participation of physicians or public health professionals in a social networks activity, which involves the preparation of posts relevant to the population health issues, participation in discussions in patients groups so on.

Sometimes, mothers do not seek medical care because of the cultural aspects or as they are unaware of the importance of it [12]. For this group, health-related aspects could be effectively embedded to appropriate activities, i.e. language school programs [13]. Healthcare professionals should be trained in cultural sensitivity and have skills in communications to improve seeking medical care and vaccination rates [12,14].

Representatives of the V cluster (trust pharmacies) demonstrated the highest levels of seeking medical care, coverage, and safety assessments of vaccination. Representatives of the VI cluster (trust physicians) are leaders in vaccination coverage, highly appreciate its effectiveness, safety, and readiness to follow the vaccination calendar, at the same time, less often than representatives of the V cluster seek medical care.

Representatives of cluster III (trust friends) are ready to follow the vaccination calendar, consider vaccination effective and safe, while most often (29.3%) stated that they observed side effects from vaccination, and have lower than clusters II, V, and VI coverage by hepatitis B vaccination (62.9% vs 70.2–75.3%).

As shown in [15,16] the Internet plays a double role in health communication. The sharing of medical advice in social media by physicians is a trusted and effective method, but also the Internet may reinforce false information and myths.

CONCLUSIONS

Based on the analysis of the data of the Multi-Indicator Cluster Survey of Households, 6 clusters of respondents were identified, depending on the trusted source of health information identified by them, including those who trust only physicians (50.0%), friends (15.3%), all information channels (15.2%) or do not trust anyone (6.0%).

It has been determined that people who do not trust any of the information channels (or trust only information from the Internet) seek significantly less medical care, have lower rates of vaccination coverage, and consider vaccination less effective and safe, compared to other clusters. People who trust information from physicians or pharmacy workers were the most active in vaccinating and seeking medical care.

Communication with patients who do not trust anyone through social networks seems to be a promising way to raise awareness of this group of people about health and increase the level of trust in physicians or certain medical services.

REFERENCES

1. WHO strategic communications framework for effective communications. World Health Organization. 2017. <https://www.who.int/mediacentre/communication-framework.pdf>.
2. Znamenska M.A. Medyko-sotsialne obgruntuvannia systemy komunikatsii v okhoroni zdorovia. Dysertatsiia na zdobuttia naukovoho stupenia doktora medychnykh nauk. Kyiv: NMAPO imeni P.L. Shupyka. 2015. (In Ukrainian).
3. Nejašmić D., Miošić I., Vrdoljak D. et al. Awareness and use of evidence-based medicine information among patients in Croatia: a nation-wide cross-sectional study. *Croat Med J.* 2017;58(4):300–301.
4. Tonsaker T., Bartlett G., Trpkov C. Health information on the Internet. Gold mine or minefield? *Can Fam Physician.* 2014;60(5):407–408.
5. Eysenbach G. Internet Health Information Seeking and the Patient-Physician Relationship: A Systematic Review. *J Med Internet Res.* 2017;19(1): e9.
6. Balashov K. Hromadske zdorovia ta kultura: tochyky dotyku. Modern science: problems and innovations. Abstracts of the 3rd International scientific and practical conference. Stockholm: SSPG Publish. 2020;74–79. (In Ukrainian).
7. Hulchiy O., Slabkiy G., Balashov K. Evidence-based approaches to communication of non-communicable diseases risks in Ukraine: identification of channel. *Ukraine. Nation's Health.* 2020(4);6–12.
8. United Nations Children's Fund, State Statistics Service of Ukraine, Ukrainian Institute for Social Reforms and Statinformconsulting. Ukraine Multiple Indicator Cluster Survey (MICS) 2012. Ref. UKR_2012_MICS_v01_M. <https://microdata.worldbank.org/index.php/catalog/2348> on 30.11.2019.
9. Falcone R., Sapienza A. How COVID-19 Changed the Information Needs of Italian Citizens. *Int J Environ Res Public Health.* 2020;17(19):6988. doi: 10.3390/ijerph17196988.
10. Gerbing K.K., Thiel A. Handling of medical knowledge in sport: Athletes' medical opinions, information seeking behaviours and knowledge sources. *Eur J Sport Sci.* 2016;16(1):141–8. doi: 10.1080/17461391.2014.989278.
11. Lecerof S.S., Stafström M., Emmelin M. et al. Findings from a prospective cohort study evaluating the effects of International Health Advisors' work on recently settled migrants' health. *BMC Public Health.* 2017;17(1):369. doi: 10.1186/s12889-017-4273-0.
12. Miteniece E., Pavlova M., Rechel B., Groot W. Barriers to accessing adequate maternal care in Central and Eastern European countries: A systematic literature review. *Soc Sci Med.* 2017;177:1–8. doi: 10.1016/j.socscimed.2017.01.049.
13. Jervelund S.S., Maltesen T., Wimmelmann C.L. et al. Know where to go: evidence from a controlled trial of a healthcare system information intervention among immigrants. *BMC Public Health.* 2018;18(1):863. doi: 10.1186/s12889-018-5741-x.
14. Vrdelja M., Kraigher A., Vercic D., Kropivnik S. The growing vaccine hesitancy: exploring the influence of the internet. *Eur J Public Health.* 2018;28(5):934–939. doi: 10.1093/eurpub/cky114.
15. Stahl J.P., Cohen R., Denis F. et al. The impact of the web and social networks on vaccination. New challenges and opportunities offered to fight against vaccine hesitancy. *Med Mal Infect.* 2016;46(3):117–22. doi: 10.1016/j.medmal.2016.02.002.

16. Učakar V., Fafangel M., Kraigher A. Vaccine confidence among mothers of young children, Slovenia, 2016. *Vaccine*. 2018;36(37):5544-5550. doi: 10.1016/j.vaccine.2018.07.062.

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ORIGINAL ARTICLE

THE INFLUENCE OF THE EXTERNAL AND INTERNAL ENVIRONMENT OF PRIMARY CARE FACILITIES ON THE PREVENTION OF DISEASES OF THE CIRCULATORY SYSTEM

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ABSTRACT

The aim: Of the work is analysis of strengths and weaknesses, opportunities and threats of the external and internal environment in primary care facilities for the implementation of preventive measures of cardiovascular diseases (CVDs).

Materials and methods: An analysis of the work of primary health care facilities for the prevention of CVDs, which included external and internal audit, such as analysis of the regulatory framework, human resources, logistics provision, questionnaire of adult population of Zaporozhye region on awareness of factors risk of diseases of the circulatory system and a healthy lifestyle.

Results: Thanks to the adoption of a number of regulations, timely management decisions, it was possible to achieve 100% provision of medical equipment necessary for the prevention of CVDs, but low staff capacity of doctors with their unsatisfactory level of knowledge about the main CVDs risk factors. Instability, pose a serious threat to the further stable development of primary health care and their prevention.

Conclusions: Significant progress had been made in the implementation of preventive measures for CVDs. Against the background of many existing problems.

KEY WORDS: primary health care, cardiovascular diseases, prevention, threats, opportunities

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INTRODUCTION

For many decades, changes in primary health care (PHCs) settings on the basis of family medicine has been implementing all over the world in order to ensure the availability and quality of health care. Nevertheless, 50% of the world's population has limited access to PHC, including the treatment and prevention of chronic noncommunicable diseases (NCD). In order to this, the World Health Organization (WHO) held a Global Conference dedicated to a primary healthcare organization, on which its state and prospects for development in the world were considered [1]. The implementation of primary healthcare on the basis of family medicine has become a priority in Ukraine after the adoption of the resolution of the Cabinet of Ministers of Ukraine № 989 "About comprehensive measures for introducing family medicine into the health care system" became a starting point in reforming the health care system of our country [2].

According to the WHO, diseases of the circulatory system (DCS) have been the leading cause of death worldwide for a half a century. [3]. In different countries of the world the share of CVDs is from 30% to 65% [4]. That is why the WHO has declared the main task for the whole world – to reduce mortality from CVDs by 25% by 2025, and the World Heart Federation – to reduce mortality from DCS by 25%. Almost every third case of a patient's referral to a health care institution (HCI) occurs due to this pathology.

The experience of developed countries shows that the most effective in reducing mortality from CVDs are preventive measures at the population level and secondary prevention. Thus, it is advisable to analyze the external and internal environment of primary care facilities, the main task of which is preventive measures.

THE AIM

The aim is analysis of strengths and weaknesses, opportunities and threats of the external and internal environment in primary care facilities for the implementation of preventive measures cardiovascular diseases.

MATERIALS AND METHODS

Medico-social substantiation of the strengths and weaknesses, opportunities and threats of the external and internal environment of primary health care facilities (HCF) of communal ownership was by the analysis of the current legal framework of the organization of work as a health care facility of primary care (PC) is provided as of requirements for its provision, in accordance with the standards of medical care for patients with chronic cardiovascular pathologies, which was as external audit, and on the results of our own research, conditionally defined as an internal audit of the health care facility. Official data

of the permanent population of Zaporizhia region and its structure were obtained from the Zaporizhia Regional Statistical Office for the purpose of social impact of the external environment, and a survey of adults in the Zaporizhia region on awareness of risk factors of CVDs (3021 questionnaire). For the internal audit, a detailed analysis of two main groups of resources was carried out: logistics of the PHCs, communal forms of ownership and human resources. The information was collected on the basis of 32 primary health care centers of Zaporizhia region, which was a total at the beginning of the retrospective study (2015-2017). During the last three years, decentralization processes (creation of united territorial communities) have been actively started and the number of PHCs providing PC has increased to 48 (as of July 1, 2019). Materials for the analysis of personnel potential were statistical data of copying from f. № 17 «Report on medical personnel for 20__ years» (112 units).

For studying the logistical support of facilities that provide PHCs, from the list of equipment of the physician was identified equipment that meets the standards for the prevention and treatment of CVDs: tonometer with a set of cuffs, stethoscope, portable otoophthalmoscope, tape measure, blood level monitor set, height meter, medical scales, portable three-channel electrocardiograph. Data on the need were calculated in accordance with the Order of the Ministry of Health of Ukraine dated January 26, 2018 № 148 [5] and data on security for all the above positions in the HCF on the financial statements of the institution. Statistical processing of the obtained material required the formation of a computer database based on Microsoft Excel, where the results of the study were grouped depending on the task of the study, and statistical processing of the results was performed using the program Statistica 10.0. To conduct a comparative analysis in the dynamics, we used the relative values, indicators of equipment and personnel, which are presented in the form of Me (25%; 75%). Estimation of reliability of a difference of the received data in dynamics was estimated by nonparametric methods.

For the systematization of the results of the study, for the strategic planning of threats and opportunities of the enterprise SWOT-analysis was used. SWOT-analysis consists of dividing factors and phenomena into four categories: strengths and weaknesses of the model, opportunities in its implementation and threats associated with its implementation [6].

Due to the fact that the analysis of the internal environment of PHCs providing communal ownership was carried out on the general population of PHCs of Zaporizhia region, and environmental factors are the only ones in the country, the obtained data are representative.

RESULTS

To ensure the basic functions of primary health care, the Ministry of Health approved the Model Table of Material and Technical Equipment of Health Care Institutions [5] and Individual Entrepreneurs Providing Primary Health

Care and allocated basic and additional lists of equipment and facilities for providing medical services using telemedicine which have been used in many countries for a long period of time. There are only 68 kits for telemedicine in the primary care facilities, which corresponds to 5% of the provision at January, 2020.

An important condition for the quality of primary care and prevention of diseases of the circulatory system is the provision of health care facilities with appropriate equipment fully. According to our data, in 2015 the maximum supply of height meters on average was 47.6 (28.9 ÷ 65.3)%, which is 2 times lower than required, the supply of tonometers for measuring of arterial pressure ranged from 10% to 52%. The worst situation was observed with the availability of devices for electrocardiography, when there was only 1 device per establishment in the presence of 10 individuals-entrepreneurs, not taking into account the separate structural units. The lack of motivation of medical workers to ensure preventive work is underlined by the fact that the provision of tapes for measuring waist circumference averaged only 7.7 (0 ÷ 9.6)% in the region against the background of minimal economic costs. In view of the foregoing, management decisions were focused on the needs of the primary health care facility. There were significant changes in the equipment of primary health care facilities in Zaporizhzhia region in 2017, namely: the provision of tonometers with a set of cuffs amounted to 143.4 (100.8 ÷ 176.3)%, which is 3.2 times more than in 2015, portable otoophthalmoscopes – 136.8 (100.0 ÷ 166.4)%, which compared to 2015 – on 121.6% more, and the least – medical scales – 107.3 (100.0 ÷ 113, 6)% and height meters – 110.7 (100.0 ÷ 113.6)%. In 2019, the minimum provision of primary care facilities in the region was on average 107.4 (100.0 ÷ 135.2)% stethoscopes and height meters 108.0 (100.0 ÷ 123.3)%. Thus, due to timely management decisions based on a systematic analysis of the material and technical state of the primary care facility with equipment for prevention and treatment of patients with diseases of the circulatory system allowed to achieve this figure of 100%, which became a strong factor in the internal environment of health care facilities.

In order to study the use of this equipment, we analyzed the staff capacity of medical workers (doctors, nurses) of primary health care and study their level of knowledge. Our data showed that the level of provision of doctors during 2017-2019 remains within the statistical error on average 66.1 (59.25 ÷ 81.2)% without a significant difference by districts and cities of Zaporozhzhia region. Staffing by nurses in the Zaporizhzhia region averages 82.4 (73.1 ÷ 91.8)%, which significantly exceeds the level of provision of doctors on the primary level ($p < 0.05$), the vast majority of whom are persons under 45 years – 62.0 (54.9 ÷ 73.7)%, which indicates a sufficient number of medical workers with nurse education in health care facilities that provide primary care. Analyzes was conducted the enactment of the order of the Cabinet of Ministers of March 28, 2018 № 302 “About approval of the Regulations of the system of continuous professional development of specialists of

health care” [7]. This order defines the basic organizational principles of continuous professional development throughout the period of professional activity.

Medical and organizational problems of prevention of diseases of the circulatory system are hidden in the insufficient level of knowledge of primary care physicians about the leading risk factors for diseases of the circulatory system, which needs urgent correction and improvement in order to effectively prevent the population [8]. All of the above proves the possibility of the development of the primary level of health care, but the vast majority of elderly and senile age influence on the amount of medical care and the workload of family doctors. Every year there is an increase in the share of the population of older than working age according to the official data of the Zaporizhia Regional Statistical Office, which part in 01.2019 is 28.3%. Even when concluding an agreement between a primary health care institution and the National Health Service of Ukraine, a correction factor of 1,232 for 2020 is envisaged, which provides additional opportunities for the population of this category. At the same time, given the constant annual growth of the elderly population, there is a risk of burden not only on doctors due to chronic non-communicable diseases but also on the budget, because there is a need for constant medication as secondary prevention. Secondary prevention became more accessible after the introduction of the state program “Affordable Medicines”, which has been implemented in Ukraine since 2016 [9]. As a result of all implemented measures at the state level, the population's requirements for the quality of medical care are growing, namely the population has low social responsibility for their health and commitment to a healthy lifestyle, which is confirmed by many medical and social studies, including ours [10]. The results of our survey showed that almost 55% of the adult population believe that they follow a healthy lifestyle, in terms of gender differences, 45.5% of men and 60% of women. 93.3% of the total number of respondents, in their opinion, know some information about risk factors of CVDs., which increases with age and mainly among women, but significant difference in terms of age and gender differences were not found. The lowest level of awareness of risk factors of CVDs is observed in the group of 18-24 years (81.6% – all together), especially among men – 75.0%, which indicates a lack of control over health policy. Threats for increasing of preventive work at the primary level are created not only by external factors, but the biggest obstacles to this work are in the internal environment, to overcome which today there is a solid basis in the form of strong factors of the internal environment of the PHC. In order to the Law of Ukraine «About state financial guarantees of medical care» [11] ensure rapid and relatively irreversible changes in the system of primary health care (work of the HCF), a number of bylaws have been developed and issued, which confirms the will of the patient (or his legal representative) to choose a physician who will provide him with primary care [12].

Thus, the imperfection of the organizational structure, approaches to the rational use of available limited resour-

es, the optimal organization of primary health care lead to the fact that the same factors not only open opportunities for development, but can also be a threat to development.

DISCUSSION

An analysis of environmental factors over the past 10 years allows us to assert that, in the conditions of several changes of the political structure and government in the country, rapid reform of the health care system was initiated. The modern health care system of Ukraine became characterized by an active transition from the budget-insurance to the market-insurance model of the healthcare system, in particular, by the transformation of medical institutions into new organizational and legal forms. The process began with health care facilities that provide primary health care, thanks to which the private health services sector developed, which for the first time in the history of the health care system of Ukraine joined the provision of primary health care by concluding agreements with The National Health Service of Ukraine (NHSU). This process could be seen as an opportunity for development. At the same time, frequent changes in the leadership of the industry and elections to councils at various levels are unfavorable political conditions for the implementation of industry reform.

Only due to the fact that relative stability and political will to implement the reform at the primary level was observed for 3 years, its implementation took place. A similar primary medical care funding mechanism has been for more than 70 years in the UK, the National Health Service (NHS), which was established in 1948 to provide affordable healthcare for both poor and rich patients. The UK's NHS is primarily funded by general taxation, but the UK spends relatively little funds on health care as compared with other Western European countries, making it difficult to improve the quality of care [13]. NHSU is also financed by taxes of Ukrainian citizens, and the cost of medical care in our country is one of the lowest in Europe [14]. In European countries, each patient chooses his own doctor, concluding an agreement with him. In the Netherlands, the location of the patient is especially important – he must live within a 15-minute drive to the clinic in case of emergency, and a change of family doctor is possible no more than 1 time in 6 months [15]. At the same time, the territory of access to the outpatient clinic and the minimum period for which a declaration (agreement) with a doctor must be signed are not regulated in Ukraine.

To fulfill its functions and tasks, the Ministry of Health of Ukraine has approved a list of medical services and interventions, as well as laboratory and instrumental diagnostic tests performed within the framework of primary health care services [16]. This list is minimal, but sufficient for all types of primary health care services. It is also small in the vast majority of countries, but in case of necessities, additional interventions are provided, which are paid separately. For example, Canadian family physicians, as in Ukraine, receive a contribution for each patient, but they also receive incentives, bonuses, and special payments for

specific health promotion services, such as diabetes care or smoking cessation. For the first time, telemedicine equipment was officially included in this list. In Norway telemedicine has been used since 1993 to provide medical care to patients living in the most remote areas [17]. Successful telemedicine projects are also available in Germany, Denmark, France, Italy, Finland, Poland, the implementation of which has already passed into the commercial field. Today, most American insurance companies have said they are willing to cover the cost of medical teleconsultation as well as clinic care, and for the uninsured, the cost of such a service will cost \$ 45 [18]. The number of teleconsultations in the United States will increase from 19.7 million in 2014 to 158.4 million in 2020 [18]. The low level of equipment, lack of experience, opportunities to consult with doctors of specialties, distrust of doctors and the public to consultations with telemedicine have led to the fact that even the existing telemedicine equipment is not constantly used for its intended purpose.

Thus, we have shown that the changes of the organization of the primary health care in Ukraine, which began from 2017 has opened up significant opportunities for quality work of facilities that provide primary health care due to the adoption of a number of regulations at the state level. Ways to introduce changes in the external and internal environment of primary health care facilities for prevention are the same with the introduction of similar processes in other countries.

CONCLUSIONS

1. It is shown that the introduction of a new organizational and legal form of health care facilities that provide primary care, on the basis of a number of regulations adopted at the state level, provided opportunities for enterprise development, as a factor of the external environment, which obliged the heads of enterprises to make timely management decisions to improve its material and technical condition in order to obtain funding through the conclusion of an agreement with the National Health Service of Ukraine. This was confirmed by significant changes in 2017: 100% provision of equipment for the prevention and treatment of patients with cardiovascular diseases for the population of Zaporizhia region, which became a strong factor in the internal environment of the institution.

2. It is proved that during 2017-2019 years there was a high level of human resources of employees with secondary medical education in the Zaporozhye region on average 82.4 (73.1 ÷ 91.8)% the vast majority of whom are persons under the age of 45 – 62.0 (54.9 ÷ 73.7)%, against the background of a significantly lower level of provision of primary care physicians – 66.1 (59.25 ÷ 81.2)% ($p < 0.05$), which is one of the weaknesses of the internal environment, especially in the presence of a threat in the form of an increase in the proportion of the population older than working age, which as of 01.2019. reached 28.3%.

3. It is established that one of the threats to the external environment is the insufficient level of knowledge about

the risk factors cardiovascular diseases among the adult population, especially among men in the group of 18-24 years (75.0%), indicating a lack of control over health policy and a healthy lifestyle for 55% of the adult population with gender differences (45.5% of men vs. 60% of women) with the free choice of a family doctor whose main work is preventive measures.

REFERENCES

1. Tkachenko V.I. Pervichnaya medicinskaya pomoshch v mire: rezultaty 40-letnej realizacii Alma-Atinskoy deklaracii (1978) budushee razvitiye sogleasno Astaninskoy deklaracii (2018) [Primary care in the world: the results of the 40-year implementation of the Almaty Declaration (1978); future development according to the Astana Declaration (2018)] *Semejnaya medicina*. 2019; 4 (84):97-102. (In Russian).
2. «Pro kompleksni zakhody shchodo vprovadzhenia simeinoi medycyny v systemu okhorony zdorovia» Postanovy Kabinetu Ministriv Ukrainy vid 20.06.2000 № 989 [The resolution of the Cabinet of Ministers of Ukraine № 989 "About comprehensive measures for introducing family medicine into the health care system" from 20.06.2000 № 989] doi: <https://zakon.rada.gov.ua/laws/show/989-2000-%D0%BF#Text>.
3. The WHO CVD Risk Chart Working Group World Health Organization cardiovascular disease risk charts: revised models to estimate risk in 21 global regions *Lancet Glob Health*. 2019; 7: 332–377. doi: [https://doi.org/10.1016/S2214-109X\(19\)30318-3](https://doi.org/10.1016/S2214-109X(19)30318-3).
4. Thomas A. Gaziano Growing Epidemic of Coronary Heart Disease in Low- and Middle Income Countries *Curr Probl Cardiol*. 2010 ; 35(2): 72–115. doi: 10.1016/j.cpcardiol.2009.10.002
5. Pro zatverdzhennya Primirnogo tabelya materialno-tehnichnogo osnashennya zakladiv ohoroni zdorov'ya ta fizichnih osib – pidpriyemciv, yaki nadayut pervinnu medichnu dopomogu: Nakaz MOZ Ukrainy vid 26.01.2018 № 148. [About approval of the main content of material and technical support of the health care institution and individuals – entrepreneurs of primary health care: Order of the Ministry of Health of Ukraine from 26.01.2018 № 148] doi: https://moz.gov.ua/uploads/0/4141-dn_20180126_148.pdf.
6. Metodika provedeniya SWOT-analiza. Obrazcy matric SWOT [Methods of conducting SWOT-analysis. Samples of SWOT matrices]. doi: <https://marketing.by/novosti-rynka/metodika-provedeniya-swot-analiza-obraztsy-matrits-swot/>.
7. Pro zatverdzhennya Polozhennya pro systemu bezperernogo profesijnogo rozvitku fahivciv u sferi ohoroni zdorov'ya: Postanova KMU vid 28.03.2018 № 302. [the enactment of the order of the Cabinet of Ministers of March 28, 2018 № 302 "About approval of the Regulations of the system of continuous professional development of specialists of health care" from 28.03.2018 № 302.] doi: <https://www.apteka.ua/article/455594>.
8. Klimenko V.I., Kremsar I.M. Mediko – organizacijni problemi profilaktiki hvorob sistemi krovoobigu. [Medico – organizational problems of prevention of diseases of the circulatory system.] *Suchasni aspekti medicini i farmaciji*. 2017; 1: 79-80. (In Ukrainian).
9. Pro zatverdzhennya Reyestru likars'kykh zasobiv, yaki pidlyahayut' reimburatsiyi Postanova KMU vid 01.06.2020 № 1284. [On approval of the Register of medicinal plants that connect reimbursement Resolution of the Cabinet of Ministers of 01.06.2020 № 1284.]doi: <https://moz.gov.ua/article/ministry-mandates/nakaz-moz-ukraini-vid-01062020-1284-pro-zatverdzhennja-reestru-likarskih-zasobiv-jaki-pidljagajut-reimburacii-stanom-na-28-travnja-2020-roku>.

10. Kovalenko V.N. Sravnitel'naya harakteristika profilaktiki serdechno-sosudistyh zabolevanij v Ukrainie i Evrope po dannym issledovaniya EUROASPIRE IV: gospitalnaya liniya. [Comparative characteristics of the prevention of cardiovascular disease in Ukraine and Europe according to the study EUROASPIRE IV: hospital line.] Ukrayinskij kardiologichnij Journal. 2015; 4: 17-24. (In Russian).
 11. Analiz regulyatornogo vplivu do proektu postanovi Kabinetu Ministriv Ukrainy «Deyaki pitannya realizaciyi derzhavnih finansovih garantij medichnogo obslugovuvannya naselennya za programoyu medichnih garantij na 2020 rik» [Analysis of the regulatory impact of the project on the establishment of the Cabinet of Ministers of Ukraine "Some issues of implementation of state financial guarantees for the provision of medical services to the population under the program of medical guarantees for 2020"]. doi: http://moz.gov.ua/uploads/3/15044-pro_20191122_1_arv.pdf.
 12. Poryadok vboru likarya, yakij nadaye pervinnu medichnu dopomogu : Nakaz MOZ Ukrainy vid 19.03.2018 № 503. [Procedure for selecting a doctor who provides primary care: Order of the Ministry of Health of Ukraine dated March 19, 2018 № 503.] doi: <https://zakon.rada.gov.ua/laws/main/z0347-18#n22>.
 13. Ulrike N., Harris M.M. Atestaciya (ekspertne ocinyuvannya) likariv u Velikobritaniyi. [Certification (expert evaluation) of doctors in the UK] Semejnaya medicina. 2017; 4 (72): 31-34. (In Ukrainian).
 14. Goroshko A., Shapoval N. Can people afford to pay for health care? doi: https://www.euro.who.int/__data/assets/pdf_file/0008/381590/ukraine-fp-eng.pdf?ua=1.
 15. Tkachenko V.I., Alekseichenko O.I. General practice in Netherlands: professional training and organization of medical care. Semejnaya medicina. 2017; 3: 21-23.
 16. Poryadok nadannya pervinnoyi medichnoyi dopomogi : Nakaz MOZ Ukrainy vid 19.03.2018. № 504. [Procedure for the onset of primary medical care: Order of the Ministry of Health of Ukraine dated March 19, 2018. № 504.] doi: <https://zakon.rada.gov.ua/laws/show/z0348-18#n19>.
 17. Goncalves M.R., Umpierre R.N. Expanding Primary Care Access: A Telehealth Success Story. The Annals of Family Medicine. 2017; 15 (4): 383. doi: <https://doi.org/10.1370/afm.2086>.
 18. Choi Y. Telemedicine in the USA: Standardization through information management and technical applications May 2006 IEEE Communications Magazine. 44(4):41-48. doi: 10.1109/MCOM.2006.1632648.
- «Scientific substantiation of optimization of the system of medical care in different levels to the adult population in the region aspect» (2016-2020, № state registration 0116U005353).

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ORIGINAL ARTICLE

DYNAMICS OF STUDENTS' FITNESS LEVEL WHILE DIFFERENTIATING PHYSICAL EDUCATION CLASSES IN ACCORDANCE WITH THEIR HEALTH AND NOSOLOGY OF DISEASES

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ABSTRACT

The aim: Is to study the dynamics of students' physical fitness level while differentiating physical education classes in accordance with their somatic health and nosology of diseases.

Materials and methods: The paper presents the results of a study of the dynamics of the physical fitness indicators of students in the process of physical education. The study involved 660 students between the ages of 17 and 25. Testing of students' physical fitness was performed using the method of control measurements. Research methods included the theoretical analysis and generalization of scientific and methodical literature, pedagogical observations, testing, pedagogical experiment, and the methods of mathematical statistics.

Results: At the end of the experiment, the students of the experimental groups (both male and female) showed authentically ($p < 0.05 - 0.001$) better indicators of the control tests than the students of the control groups.

Conclusions: It was established that the introduction of the original program of differentiating classes in accordance with the level of students' somatic health and nosology of diseases into the process of physical education has a positive effect on their physical fitness level. This will help to improve their learning and future professional activities.

KEY WORDS: students, differentiating physical education classes, health, physical fitness

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INTRODUCTION

Physical fitness is an important indicator of the health and physical education of students, which ensures their readiness to perform the physical activities provided by the curriculum at higher education institutions (HEI) [1, 2, 3]. Physical fitness characterizes the level of physical qualities development, which was achieved in the process of physical education [4, 5, 6]. The physical fitness of students is related to the level of physical health. It can be argued that a student who has a high level of physical health also has a high level of physical fitness. Therefore, the results of motor tests of the students with a "safe" level of physical health are benchmarking for the development of motor skills of young people with lower levels of health. Physical fitness of students should be focused on improving health and only indirectly on the results of motor tests [7, 8]. The introduction of control tests significantly activates students, changes their attitude to the educational process [9, 10].

The issue of the differentiating physical education classes has been studied in the works of scientists [11, 12], however, given the current state of health and physical fitness of school and university students, it still remains relevant.

THE AIM

The aim is to study the dynamics of students' physical fitness level while differentiating physical education classes in accordance with their somatic health and nosology of diseases.

MATERIALS AND METHODS

The study was conducted at Polissia National University (PNU), Zhytomyr Ivan Franko State University (ZSU) (Ukraine) and Polesky State University (PSU) (Republic of Belarus). To analyze the state of students' physical fitness, we organized an initial experiment, which involved 388 students (142 students from PNU, 127 students from ZSU,

Table I. The physical fitness state of male students ($\bar{X}\pm m$)

Types of tests	The year of study			
	1st	2nd	3rd	4th
100 m run (s)	16.64±0.75	16.65±1.09	16.37±0.62	16.79±0.99
Standing long jumps (cm)	204.31±12.37	212.41±14.52	205.30±15.23	200.31±14.23
Push-ups (reps)	24.63±5.27	25.52±4.26	24.09±6.48	22.20±5.12
Pull-ups (reps)	11.50±1.64	11.49±3.03	09.23±3.46	09.70±3.15
Sit-ups in 1 min (reps)	25.41±3.86	25.77±1.80	24.58±3.49	24.48±3.18
Single-leg squats (reps)	6.44±0.58	6.87±0.49	6.54±0.23	6.87±0.42
Bending forward in a sitting position (cm)	12.54±1.69	11.52±3.03	09.21±5.43	10.30±3.09

Table II. The physical fitness state of female students ($\bar{X}\pm m$)

Types of tests	The year of study			
	1st	2nd	3rd	4th
100 m run (s)	18.31±0.87	18.55±0.79	18.77±0.72	18.75±0.98
Push-ups (on the knees) (reps)	21.34±1.52	20.81±1.98	20.09±2.28	19.56±2.92
Sit-ups in 1 min (reps)	23.73±6.12	28.07±2.93	24.66±3.11	23.78±4.96
Bending forward in a sitting position (cm)	10.88±3.07	11.61±1.92	11.21±2.17	10.12±2.10
Arch hold (reps)	19.29±1.29	18.46±1.47	17.98±1.83	17.21±2.83
Lunges (reps)	14.80±0.42	14.47±0.63	14.29±0.42	14.03±1.94

119 students from PSU): 175 male and 213 female students of the 1st-4th years of study (1st year n=88; 2nd year n=141; 3rd year n=93; 4th year n=66). To substantiate the authors' program of differentiating physical education classes, 2 experimental (n=139) and 2 control (n=133) groups of the students of the 1st-2nd year (male and female) were formed. The experimental group EGm included 60 male students, and the EGf group – 79 female students; the control group CGm – 52 male students, CGf – 81 female students. The students of experimental groups were engaged in the sectional form of physical education according to the original program, according to which the means of physical education and physical activity were differentiated depending on the level of physical health, disease nosology, doctor's indications, and the requirements of future professional activity. The students of control groups attended traditional physical education classes at HEI. The number of hours devoted to physical education per week in the experimental and control groups was the same and accounted for 4 hours.

The students' physical fitness level was assessed using control tests. The tests were applied to evaluate power qualities: 1) standing long jumps (males); 2) push-ups (males – lying on the floor, females – standing on the knees); 3) pull-ups on the crossbar (males); 4) sit-ups in 1 min; 5) single-leg squats (males); 6) the arch hold (females); 7) lunges (females). In order to assess the speed, a 100 m race with a sprint start was used. Flexibility was assessed by the exercise of bending forward in a sitting position. The following tests were used in the experimental groups to monitor the development of professionally significant motor skills: 1) the Cooper test (run-walk within 12 min-

utes) – to assess overall endurance; 2) the Flamingo Balance Test – to control coordination abilities.

The research methods included theoretical analysis and generalization of scientific and methodical literature, pedagogical observations, testing, pedagogical experiment, and the methods of mathematical statistics.

RESULTS

The state of physical fitness of the students of the 1st – 4th years can be considered satisfactory in general (Tables I, II). The level of physical fitness of the female students of the 1st – 2nd years was better than that of male students. The students of the 3rd – 4th years were defined to have a tendency of changing results.

The satisfactory indicators of the students' physical fitness indicated not only the actual state of their physical fitness but also the shortcomings of the curriculum. The increase in the number of students with disabilities, the hard disease course, and the disease development for younger people were the reasons to lower the criteria for assessing some physical qualities. The control over the development of such important human qualities as general endurance and coordination skills was eliminated because the students were given an alternative choice of 4 test exercises in each semester out of 10 common and 8 variable control exercises. This implied that only the most effective type of control tests for each student was evaluated.

The analysis of the study results shows that a very low level of physical fitness was shown by 27.27 % of first-year students, 20.83 % of second-year students, 33.33 % of third-year students, and 25.00 % of fourth-year students.

Table III. The dynamics of the male students' physical fitness indicators after introducing the original program into the educational process ($\bar{X} \pm m$)

Tests	Groups	Initial data	Final data	Changes	Significance of differences	
					t	p
Cooper test – run-walk within 12 minutes (m)	EGm1	1278.46±59.16	1777.34±68.58	498.88	2.34	<0.05
	CGm1	1291.58±63.14	1512.07±66.72	220.49	1.68	>0.05
	EGm2	1421.31±67.78	2039.54±78.63	618.23	5.06	<0.001
	CGm2	1413.83±69.13	1799.25±72.34	385.42	2.19	<0.05
100 m run (s)	EGm1	17.91±1.11	16.21±0.97	1.70	2.89	<0.01
	CGm1	17.74±0.93	17.19±1.05	0.55	1.94	>0.05
	EGm2	16.93±1.08	15.46±1.13	1.47	2.47	<0.05
	CGm2	16.42±0.86	16.14±1.22	0.28	1.63	>0.05
Standing long jumps (cm)	EGm1	178.72±1.84	199.14±2.16	20.42	2.92	<0.01
	CGm1	181.40±1.67	187.43±1.77	6.03	1.83	>0.05
	EGm2	186.63±1.92	201.16±2.14	14.53	2.51	<0.05
	CGm2	187.85±1.87	189.64±1.65	1.79	1.49	>0.05
Pull-ups (reps)	EGm1	4.24±0.64	6.98±0.66	2.74	3.82	<0.001
	CGm1	4.71±0.57	4.92±0.54	0.21	1.64	>0.05
	EGm2	5.62±0.77	8.29±0.72	2.67	3.23	<0.01
	CGm2	5.80±0.82	5.95±0.76	0.15	1.57	>0.05
Sit-ups in 30 s (reps)	EGm1	11.36±0.95	21.63±1.67	10.27	4.23	<0.001
	CGm1	12.14±0.91	14.21±0.99	2.07	1.62	>0.05
	EGm2	13.62±0.85	23.87±1.48	10.25	4.17	<0.001
	CGm2	13.91±0.79	16.12±0.86	2.21	1.72	>0.05
Flamingo Balance Test (s)	EGm1	7.95±0.95	11.54±1.16	3.59	2.96	<0.01
	CGm1	8.15±0.66	8.59±0.84	0.44	1.85	>0.05
	EGm2	8.27±0.72	13.36±1.32	5.09	4.52	<0.001
	CGm2	8.33±0.63	9.41±0.81	1.08	1.83	>0.05
Bending forward standing on a bench (cm)	EGm1	11.14±0.43	13.77±0.87	2.63	2.56	<0.05
	CGm1	10.25±0.67	10.94±0.71	0.69	1.92	>0.05
	EGm2	10.02±0.56	14.52±0.86	4.50	3.24	<0.01
	CGm2	11.05±0.62	11.58±0.69	0.53	1.81	>0.05
Single-leg squats (reps)	EGm1	5.68±0.49	8.67±0.69	2.99	2.98	<0.01
	CGm1	5.45±0.56	5.94±0.60	0.49	1.79	>0.05
	EGm2	6.13±0.65	9.98±0.75	3.85	4.07	<0.001
	CGm2	5.24±0.51	6.29±0.58	1.05	1.96	>0.05

The students showed the best results during the exercise of standing long jumps. The largest number of female students who participated in the testing was observed among first- and second-year students depending on the type of tests, the smallest number – in all tests among fourth-year students. There was a noticeable tendency to decrease in the number of test participants from year to year for both males and females. Depending on the type of test, the percentage of the total number of students ranged from 18.69 % – 71.96 % (first year), 42.97 % – 74.38 % (second

year), 26.21 % – 40.00 % (third year), 20.00 % – 40.00 % (fourth year).

The analysis of the results of physical fitness shows that, first, fitness standards are not suitable for most students with disabilities, which necessitates a revision of the criteria for assessing physical fitness, taking into account individual capabilities, physical condition, and future professional requirements. Secondly, an urgent requirement today is the introduction of a differentiated approach when planning physical activity, taking into account the level of physical health of students.

Table IV. The dynamics of the female students' physical fitness indicators after introducing the original program into the educational process ($X \pm m$)

Tests	Groups	Initial data	Final data	Changes	Significance of differences	
					t	p
Cooper test – run-walk within 12 minutes (m)	EGf1	1128.42±56.14	1534.51±57.38	406.09	2.38	<0.05
	CGf1	1131.53±56.31	1366.49±58.37	234.96	1.64	>0.05
	EGf2	1250.28±57.86	1798.74±61.26	548.46	2.47	<0.05
	CGf2	1259.89±58.05	1484.63±59.23	224.74	1.53	>0.05
100 m run (s)	EGf1	20.53±0.83	18.96±0.68	1.57	2.31	<0.05
	CGf1	19.34±0.90	19.04±0.96	0.30	1.73	>0.05
	EGf2	19.07±0.89	18.72±0.86	0.35	1.79	>0.05
	CGf2	20.92±0.96	20.47±0.91	0.45	1.84	>0.05
Standing long jumps (cm)	EGf1	143.74±2.64	158.67±2.65	14.93	2.45	<0.05
	CGf1	148.91±2.14	149.32±2.53	0.41	1.34	>0.05
	EGf2	149.36±2.38	161.17±2.49	11.81	2.32	<0.05
	CGf2	152.29±2.71	153.65±2.68	1.36	1.89	>0.05
Push-ups on the knees (reps)	EGf1	21.34±1.45	26.67±1.58	5.33	2.65	<0.05
	CGf1	20.03±1.53	21.45±1.75	1.42	1.59	>0.05
	EGf2	22.64±1.67	27.93±1.84	5.29	2.48	<0.05
	CGf2	21.78±1.49	22.13±1.52	0.35	1.30	>0.05
Sit-ups in 30 s (reps)	EGf1	8.93±0.64	18.03±0.77	9.10	4.28	<0.001
	CGf1	9.44±0.78	11.21±0.69	1.77	1.87	>0.05
	EGf2	10.72±0.83	19.68±0.91	8.96	4.19	<0.001
	CGf2	11.60±0.72	13.24±0.82	1.64	1.72	>0.05
Flamingo Balance Test (s)	EGf1	7.95±0.95	12.65±0.86	4.70	2.87	<0.01
	CGf1	8.18±0.66	9.14±0.74	0.96	1.34	>0.05
	EGf2	7.80±0.72	13.53±0.93	5.73	2.98	<0.01
	CGf2	8.13±0.43	9.67±0.61	1.54	1.57	>0.05
Bending forward (cm)	EGf1	10.10±0.69	13.75±0.86	3.65	2.57	<0.05
	CGf1	10.50±0.73	10.89±0.74	0.39	1.24	>0.05
	EGf2	11.07 ± 0.79	14.36±0.97	3.29	2.43	<0.05
	CGf2	10.45 ± 0.81	11.25±0.67	0.80	1.46	>0.05
Arch hold (reps)	EGf1	14.23±0.93	18.83±1.23	4.60	2.67	<0.05
	CGf1	15.02±1.09	16.22±1.11	1.20	1.53	>0.05
	EGf2	16.13±1.03	21.43±1.27	5.30	2.96	<0.01
	CGf2	17.86±1.12	18.99±1.18	1.13	1.40	>0.05
Lunges (reps)	EGf1	12.34±0.94	16.43±1.04	4.09	2.52	<0.05
	CGf1	14.17±0.98	15.13±0.99	0.96	1.35	>0.05
	EGf2	13.56±0.87	18.74±1.17	5.18	2.93	<0.01
	CGf2	14.63±0.93	15.24±0.96	0.61	1.42	>0.05

In order to ensure the physical education efficiency of the students of HEI, we developed an original program of differentiating physical education classes for students, which takes into account their level of physical health and disease nosology.

There are means of physical education provided that meet the interests, needs, and individual capabilities of

students. In order to develop motor skills, we used physical exercises, which are basic in the curriculum: to develop general endurance – health walking and running, swimming, the elements of rhythmic gymnastics, dance, and step aerobics; to develop speed – running, swimming, sports games; to develop strength – exercises on gym-machines, with one's own weight, additional weights; to develop dex-

terity – moving games and the elements of sports games, shuttle running, and relay races; to develop flexibility – the elements of rhythmic gymnastics, aerobics, fitness, yoga.

The following tools were used in classes with students with disabilities: with the students of group A (with diseases of the musculoskeletal system): exercises of classical, dance and step aerobics, fitness, yoga, pilates, sports games; with the students of group B (with diseases of the cardiorespiratory system): healthy running, walking, general development exercises, the elements of classical aerobics, yoga, active games, the elements of respiratory gymnastics and autogenic training; with the students of group C (with diseases of the visual organs, kidneys, and other internal organs): healthy running, walking, general developmental exercises, moving games, dance aerobics, exercises on cardio gym-machines, fitness, yoga, stretching, breathing exercises.

The analysis of the students' physical fitness indicators, obtained in the process of formative pedagogical experiment, convincingly proved the high efficiency of the original program. In all eight tests on physical fitness, male students of the experimental groups significantly improved their performance (Table III).

There were significant changes in the results in the experimental groups. The most significant results were demonstrated by the EGm2 students in the Cooper test, sit-ups in 30 s, Flamingo Balance Test, single-leg squats ($p < 0.001$); the EGm1 students – in pull-ups ($p < 0.001$). The results of the experimental groups were also significantly improved in other tests ($p < 0.05$; $p < 0.01$). In the control groups, males improved the results in all tests, but the average indicators were significantly lower ($p > 0.05$). It should be noted that in EG1, CG1, both in the groups of males and females, there was a decrease in the number of subjects at the end of the experiment. Females from the experimental groups also significantly improved performance in all fitness tests, except for the results of EGf2 in the 100 m run. The best results in both EGf1 and EGf2 were achieved in sit-ups in 30 s ($p < 0.001$). The results in the Flamingo Balance Test also increased substantially ($p < 0.01$). In the control groups, females improved the results in all tests, but the average values were lower than the level of reliability ($p > 0.05$). In general, the performance of the female students of the control groups was significantly lower (Table IV).

This generally characterizes the increase in reserve capacity of the students' motor systems and reflects the efficiency of the presented original program and organizational approaches providing physical education.

DISCUSSION

The analysis of the students' health in the process of physical education and the dynamics of their physical fitness indicators during different years of study, showed that the quantitative composition of students belonging to a particular level of physical fitness, differs between authors, and, in general, it characterizes the low state of the physical fitness of students in Ukraine, especially females [13, 14].

It was proved that the most common diseases among first-year students of HEI are the diseases of the cardiovascular, digestive, and musculoskeletal systems. Some researchers propose to differentiate students on the nosological principle of diseases or combining several diseases [8, 11]. However, even in a subgroup with the same diagnoses, there are students with different physical fitness levels and general physical performance, which leads to inconsistency of activities with the functional capabilities. At the same time, many students have not only one but two or more diseases, which also creates difficulties in attributing them to a certain nosological subgroup. In practice, there are also organizational problems in conducting classes on the nosological principle. There is an approach to the individualization of the students' physical training based on the types of the physique, constitutional identification, including a special medical group. The problem of choosing the principles of forming groups of students with disabilities is solved by the writing team. There are six main approaches to forming groups distinguished: on a nosological basis; taking into account the level of physical fitness; based on the functional abilities; according to the contraindications to physical activity; based on an individual differentiated approach; paying attention to the gender. At the same time, scientists agree with other experts and recognize the most acceptable principle of forming groups is based on nosology.

CONCLUSIONS

1. The level of physical fitness of first-year students was assessed as "low" or "below the medium". A very low level of physical fitness was demonstrated by 27.27 % of the first-year male students, 20.83 % of the second-year male students, 33.33 % of the male third-year students, and 25.00 % of the male fourth-year students. Besides, 14.89 % of the first-year female students, 13.21 % of the second-year female students, 15.00 % of the third-year female students, 18.25 % of the fourth-year female students did not get to the assessment scale.
2. It was found that there was not significant difference between the indicators physical fitness and health of students of Ukraine and the Republic of Belarus ($p > 0.05$), which indicates that Belarusian students have problems similar to Ukrainian students in the system of physical education in the HEI.
3. The introduction of the original program of differentiating physical education classes in the students' physical education process, taking into account their level of physical health, nosology of the disease, the doctor's instructions had a positive effect on the students' physical fitness level. The largest increase in the indicators of physical fitness of female students was recorded in the following control tests: sit-ups ($p < 0.001$); Flamingo Balance Test ($p < 0.01$); the arch hold ($p < 0.01$); lunges ($p < 0.01$). For the male students these were sit-ups ($p < 0.001$); Flamingo Balance Test ($p < 0.001$); single-leg squats ($p < 0.001$); pull-ups ($p < 0.001$); standing long jumps ($p < 0.01$); the 100 m run ($p < 0.01$); the Cooper test ($p < 0.05$).

REFERENCES

1. Griban G., Lyakhova N., Tymoshenko O. et al. Current state of students' health and its improvement in the process of physical education. *Wiad. Lek.* 2020; 73(7): 1438-1447. doi: 10.36740/WLek202007124.
2. Prontenko K., Griban G., Dovgan N. et al. Students' health and its interrelation with physical fitness level. *Sport Mont.* 2019; 17(3): 41-46. doi: 10.26773/smj.191018.
3. Mozolev O., Bloschynskyi I., Aliksieiev O. et al. Influence of modern fitness technologies on the state of health and development of motor abilities of 17–19-year-old female students. *Journal of Physical Education and Sport.* 2019; 19(3): 917-924. doi:10.7752/jpes.2019.s3132.
4. Prontenko K., Bloschynskyi I., Griban, G. et al. Formation of readiness of future physical culture teachers for professional activity. *Universal Journal of Educational Research.* 2019; 7(9): 1860-1868. doi: 10.13189/ujer.2019.070903.
5. Griban G., Yavorska T., Tkachenko P. et al. Motor activity as the basis of a healthy lifestyle of student youth. *Wiad. Lek.* 2020; 73(6): 1199-1206. doi: 10.36740/WLek202006123.
6. Mozolev O., Halus O., Bloschynskyi I. et al. Human resources management of educational development in sphere of physical culture and sports in Ukraine: comparative analysis (1992–2016). *Journal of Physical Education and Sport.* 2019; 19(1): 185-192. doi:10.7752/jpes.2019.s1028.
7. Griban G., Kobernyk O., Terentieva N. et al. Formation of health and fitness competencies of students in the process of physical education. *Sport Mont.* 2020; 18 (3): 73-78. doi: 10.26773/smj.201008.
8. Prysiazhniuk S., Tolubko V., Oleniev D. et al. The influence of physical activities on biological age parameters of the first-year female students from the special medical department. *Journal of Physical Education and Sport.* 2018; 18(2): 561-564. doi:10.7752/jpes.2018.02081.
9. Zhamardiy V., Shkola O., Okhrimenko I. et al. Checking of the methodical system efficiency of fitness technologies application in students' physical education. *Wiad Lek.* 2020; 73 (2):332-341. doi: 10.36740/WLek202002125.
10. Prontenko K., Griban G., Alosyna A. et al. The physical development and functional state as the important components of the students' health. *Wiad. Lek.* 2019; 72(12a): 2348-2353. doi: 10.36740/WLek201912115.
11. Arefiev V., Tymoshenko O., Malechko T. et al. Methodology of differentiation of health-improving classes in physical education for primary school students. *International Journal of Applied Exercise Physiology.* 2020; 9(7): 134-143.
12. Griban G., Tymoshenko O., Arefiev V. et al. The role of physical education in improving the health status of students of special medical groups. *Wiad. Lek.* 2020; 73 (3): 534-540. doi: 10.36740/WLek202003125.
13. Prontenko K., Griban G., Bloschynskyi I. et al. Improvement of students' morpho-functional development and health in the process of sport-oriented physical education. *Wiad Lek.* 2020; 73(1): 161-168. doi: 10.36740/WLek202001131.
14. Makarov S., Stoyan N., Serheta I. et al. Peculiarities of the interaction of the indicators of psychophysiological adaptation of modern students in the context of the effective monitoring of individual health of young women and young men. *Wiad. Lek.* 2019; 72 (5a): 1053-1058.

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ORIGINAL ARTICLE

THE PRIORITY DIRECTIONS OF INTEGRATION OF OBSTETRICAL AND GYNECOLOGICAL CARE TO THE FEMALE POPULATION OF UKRAINE AT THE PRIMARY LEVEL

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ABSTRACT

The aim: To determine the priority directions for the integration of obstetric and gynecological care for the female population of Ukraine to the primary level of its provision.

Materials and methods: Sociological, statistical and bibliosemantic methods were used in the research. The systematic approach was the methodological basis of the study. 79 health care providers, 127 family doctors, 92 doctors of obstetrics and gynecology, and 248 women of reproductive age were interviewed as experts using a special questionnaire.

Results: Some priority management and organizational measures that need to be carried out for the effective integration of obstetric and gynecological care to the female population of Ukraine at the primary level of its provision were identified in the research. They include, first of all, the training of family physicians and family nurses to provide medical services to the female population and the coordination of primary care and specialized obstetric and gynecological services.

Conclusions: The priority of application of management and organizational measures for the effective integration of obstetric and gynecological care to the female population of Ukraine to the primary level of its provision was determined by an expert way.

KEY WORDS: obstetric and gynecological care, primary level, integration, priorities, expert determination

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INTRODUCTION

A comprehensive reform of the health care system [1-3] with the priority development of primary health care on the basis of general medical practice-family medicine [4,5] and the introduction of a fundamentally new system of financing health care facilities for medical care services within the package of free state guarantees [6] is carrying out in Ukraine. At the legislative level, it is determined that the responsibilities of family doctors include the provision of comprehensive obstetric and gynecological care to women [7]. At the same time, in the publications of recent years, it has been established that the primary care unit in Ukraine is not sufficiently prepared to provide women with this type of medical care [8]. All above mentioned determined the relevance of this study.

THE AIM

To determine the priority directions for the integration of obstetric and gynecological care for the female population of Ukraine to the primary level of its provision.

MATERIALS AND METHODS

Sociological, statistical and bibliosemantic methods were used in the research. The systematic approach was the

methodological basis of the study. 79 health care providers, 127 family doctors, 92 obstetrician-gynecologists, and 248 women as providers and consumers of obstetric-gynecological medical services were interviewed as experts by a special questionnaire. The competence of medical workers was determined by their highest and first attestation categories.

The results obtained in the study were processed using generally accepted statistical methods.

The application of these methods in the study was reviewed and approved by the committee on ethics of state higher educational institution «Uzhhorod National University» (protocol No. 3 of December 11, 2020).

RESULTS

At the beginning of the study, the approaches of primary health care activities of the obstetric and gynecological services were determined by an expert way. The results of the expert way are presented in table 1.

The following positions received the highest assessment from the experts: the preventive examinations to detect visual forms of malignant neoplasms in the early stages of development (100.0 % of health care providers, family doctors, obstetricians-gynecologists assessed this form of activity, women – 96.4 %), the complex information

Table I. The forms of activity of primary health and gynecological services care for the provision of obstetric and gynecological services (results of an expert assessment)

The forms of activity and types of medical services	Health care providers		Family doctors		Doctors obstetricians-gynecologists		Women	
	abs.	%	abs.	%	abs.	%	abs.	%
The complex information and educational activity among the female population on disease prevention and preservation of the reproductive health	74	93.7	125	98.4	92	100.0	240	96.8
An informational and educational activity among adolescent girls on safe sexual behavior and preservation of reproductive health	75	94.9	120	94.5	87	94.6	227	91.5
Educational work among parents of adolescent girls and teachers, informing them about the features of educational work during the puberty period	72	91.1	112	88.2	83	90.2	201	81.0
The conducting preventive examinations to detect visual forms of malignant neoplasms in the early stages of development	79	100.0	127	100.0	92	100.0	239	96.4
Providing family planning counseling services	70	88.6	120	94.5	87	94.6	217	87.5
The management of pregnant women with the physiological course of gestation	72	91.1	117	92.1	82	89.1	192	77.4
Organization of the School for Responsible Parenting	74	93.7	112	88.2	82	89.1	187	75.4
Medical monitoring of women in the postpartum period	72	91.1	117	92.1	82	89.1	192	77.4
The diagnosis and medical care for women with the most common gynecological diseases	70	88.6	109	85.8	83	90.2	194	78.2
The provision of counseling services for the prevention of sexually transmitted infections, their syndrome diagnosis and treatment	63	79.7	105	82.7	74	80.4	171	68.9
Providing emergency medical care in obstetrics and gynecology problems to women	75	94.9	125	98.4	88	95.7	201	81.0
The referral, if necessary, of women to receive specialized medical care at the highest levels	79	100.0	127	100.0	92	100.0	248	100.0

and educational activity among the female population on disease prevention and preservation of the reproductive health (93.7 %, 98.4 %, 100.0 % and 96.8 %, respectively), an informational and educational activity among adolescent girls on safe sexual behavior and preservation of reproductive health (94.9 %, 94.5 %, 94.6 %, 91.5 %, respectively), providing emergency medical care in obstetrics and gynecology problems to women (94.9 %, 98.4 %, 95.7 % and 81.0 % respectively), referral, if necessary, of women to receive specialized medical care at the highest levels (supported by all experts). At the same time, the following positions of obstetric and gynecological care at the primary level received the lowest assessment of experts: the provision of counseling services for the prevention of sexually transmitted infections, their syndrome diagnosis and treatment (79.7 %, 82.7 %, 80.4 %, 68.9 %), diagnosis and medical care for women with the most common gynecological diseases (88.6 %, 85.8 %, 90.2 %, 78.2 %, respectively).

The level of support by women for certain obstetric-gynecological services at the primary level was assessed by us as the level of their primary attachment to receive these services from the family doctors. According to the expert

survey, the level of commitment of women to receive certain obstetric and gynecological medical services from family doctors is not high.

The next step of the study was an expert assessment of the priority of management measures to ensure the effective integration of obstetric and gynecological care at the primary level. We divided the necessary management measures that need to be taken for the effective integration of obstetric and gynecological care at the primary level according to the levels of their adoption: sectoral, regional, territorial and local. The results of the expert assessment are presented in table 2.

The following management decisions had the highest assessment of experts: to approve the local motivational mechanisms for family doctors and family nurses at the level of territorial communities (100.0 % of health care providers and family doctors assessed this form of activity, obstetricians-gynecologists – 89.1 %, women – 92.7 %), to approve the rational routes for women with obstetric and gynecological pathology at the level of administrative territories (100.0 %, 96.8 %, 92.4 %, 92.7 % respectively), to improve the table of equipment of family outpatient clinics in accordance with

Table II. The priority of management measures to ensure the effective integration of obstetric and gynecological care at the primary level (results of an expert assessment)

The forms of activity and types of medical services	Health care providers		Family doctors		Doctors obstetricians-gynecologists		Women	
	abs.	%	abs.	%	abs.	%	abs.	%
At the level of territorial communities - to approve complex plans for the integration of obstetrical and gynecological care at the primary level.	73	92.4	122	96.1	81	88.0	216	87.1
At the level of public health centers - to prepare and spread among family doctors the methodological materials for conducting comprehensive informational and educational activity.	78	98.7	127	100.0	90	97.8	245	98.8
At the level of the Ministry of Health Ukraine - to improve the table of equipment of family outpatient clinics in accordance with the medical services in obstetrical and gynecological care	78	98.7	125	98.4	91	98.9	241	97.2
At the level of territorial communities - to approve local motivational mechanisms for family doctors and family nurses.	79	100.0	127	100.0	82	89.1	230	92.7
At the level of the Ministry of Health Ukraine - to approve the division of responsibilities between family doctors and family nurses for the provision of medical care to women.	72	91.1	115	90.6	84	91.3	225	90.7
At the level of administrative territories - to approve the rational routes for women with obstetric and gynecological pathology.	79	100.0	123	96.8	85	92.4	230	92.7
At the level of primary health care centers to approve plans-schedules for theoretical and practical training of family doctors and family nurses to provide the certain obstetrical and gynecological services.	74	93.7	125	98.4	90	97.8	238	95.9
At the level of higher medical establishments - to develop the educational programs in the universities to train family doctors and family nurses to provide comprehensive obstetric and gynecological services.	74	93.7	125	98.4	87	94.6	238	95.9
At the level of administrative territories - to approve the mechanisms of interaction between family doctors and specialized obstetric and gynecological services.	72	91.1	117	92.1	84	91.3	230	92.7

the medical services of obstetrical and gynecological care at the level of the Ministry of Health Ukraine (98.7 %, 98.4 %, 98.9 %, 97.2 % respectively), to approve complex plans for the integration of obstetrical and gynecological care at the primary level at the level of territorial communities (92.4 %, 96.1 %, 88.0 %, 87.1 %, respectively).

The necessity to develop educational programs in the universities to teach family doctors and family nurses to provide comprehensive obstetric and gynecological services and the approval of plans-schedules for theoretical and practical training of family doctors and family nurses at the level of primary health care centers to provide the certain obstetrical and gynecological services received the high level of the assessment by the experts.

The experts determined the prioritization of organizational measures to ensure the effective integration of obstetric and gynecological care at the primary level. The

results of which are demonstrated in table 3. It was found that all experts supported.

The necessity to provide family doctors with the methodological and visual materials for carrying out informative and educational activity among the female population and almost all experts supported the necessity to train family doctors and family nurses to conduct preventive examinations of women.

The priority of organizational activities as a teaching of the family doctors and family nurses to diagnose pregnancy, management of pregnant women and women in the postpartum period (94.9 % of the health care providers assessed this form of activity, family doctors and obstetricians-gynecologists – 100.0 % each, women – 81.0 %), as well as a training of the family doctors and family nurses to provide emergency medical care in obstetrics and gynecology to women (96.2%, 98.4%, 100.0%, 89.9%, respectively)

Table III. The priority of organizational measures to ensure the effective integration of obstetric and gynecological care at the primary level (results of an expert assessment, %±m)

The forms of activity and types of medical services	Health care providers		Family doctors		Doctors obstetricians-gynecologists		Women	
	abs.	%	abs.	%	abs.	%	abs.	%
A providing of family doctors with the methodological and visual materials for conducting informational and educational activity among the female population.	79	100.0	127	100.0	92	100.0	248	100.0
A providing of family doctors with the methodological and visual materials for educational activity among adolescent girls and their parents and teachers.	72	91.1	127	100.0	87	94.6	217	87.5
To develop a website for each family doctor with a specialized informative section for women.	75	94.9	120	94.5	85	92.4	207	83.5
A providing of the family outpatient clinics with medical supplies necessary for the provision of obstetric and gynecological services.	72	91.1	122	96.1	84	91.3	241	97.2
A formation of women's commitment to receive medical care from family doctors.	73	92.4	115	90.6	83	90.2	209	84.3
A preparing of the family doctors and family nurses for preventive examinations of women	79	100.0	127	100.0	92	100.0	231	93.1
A preparing of the family physicians and family nurses to provide family planning counseling services.	74	93.7	120	94.5	83	90.2	217	87.5
A preparing of the family doctors and family nurses to diagnose pregnancy, management of pregnant women and women in the postpartum period.	75	94.9	127	100.0	92	100.0	201	81.0
A preparing of the family doctors and family nurses to provide medical care to women with the most common gynecological diseases.	71	89.9	117	92.1	87	94.6	206	83.1
A preparing of the family doctors and family nurses to provide services for women with sexually transmitted infections, their diagnosis and treatment.	65	82,2	113	88,9	74	88,4	192	77,4
A training of the family doctors and family nurses to provide emergency medical care in obstetrics and gynecology to women.	76	96,2	125	98,4	92	100,0	223	89,9
The introduction of the mechanisms of interaction between the family doctors and specialized obstetric and gynecological services, including rational routes for women in the cases of the necessity of specialized medical care	77	97,5	127	100,0	90	97,8	244	98,4

and the introduction of the mechanisms of interaction between the family doctors and specialized obstetric and gynecological services, including rational routes for women in the cases of the necessity of specialized medical care (97.5 %, 100.0 %, 97.8 %, 98.4 %, respectively) received a high level of support from experts.

DISCUSSION

It was determined in our research a sufficiently high level of the support by providers of medical services of the activities of primary health care for the provision of obstetric and gynecological services, which indicates their readiness

to integrate the provision of obstetric and gynecological services to the level of primary health care. Thus, the level of support for the provision of certain services by healthcare providers ranges from 79.7-100.0 %, by family doctors within 82.7 -100.0 %, by obstetricians-gynecologists – 80.4-100 %. The level of support by women, as recipients of medical services, of individual services is lower, between 75.4-100.0%, which indicates an insufficient level of women's readiness to receive obstetric and gynecological medical care in family doctors.

In order to ensure the effective integration of obstetrical and gynecological services for their provision by family doctors, the experts have supported at different levels of

ranges the management and organizational measures, which indicates their possible impact on the integration process. At the same time, it is important that all experts support the priority of theoretical and practical training of the family doctors and family nurses for the comprehensive provision of medical services in obstetrics and gynecology and mechanisms for professional interaction between family doctors and specialized obstetric and gynecological services, including the development of the rational routes for women who need specialized obstetrical and gynecological care.

CONCLUSIONS

It was determined by an expert way the priority of application of management and organizational measures, which must be provided at the all levels of government from the level of united communities to the Ministry of Health of Ukraine, for the effective integration of obstetric and gynecological care to the female population of Ukraine to the primary level of its provision. At the same time, it is ought to pay attention of health care providers to the necessity for the activity on the formation of women's commitment to receive obstetric and gynecological medical services from family doctors.

REFERENCES

1. Anishchenko O.V., Moiseienko R.O., Tolstanov O.K. Pozytyvnyi dosvid reformuvannya haluzi okhorony zdorovia rehioniv [Positive experience of reforming the health care of the regions]. Kyiv. 2011. (in Ukrainian).
2. Popchenko T.P. Reformuvannya sfery okhorony zdorovia Ukrainy: orhanizatsiine, normatyvno-pravove ta nansovo-ekonomichne zabezpechennia (analytychna dopovid) [Healthcare Reform in Ukraine: Organizational, Regulatory, Legal and Financial Support (Analytical Report)]. Kyiv. 2011. (in Ukrainian).
3. Potseluev V.I. Obhruntuvannya systemy monitorynhu yakosti ta dostupnosti medychnoi dopomohy v zakladakh simenoi medytsyny (na prykladi silskoho naseleennia Sumskoi oblasti) [Substantiation of the system of monitoring the quality and availability of medical care in family medicine institutions (on the example of the rural population of Sumy region)]. Extended abstract of Candidate's thesis. Kyiv, P. Shupyk National Medical Academy of Postgraduate Education. 2014. (in Ukrainian).
4. Ordynskiy V.A. Medyko-sotsialne obhruntuvannya modeli pervynnoi medyko-sanitarnoi dopomohy silskomu naseleenniui na rivni administratyvnoho raionu [Medical and social substantiation of the model of primary health care for rural population at the level of the administrative district]. Extended abstract of Candidate's thesis. Kyiv, P. L. Shupyk National Medical Academy of Postgraduate Education. 2015. (in Ukrainian).
5. Musii O.S. et al. Shchorichna dopovid pro stan zdorovia naseleennia, sanitarno-epidemichnu sytuatsiiu ta rezultaty diialnosti systemy okhorony zdorovia Ukrainy. 2013 rik [Annual report on the state of health of the population, the sanitary-epidemic situation and the results of activity of the health care system of Ukraine. 2013]. Kyiv. 2014. (in Ukrainian).
6. Zakon Ukrainy „Pro derzhavni nansovi harantii medychnoho obsluhovuvannya naseleennia“ № 2168-VIII [Law of Ukraine “On State Financial Guarantees of Public Health Services” October 19, 2017 № 2168-VIII]. http://search.ligazakon.ua/l_doc2.nsf/link1/T172168.html. (in Ukrainian).
7. Nakaz MOZ Ukrainy vid 19.03.2018 №504 «Pro zatverdzhennia Poriadku nadannia pervynnoi medychnoi dopomohy». <https://moz.gov.ua/article/ministry-mandates/nakaz-moz-ukraini-vid-19032018-504-pro-zatverdzhennja-porjadku-nadannja-pervynnoi-medichnoi-dopomogi>. (In Ukrainian).
8. Shcherbynska O.S., Slabkyi H.O. Nadannia likariamy zahalnoi praktyky – simeinymy likariamy akusherskohinekologichnoi dopomohy ta kharakterystyka vzaiemoziazku pervynnoi lanky z akusherskohinekologichnymy sluzhbamy [Provision of general practitioners by obstetric and gynecological family physicians and characterization of primary link with obstetric/gynecological services]. Simeina medytsyna – Family Medicine. 2019; 3: 63-67. (in Ukrainian).

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ORIGINAL ARTICLE

MEDICO – SOCIAL SUBSTANTIATION OF THE CONCEPT OF PERSONALIZED MEDICINE IN THE PREVENTION OF ARTERIAL HYPERTENSION AMONG THE ADULT POPULATION AT THE REGIONAL LEVEL

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ABSTRACT

The aim: Is to scientifically substantiate the concept of personalized medicine in the prevention of arterial hypertension (AH) among the adult population at the regional level.

Materials and methods: The study, after obtaining informed consent, involved 2000 patients, residents of Zaporizhzhia Region, including 1000 patients (average age 59 ± 0.5 years, the ratio of men to women 1:1.22 people) with and 1000 patients (average age of whom is 62 ± 0.7 years, the ratio of men to women is 1:1.1) without AH. The data of the sociological survey were processed, the methods of mathematical modeling, statistical, system analysis were applied. Odds ratio (OR) is determined by generally accepted methods with the calculation of 95% of confidence interval (CI).

Results: The application of the concept of personalized medicine in the prevention of AH among the adult population has been scientifically substantiated by studying the associations between medical and social risk factors and the development of AH and determining on their basis 3 modules – "risk behavior", "adverse health factors" and "social determinants of the development of AH", based on stepwise multiple logistic regression analysis.

Conclusions: It has been proved that the use of the final prognostic model of the development of arterial hypertension with the inclusion of the most significant risk factors has high operational characteristics: sensitivity – 78.6%, specificity – 96.6%, positive predicative value – 95.85%, negative predicative value – 81.86%, the area under the ROC curve is 0.9623. The application of the concept of personalized medicine in the prevention of this disease among the adult population was substantiated by studying the associations between medical and social risk factors and the development of arterial hypertension.

KEY WORDS: risk factors, arterial hypertension, personalized medicine

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INTRODUCTION

The profile of risk factors (RFs) among different segments of the population may differ, which justifies the need to develop a system for the prevention of arterial hypertension (AH) for each individual with the determination of individual RFs. In this aspect it is interesting the theory of ideal cardiovascular health [1-6], which shifts the priorities for determining the RFs of the development of circulatory system diseases (CSD) to health factors of the cardiovascular system (CVS), in particular, the concept "risky" behavior that increases the likelihood of developing CVD and stroke, or conditions that lead to their development, such as hypertension, dyslipidemia and diabetes, are changed to "healthy" behavior.

Currently, the definition of "ideal cardiovascular health" is well known and is characterized by the simultaneous presence of 4 criteria for "healthy" behavior: abstaining from smoking during the last year, ideal body mass index [$<25 \text{ kg/m}^2$], recommended physical activity, consumption an appropriate set of products that prevent the development

of CVD and 3 favorable health factors: total cholesterol $<200 \text{ mg / or } (4.5 \text{ mmol/l})$, blood pressure $<120/<80 \text{ mm Hg}$, the absence of diabetes mellitus and clinical manifestations of CSD, including coronary heart disease (CHD), stroke, heart failure, etc. [7, 8, 9].

THE AIM

The aim of the work is to scientifically substantiate the concept of personalized medicine in the prevention of arterial hypertension among the adult population at the regional level.

MATERIALS AND METHODS

Methods of mathematical modeling, statistical, system analysis were used. In the course of the study, the need to implement the concept of personalized medicine into the system of primary and secondary prevention of arterial hypertension was substantiated by studying and identifying

Table I. Associations between risk factors and the development of hypertension among the adult population, n (%)

Risk factors	Individuals with AH n=1000	Individuals without AH n=1000	OR (95% CI)	p
Social status – employee	878 (87.8)	740 (74.0)	2.53 (1.99–3.205)	<0.001
Low level of education	423 (42.3)	234 (23.4)	2.39 (1.97–2.91)	<0.0001
Salary < 1900 UAH	664 (66.4)	342 (34.2)	3.80 (3.15–4.57)	<0.0001
Poor living standards	670 (67.0)	453 (45.3)	2.45 (2.04–2.94)	<0.0001
Stress-related profession	320 (32.0)	320 (32)	1.00 (0.83–1.21)	1.00
Unemployed	122	68	1.9 (1.38–2.64)	<0.0001
Loneliness	264 (26.4)	265 (26.5)	0.99 (0.82–1.21)	0.960
Low average income	670 (67.0)	132 (13.20)	13.35 (10.65–16.73)	<0.0001
Lack of healthcare facility at the place of residence	116 (11.60)	320 (32.0)	0.29 (0.22–0.35)	<0.0001
Salt intake > 5 g per day	524 (52.4)	64 (6.4)	16.09 (12.14–21.34)	<0.0001
Excessive consumption of fatty meats, fish daily	423 (42.3)	342 (34.2)	1.41 (1.18–1.69)	<0.0001
Insufficient consumption of vegetables and fruits	854 (86.4)	245 (24.5)	18.02 (14.36–22.62)	<0.0001
Level of glucose in blood >6.0 mmol/L	158 (15.8)	66 (6.6)	2.65 (1.96–3.59)	<0.0001
Cholesterol level > 4.5 mmol/L	363 (36.3)	152 (15.2)	3.18 (2.56–3.94)	<0.0001

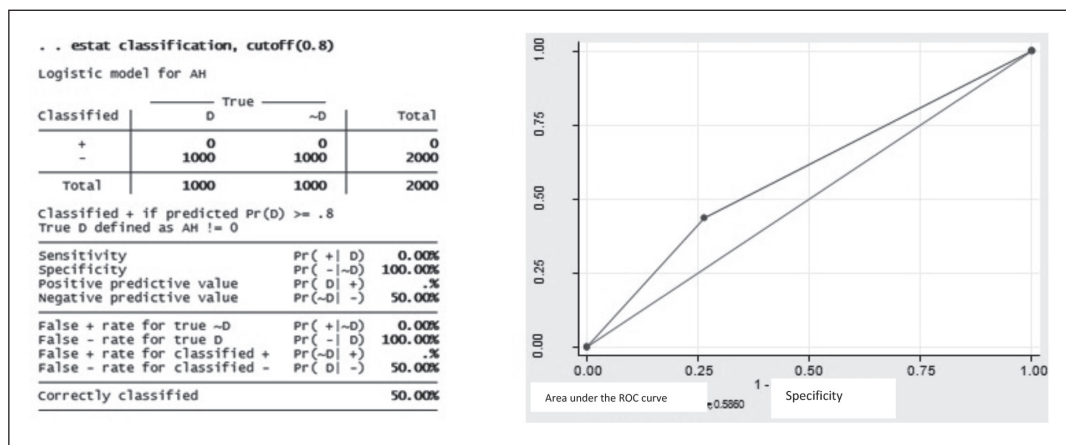


Fig. 1. Operational characteristics of the predictive model, which includes 1 risk factor – lack of physical activity and the ROC-curve of the predictive model, containing 1 risk factor – lack of physical activity

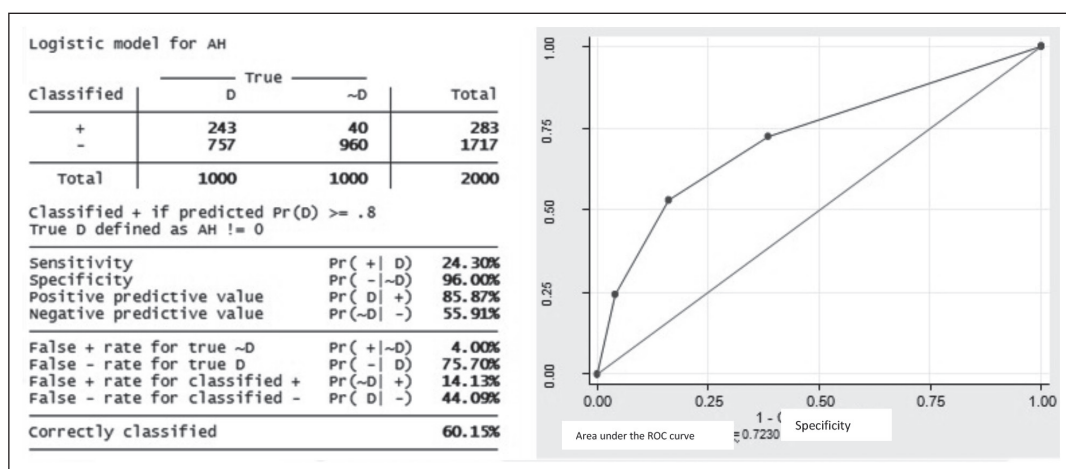


Fig. 2. Operational characteristics of the predictive model, which includes 2 risk factors – lack of physical activity and overweight and the ROC curve of the predictive model, which contains 2 risk factors – lack of physical activity and overweight

the most significant factors that are reliably associated with the development of the disease and developing clinical prognostic models of arterial hypertension with the calculation of operational characteristics and the construction of ROC curves.

For this, a prospective cohort study was carried out, which included 1000 patients with arterial hypertension treated in the 9th City Hospital of the Zaporizhzhia (average age 59±0.5 years, the ratio of men to women 1:1.22 people) and 1000 people without arterial hypertension (average age of whom

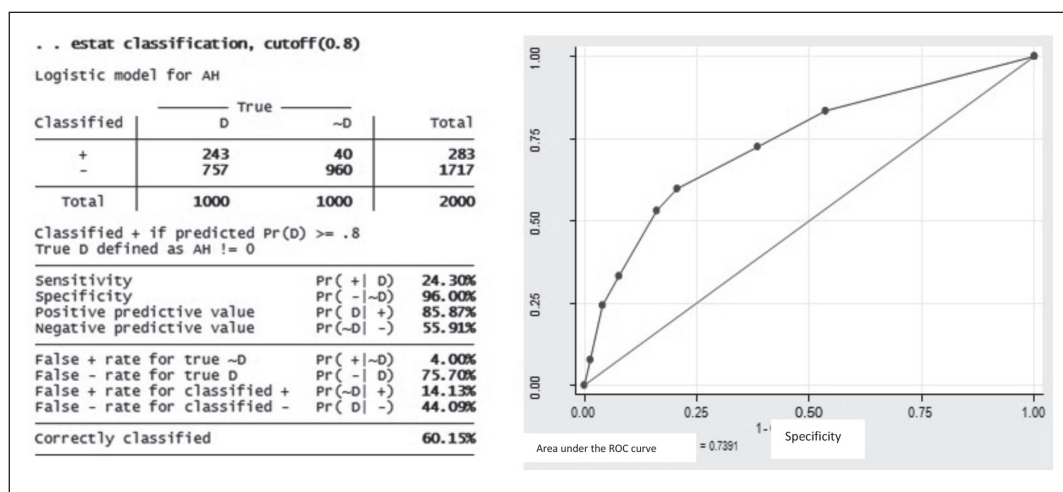


Fig. 3. The operational characteristics of the predictive model, which includes 3 risk factors – lack of physical activity, overweight and smoking, and the ROC curve of the predictive model, contains 3 risk factors – lack of physical activity, overweight and smoking

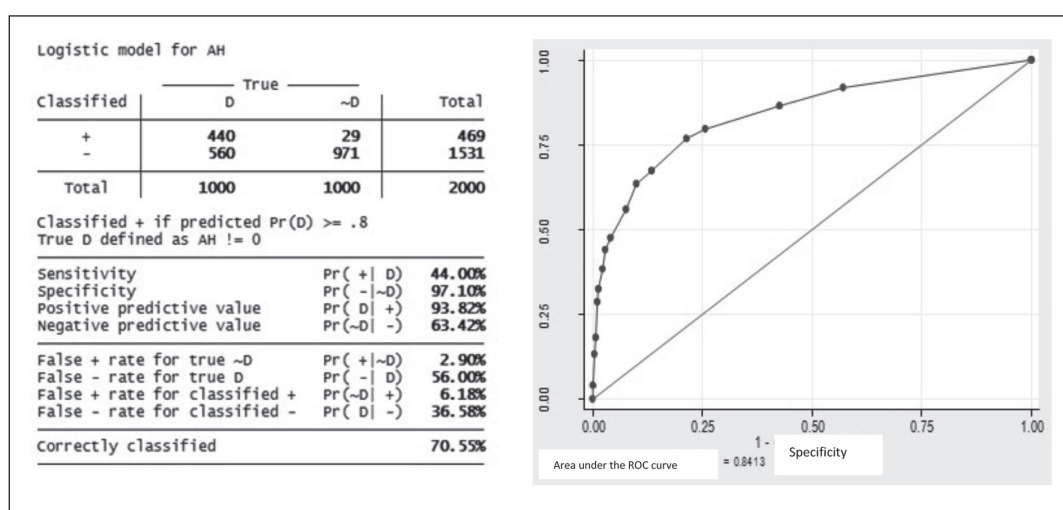


Fig. 4. Operational characteristics of the predictive model, which includes 4 risk factors – lack of physical activity, overweight, smoking and excessive salt intake and the ROC curve of the predictive model containing 4 risk factors – lack of physical activity, overweight, smoking and excessive salt intake

is 62±0.7 years, the ratio of men to women is 1:1.1). In total, 20 prognostic variables were considered, probably associated with the development of arterial hypertension. The identified risk factors were significantly associated with the development of arterial hypertension in simple logistic regression analysis, were subjected to multiple logistic regression analysis to identify reliable risk factors, which later became the basis for the development of an algorithm for identifying high-risk patients. The generally accepted methods were used to determine the odds ratio (OR) based on the 95 % confidence interval (CI).

RESULTS

The initial stage of the study was to study the association between RFs and the development of AH in the adult population. It was found that the development of AH among the population of the Zaporizhzhia region is most affected by a burdened family history, therefore, such a criterion as the absence of CSD in close relatives was necessarily added to the favorable health factors.

The definition “Ideal cardiovascular health” as a separate module includes the social determinants of health – a satisfactory standard of living, which implies an adequate average standard of living and a decent salary.

According to the experts of the World Health Organization, the morbidity and mortality rates from CSD are influenced by: low standard of living of the population; associated unemployment, stress, alcoholism; lack of motivation among the population to be healthy; lack of motivation among medical workers to work efficiently, low level of material and technical base of health care, insufficient funding of the industry [3].

In our study, among the surveyed respondents without AH in the surveyed cohort (1000 persons without AH), only 56 people had ideal cardiovascular health (Table 1). According to the data, the prognostic model of the development of AH includes the criteria of all 3 modules: “crisis behavior”, “adverse health factors” and “social determinants of the development of AH”.

To determine the risk of the development of AH in an individual with the cumulative effect of several factors, a stepwise multiple logistic regression method based on risk calculations is used, combining and integrating premorbid conditions, accessible and minimally intrusive demographic and medical criteria that are easily understood by individuals and are available in medical institutions. The first predictive model, which includes only one RF – lack of physical activity, has low operational characteristics (Fig. 1).

Table II. Clinical prognostic models for the development of AH in the adult population

Prognostic changes	β	m	OR	95% CI	p	Area under the ROC curve	% of area increase
<i>“Risky behavior”</i>							
Lack of physical activity	0.768	0.095	2.15	1.78-2.60	<0.001	0.5860	
Overweight	1.76	0.108	5.83	4.72-7.21	<0.001	0.723	23.4
Smoking	0.51	0.109	1.68	1.35-2.08	<0.001	0.739	2.2
Salt abuse	2.73	0.152	15.42	11.44-20.78	<0.001	0.8413	13.8
<i>«Unfavorable health»</i>							
Family history of hypertension	3.91	0.18	50.01	35.10-71.24	<0.001	0.9439	12.2
High cholesterol level	0.76	0.18	2.14	1.49-3.08	<0.001	0.946	0.2
High glucose level	0.79	0.25	2.20	1.34-3.59	0.002	0.9478	0.2
<i>«Social determinants of the development of AH»</i>							
Low income	2.63	0.187	13.87	9.61-20.04	<0.001	0.9674	2.1

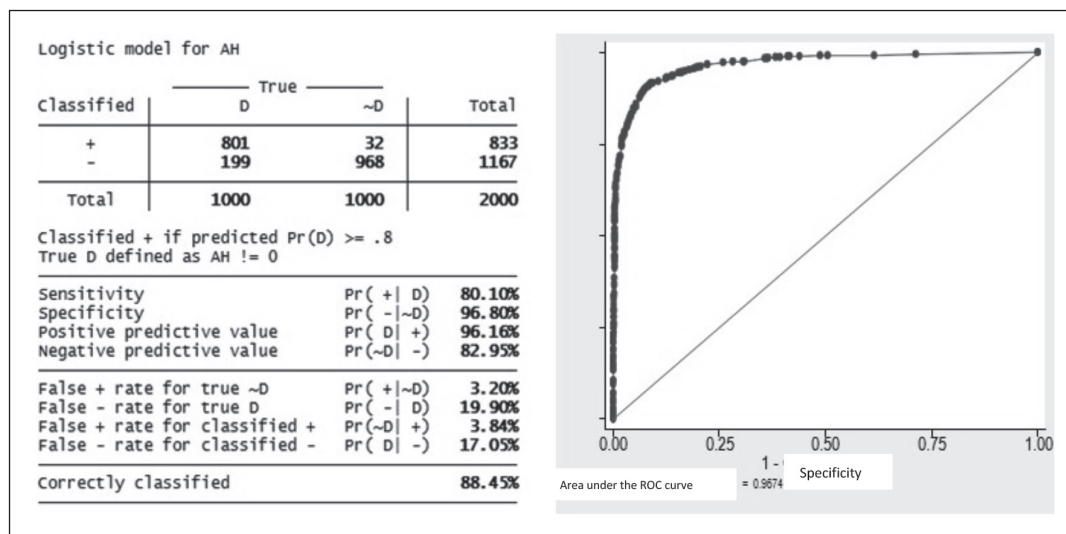


Fig. 5. Operational characteristics of the predictive model, which includes 8 risk factors and the ROC curve of the predictive model, which contains 8 risk factors

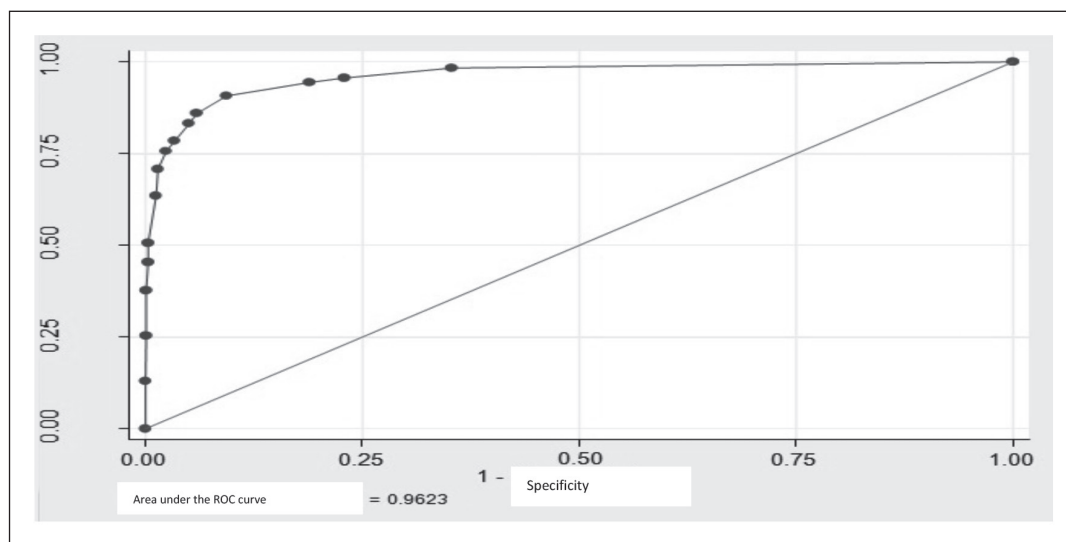


Fig. 6. Predictive model of the development of AH in the adult population

The addition of the following RF – overweight – has a significant effect on the development of AH such a factor as lack of physical activity, and somewhat in-

creases the operational characteristics of the model, in particular, the area under the ROC-curve increases by 23.4 % (Fig. 2).

The addition of a third RF from the module “risky behavior” to the predictive model – smoking – increases the model’s characteristics by only 2.2%, but RF – excessive salt intake – by 13.8%, leaving all previous RFs significant (Fig. 3).

Thus, in multiple logistic regression analysis, all of the above RFs of the “risky behavior” module are reliably associated with the development of AH. But overweight and excessive salt intake have the greatest influence on the development of AH. The inclusion of all 4 risk factors from the “risky behavior” module significantly increases the area under the ROC curve, indicating high predictive characteristics of such a model (Fig. 4).

The next RFs added to the predictive model are factors from the module “adverse health factors”. According to the data of the table 2, the addition of such RF as family history of hypertension significantly increases the characteristics of the model, and the area under the ROC curve increases immediately by 12.2% – from 0.8413 to 0.9439.

However, adding “high glucose level” or “high cholesterol level” to the RFs model increases the predictive value of the model by only 0.2 %. Thus, it is the RF of the “risky behavior” module and the burdened heredity that are most often associated with the development of AH, and the appointment of additional research methods does not increase the predictive power of the model. From the module “social determinants of the development of AH”, only one RF is included – low income, of all the factors of the indicated module, it has the highest OR of the development of AH (OR – 13.35). At the same time, the operational characteristics of the predictive model, which includes 8 risk factors, increase by 2.1 % (Fig. 5).

Thus, the additional inclusion of other risk factors in the model only complicates the calculations but does not improve forecasting. Therefore, our final model includes the RFs most associated with the development of AH: overweight, high dietary salt intake, family history of hypertension and low income, that is, factors that can be determined by direct conversation with the patient, or factors that each individual can determine in himself directly. The predictive model, which includes only the above factors, has high operational characteristics: sensitivity – 78.6 %, specificity – 96.6 %, positive predictive value – 95.85 %, negative predictive value – 81.86 %, area under the ROC curve – 0.9623, which is only 0.0051 less than the predictive model, which includes 8 RFs (Fig. 6).

Thus, when planning a prevention system, it is of paramount importance to determine whether an individual patient has RF from the “crisis behavior” module, and the developed measures should be aimed at modifying the existing RFs.

DISCUSSION

Our study showed that prevention of AH should be based on finding out whether patients have RF of 3 key modules:

- “healthy behavior” – abstinence from smoking during the last year, ideal body mass index [$<25 \text{ kg/m}^2$],

recommended physical activity, consumption of an appropriate set of foods that prevent the development of CVD;

- “favorable health factors” – total cholesterol $<200 \text{ mg}$ for (4.5 mmol/l), blood pressure $<120/<80 \text{ mm Hg}$, absence of diabetes mellitus and clinical CSD (including CHD, stroke, heart failure, etc.);
- “social determinants of health” – low level of education, low average income, incl. wages $<1900 \text{ UAH}$, poor living standards, associated unemployment, stress, alcoholism, lack of motivation among the population to be healthy, lack of health care facilities at the place of residence.

Therefore, the system of prevention of AH should be aimed not only at each individual, who has his own individual differences in genes, in the way of life, but also at the population as a whole, which forms his environment. In this aspect, it is the concept of personalized medicine (Precision medicine) that is the tool that will allow influencing each individual in the population [2, 9]. In early 2015, the concept of personalized medicine was defined as one of the strategic directions of fundamental research by the US National Institutes of Health, the goal of which is to ensure the health of an individual and increase his life expectancy through the use of preventive or therapeutic measures taking into account individual differences in the genes, environment and lifestyle of the patient. The theory of “ideal cardiovascular health” (American Heart Association Strategic Planning Task Force, 2015), which in recent years has been widely spread in the developed countries of the world, closely intersects with this concept. This theory is based on basic concepts related to the field of health improvement and disease prevention:

1. the importance of primary (primordial) prevention;
2. the presence of evidences that CSD and RFs of their occurrence often develop at an early age;
3. the need for an appropriate balance between approaches to health improvement and disease prevention at the population and individual levels in high-risk individuals, ie focusing on RFs prevention at all levels is paramount, and avoiding adverse RFs levels may be the most effective means of preventing development of the disease throughout life.

Family doctors should make a significant contribution to personalized medicine. The family doctor should take part in the formation of a specific family education program, focused on the tendency of family members to follow the rules of a healthy lifestyle and the prevention of alimentary dependent diseases. The patient should be offered specific health-improving measures, including more often non-pharmacological, stimulating natural mechanisms of repair: the regime of the day and rest, physical exercises, proper nutrition. The patient can receive consultations and assistance in their implementation on the basis of multimodular participation from various public health services, including specialists in food technology, physical culture, tourism, ecology, agrochemistry, etc.

CONCLUSIONS

It is proved that the application of the final prognostic model of the development of AH with the inclusion of the most significant risk factors has high operational characteristics: sensitivity – 78.6 %, specificity – 96.6 %, positive predicative value – 95.85 %, negative predictive value – 81.86 %, the area under the ROC curve – 0.9623. The application of the concept of personalized medicine in the prevention of arterial hypertension among the adult population by studying the associations between medical and social risk factors and the development of arterial hypertension is substantiated.

REFERENCES

- Williams B., Mancia G., Spiering W. et al. 2018 ESC/ESH Guidelines for the management of arterial hypertension [published correction appears in Eur Heart J. Eur Heart J. 2018; 39(33): 3021-3104. doi:10.1093/eurheartj/ehy339.
- NCD Risk Factor Collaboration. Worldwide trends in blood pressure from 1975 to 2015: a pooled analysis of 1479 population-based measurement studies with 19.1 million participants. Lancet. 2017; 389: 37-55.
- Piepoli M.F., Hoes A.W., Agewall S. et al. ESC Scientific Document Group. 2016 European Guidelines on cardiovascular disease prevention in clinical practice: The Sixth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of 10 societies and by invited experts) Developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EACPR). Eur. Heart J. 2016; 37: 2315-2381.
- Tiffe T., Wagner M., Rucker V. et al. Control of cardiovascular risk factors and its determinants in the general population – findings from the STAAB cohort study. BMC Cardiovasc. Disord. 2017; 17: 276.
- Gupta P., Patel P., Strauch B. et al. Biochemical screening for nonadherence is associated with blood pressure reduction and improvement in adherence. Hypertension. 2017; 70: 1042-1048.
- Dedov I.I. Personalized Medicine. – Annals of the Russian Academy of Medical Sciences. 2019; 74(1):61–70.
- Report of the USA President's Council of Advisors on Science and Technology. Priorities for Personalized Medicine. 2008 . <http://oncotherapy.us/pdf/PM.Priorities.pdf>.
- Terkola R., Antoñanzas F., Postma M. Economic evaluation of personalized medicine: a call for real-world data. Eur J Health Econ. 2017; 18(9):1065–1067. doi: 10.1007/s10198-017-0890-x.
- Kolpachkova E.V., Sokolova A.A., Napalkov D.A. Personalized medicine in cardiology: state, problems and prospects. Meditsinskiy sovet [Medical Council]. 2017; 12: 162-168. (In Russian). <https://doi.org/10.21518/2079-701X-2017-12-162-168>

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ORIGINAL ARTICLE

HEALTH OF THE ELDERLY PEOPLE AS THE BASIS FOR FORMATION OF MEDICAL AND SOCIAL NEEDS

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ABSTRACT

The aim: The identification and determination of needs that the population of older age groups have in medical and social services on the basis of health data and the results of a survey.

Material and methods: Because of bibliographic, epidemiological, medical-statistical, analytical methods the research has investigated the problems of healthy aging, tendencies in population health of the population of Ukraine of senior age groups during 2000-2017, features and tendencies of health of a sample contingent of urban population of elderly age according to appeals in health care facilities during 2009-2019. The use of the sociological method, the self-evaluation of elderly people of their own health, characteristics of lifestyle and medical activity are determined, the needs of older people in medical and social services were assessed.

Results: Negative tendencies to increase during 2000-2017 the prevalence of pathology among the population older than working age by 22.8%, including blood diseases in 2 times, endocrine system – in 1.8 times, urogenital system – by 1.5 times, digestive organs – by 1.4 times, tumors and nervous system – by 1.3 times. Among the urban elderly population, the prevalence of sensory diseases, including ear and eye diseases, endocrine disorders, injuries and poisonings, has increased, and mental health indicators have deteriorated.

The sociological survey found a low level of self-esteem (31.5±3.5 per 100 had health problems, 10.1±2.3 are significant). Self-medication was practiced by 76.4±3.2 per 100 respondents, 74.2±3.3 were not followed or they violated the doctor's recommendations. 56.2±3.7 per 100 respondents had physical examinations in the non-right time 29.7±3.4 had not it.

There was a significant prevalence of risk factors, including hypodynamics (21.9±3.1 per 100), tobacco use (29.8±3.4), malnutrition (37.1±3.6), overweight (obesity) (32, 6±3.5), arterial hypertension (37.6±3.6), hypercholesterolemia (28.7±3.4), glucosemia 16.3±2.8).

The research has discovered the needs of older people in health care and social services, inter alia in preventive counseling (65.2±3.6 per 100), the introduction of electronic technologies in health care (68.5±3.5), information educational services on health issues (67.4±3.5), provision of services in hospitals at home (66.3±3.5), in increasing the availability of rehabilitation (43.8±3.7), specialized counseling (34.3±3.6) and emergency medical care (16.2±2.8), improvement of socio-economic determinants (78.0±3.1), introduction of activities (48.3±3.7), joint training programs for older people (42.1±3.7), the development of certain skills, the use of technical means, assistive devices (67.4±3.5), the formation of a conducive to better health environment (58, 4±3.7).

Conclusions: The low level of the elderly people's health, the tendency to increase the burden of disease, the prevalence of risk factors for disease and low medical activity lead to significant needs for medical and social services of preventive, treatment-diagnostic, rehabilitation, improving socio-economic determinants, measures to reduce social isolation.

KEY WORDS: health, aging, older people, morbidity (incidence), mortality, need for services, health care, social protection

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INTRODUCTION

Monitoring population health indicators at the global and regional levels shows that it is improving in many countries around the world, as well as reducing some health inequalities between countries. Progress has been made through the implementation of World Health Organization's (WHO's) recommended strategies and the implementation of national action plans to reduce the burden of disease, improve health and its determinants, and reduce health risks [1-3].

One of the important indicators of progress in health policy is the average life expectancy, which tends to increase. This process is accompanied by accelerating the aging of the population and increasing the share of the

population of older age groups in the age structure of the population. Forecast data indicate an increase in the number of people aged 60 and over from 1 billion in 2019 to 1.4 billion in 2030 and 2.1 billion in 2050 and their share in the total population structure from 12% to 22%. Aging is characterized by an unprecedented high rate, especially in developing countries [4-5].

The European Region is one of the WHO regions where the aging process is particularly pronounced. The European health report 2018 shows that most countries in the Region have made considerable progress in implementation of the key policy targets of "Health 2020". They lay the foundation for the tasks which the Agenda Today for Sustainable Development in the

2030 set out. Demographic trends show a significant increase in life expectancy in Europe, a reduction in premature mortality and an improvement in quality of life. It is noted that in the WHO European Region over the past five years, life expectancy has increased by more than 1 year, and all-cause mortality has decreased by 25% over the past 15 years. At the same time, there are significant differences in life expectancy between individual countries, which reach 11.5 years [6].

The rate of population aging in Europe predicts a doubling of the number of people aged 65 and over in 2010-2050, and a population of 85 and older from 14 million to 40 million. The proportion of people aged 65 and over will increase for the specified period from 14% to 25% [7-8].

Ukraine is one of the European countries with a rapidly aging population. Since 1990, the proportion of people over 60 in the age structure of the population has increased from 18.3% to 20.4% in 2000 and 23.9% in 2020. The proportion of people over 65 has increased from 12.0% to 13.6 and 17.1%, respectively [9-12].

Taking into account the demographic context, it is important not only to prolong life expectancy, but also to ensure its proper quality. It is known that the older contingents of the population often have low health indicators due to insufficient living standards, lack of opportunities to maintain a healthy lifestyle, low availability of health and social services, etc. [13-14].

Global demographic changes and the epidemiological context in many countries of the world necessitate the adaptation of state, regional and sectoral policies to the real needs of the population to ensure healthy living conditions, the building a framework for healthy aging. It involves the development and maintenance of the functional capabilities of the elderly, for their well living. Ensuring healthy aging requires reforming many sectors, especially health, social security, science and education, transport, housing, food industry, urban planning, and so on [15].

Drawing attention to the acceleration of population ageing of the world and the prominence of the demographic transition, the world community is launching the Decade of Healthy Aging (2020-2030), which provides for coordinated global action to improve the lives of older people, their families and the local communities or societies where they live [8].

A lot of people do not even have access to the basic resources needed for a full and decent life. Others face numerous obstacles that prevent them from fully participation in society.

The aim of the transformation should be to create more comfortable conditions for the elderly, to support, preserve and strengthen their health. This requires monitoring and assessing the health of older people and identifying the needs of older people in the services of the health and social security (welfare) sector [16].

THE AIM

The aim was the identification of needs the older age groups' population in medical and social services on the basis of health data and the results of a sociological survey.

MATERIALS AND METHODS

Bibliographic, epidemiological, medical-statistical, sociological, analytical methods are used in the study. The data of the Center for Medical Statistics of the Ministry of Healthcare of Ukraine for 2000-2017 are analyzed, the proportions of a disease of the population older than working age is studied, the trends in the population health of the population of older age groups' in Ukraine are revealed. The information from the accounting statistical data of patients of Kyiv health care facilities has copied and the peculiarities and tendencies of health of the sample contingent of the elderly urban population were determined according to the appeals to health institutions during 2009-2019. An anonymous questionnaire of 178 patients of health institutions using sociological survey was made. A quarter of respondents were aged 55-59 years old, over 40% – 60-64 years, a one-third – 65 years and older for a sample-based survey. The gender distribution corresponded to a similar one in the population of the older age groups, where 65% were female and 35% were male. 67.0% had the status of a pensioner, but 62.4% of them worked. According to educational qualifications, 39.0% of respondents had a higher level of education, 12.0% – an incomplete higher education, 23.0% – a specialized secondary education, 22.0% – general secondary education. Because of sociological survey as the base the research has determined the self-evaluation of elderly people of their own health, characteristics of lifestyle and medical activity, assessed the needs of older people in medical and social services.

RESULTS

Analysis of the data by the Center for Medical Statistics of the Ministry of Healthcare of Ukraine in 2000-2017 revealed that in general the incidence of the population over working age decreased over the period by 8.0% and reached 44,000.6 cases per 100,000 of the population. Despite the reduced scale in primary morbidity in most classes of diseases, the incidence of diseases of the endocrine system increased by 57.8%, diseases of the blood and blood circulation organs – by 34.1%, diseases of the nervous system – by 20.5%, diseases of the urogenital system – by 7.7%.

The base of the structure of morbidity of older persons in 2017 were respiratory diseases (26.1%), diseases of the circulatory system (17.9%), diseases of the eye and its appendages (adnexa) (8.8%), diseases of the musculoskeletal system and connective tissue (7.4%), traumas (injuries) and poisoning (7.0%), diseases of the urogenital system (6.1%), skin and hypoderm diseases (5.6%).

Bearing in mind importance of indicators of disease prevalence among the population for the formation of needs for medical and social services, their features and trends during the seventeen-year period were studied.

There is a negative tendency to increase the prevalence of all diseases among the population older than working age by 22.8%. At the same time, during 2000-2017, the prevalence of blood diseases among the elderly increased 2 times, diseases of the endocrine system – 1.8 times, diseases

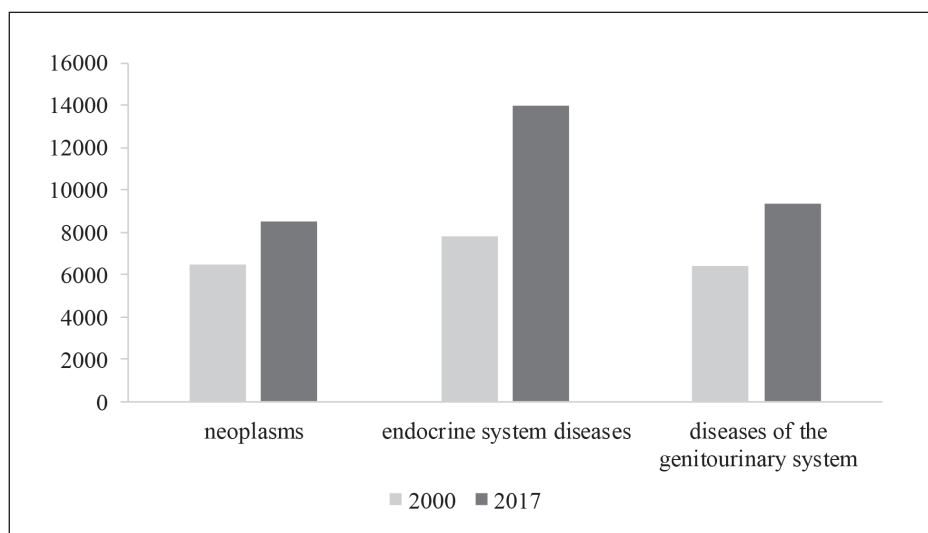


Fig. 1. Prevalence of diseases among the population that is older than working age in 2000 and 2017 (per 100 thousand)

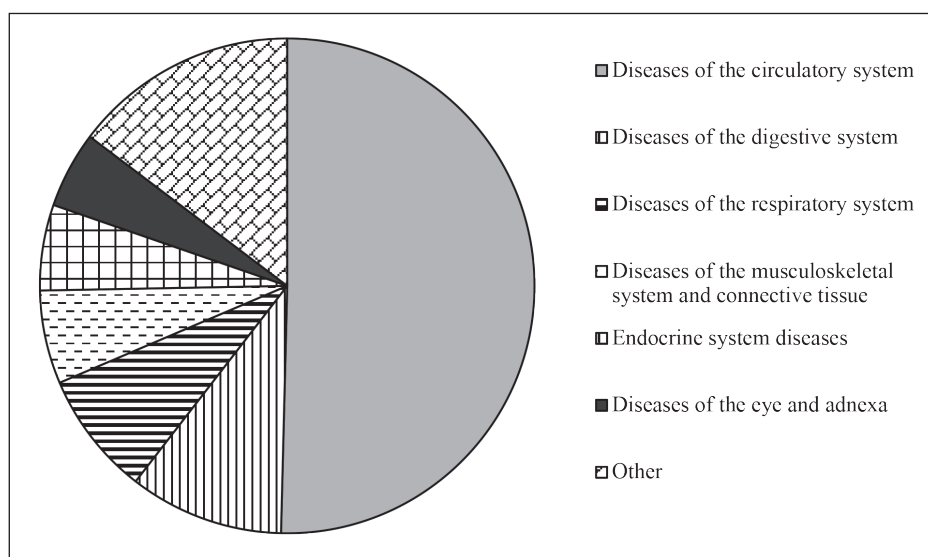


Fig. 2. The structure of the prevalence of diseases among the population of older age groups in 2017 (%)

of the urogenital system – by 45.7%, diseases of the digestive system – by 45.3%, neoplasms – by 31.7%, diseases of the nervous system – by 30.0%, diseases of the circulatory system – by 26.7%, diseases of the musculoskeletal system and connective tissue – by 18.1% (Fig. 1).

The structure of the prevalence of diseases among the elderly in 2017 was dominated by diseases of the circulatory system, which accounted for half of all existing diseases. There was a significant share of diseases of the digestive system (10.1%), diseases of the respiratory system (8.1%), diseases of the musculoskeletal system and connective tissue (6.1%), diseases of the endocrine system (5.6%), diseases of the eye and its appendages (adnexa) (5.0%) (fig. 2).

The above classes of diseases were determining the structure of the prevalence of diseases among the older population in 2000.

Therefore, the increase in the prevalence of pathology among older age groups occurred in almost all classes of diseases, except for some infectious and parasitic diseases, diseases of the ear and mammary gland, skin and hypoderm (subcutaneous tissue) diseases, mental and

behavioral disorders, traumas (injuries) and poisonings. The prevention, diagnosis and effective treatment of cardiovascular pathology due to its high prevalence and constant growth require special attention. The ill-health of older people indicates the need to study the causes of negative trends and identify the needs for medical and social services to organize their provision to the population.

The analysis of the volumes and reasons of appeals of urban residents to health care institutions during 2009-2019 showed that the incidence of the elderly population as a whole has increased. The growth rate of primary morbidity of elderly urban residents in eleven years was 3.6%. Uneven growth of the indicator by individual years was revealed. In the range of causes of primary morbidity of the urban population of older age groups diseases of the respiratory system (27.3%), urogenital system (14.3%), endocrine diseases, eating disorders, metabolic disorders (9.9%), diseases of the eye and its appendages (9.7%), diseases of ears and mammary gland (9.0%), neoplasms (6.7%), diseases of the blood circulatory system (5.5%) prevailed.

The study of the trends of primary morbidity of older age groups' urban residents revealed a significant increase in the incidence of diseases of the ear and mammary gland, eye and its appendages, blood circulatory system, vital organs and digestion. The fourfold image of frequently occurring mental and behavioral disorders, which indicates mental health problems, requires special attention. The appearance twice of frequency of nervous system's diseases and dermatological pathology, which often appear in the elderly other patients, require further study.

The leading places were occupied by cardiovascular diseases or illnesses, diseases of the digestive system and endocrine diseases, diseases of the eye and its appendages, diseases of the urogenital system and tumors, in the structure of the prevalence of diseases among the urban population of the elderly in 2019.

The spread of diseases among the urban elderly population over a ten-year period tended to decrease at a rate of 6.8%. However, there was a significant increase in the prevalence of diseases of the ear and mammary gland in 1.8 times, of the endocrine system – 1.7 times, infectious diseases and diseases of the musculoskeletal system and connective tissue – 1.2 times. The increase of elderly urban residents' appeals to health care facilities owing to traumas, poisonings and other consequences of external causes by more than threefold gives cause for reasonable concern.

The identified trends in the health of the elderly people, characterized by an increasing prevalence of chronic pathology, necessitated a study of self-evaluation of the health of the elderly, lifestyle and identification of their medical and social needs.

Elderly people's self-evaluation showed that there were no people who considered it very good. Among the respondents, 20.2±3.0 per 100 respondents rated their own health as mostly good, 31.5±3.5 – indicated health problems, and 10.1±2.3 confirmed significant health problems. Such estimates are quite impartial given the prevalence of non-infectious pathology, which was confirmed by 85.4±2.6 per 100 respondents. Such evaluations are quite objective because of the spread of non-infectious pathology, which was confirmed by 85.4±2.6 per 100 respondents. The range of existing chronic pathology included hypertension (37.1±3.6 per 100 respondents), allergies (23.6±3.2), heart disease (27.0±3.3), diabetes mellitus (11.2±2.4), arthrosis, arthritis (9.6±2.2), depression (5.6±1.7), malignant neoplasms (5.1±1.6), bronchial asthma (4.5±1.6), cataract (3.9±1.5). In most respondents, chronic pathology was combined.

This problem has been studied in the elderly population, considering the importance of everyone being aware of their personal responsibility for their own health. According to its results, it was found that only 13.5±2.6 per 100 respondents are quite responsible for their own health; 46.1±3.7 – mostly responsible, but 19.1±2.9 mostly irresponsible, 11.8±2.4 – irresponsible. Confirmation of the revealed evaluations is self-medication, which was indicated by 76.4±3.2 per 100 respondents, of which 65.4±4.1 practice it very often, and 20.6±3.5 – sometimes. Factors that stimulate older people to resort to self-medication are

problems with visiting health workers, low level of trust in their recommendations, confidence in the success of self-medication, the use of previous appointments, time pressure to visit a health care facility, lack of financial resources to pay for medical services.

The research of the compliance has shown that about 25.8±3.3 per 100 respondents always follow the recommendations of health professionals, while sometimes, or often do not follow the advice of 74.2±3.3. Elderly people attributed the low level of the compliance to fears of side effects, complex medication regimens, prescribing several forms of medication at the same time, uncertainty about the correctness of prescriptions, high cost of medication, duration of medication, lack of treatment, memory problems and more.

The study of the elderly people's lifestyle included a research of physical activity, the presence of risk factors for disease. It was found that they have a regular physical activity of 33.7±3.5 per 100 respondents, and 16.3±2.8 – are engaged in physical culture and sports. However, a quarter of respondents do not exercise regularly, there is a lack of sufficient physical activity in 21.9±3.1 per 100 elderly people.

The significant prevalence of risk factors for the development of the disease in the population of older age groups is revealed in the course of the investigation. Smoking status was confirmed by 29.8±3.4 per 100 respondents, frequent alcohol consumption – 7.9±2.0, malnutrition – 37.1±3.6, dangerous regime of insolation – 13.5±2.6, 32.6±3.5 per 100 respondents had overweight, arterial hypertension was 37.6±3.6, hypercholesterolemia was 28.7±3.4, and glucosemia was 16.3±2.8.

The reasons for the appeals of the population of older age groups to health care facilities were not only health problems, including diseases, accidents, traumas, but also preventive measures, including medical preventive examinations, vaccination, and also updating recipes, obtaining medical certificates, etc.

Only 14.0±2.6 per 100 respondents passed preventive examinations on time, while 56.2±3.7 did not perform on time, and 29.8±3.4 ignored these preventive actions. Only two-thirds of respondents indicated that they received preventive recommendations from health workers.

The survey identified the need of all respondents for outpatient care. Its preferred forms are called day hospitals (69.7±3.4) and hospitals at home (66.3±3.5). The need for rehabilitation polyclinic care is high (43.8±3.7). The demand for inpatient intensive care was confirmed (39.3±3.7) per 100 respondents, in the development of "one-day surgery" – 41.6±3.7 per 100 respondents. The need to improve the provision of elderly people with specialized counseling was confirmed by 34.3±3.6 per 100 respondents, emergency medical care – 16.3±2.8 per 100 respondents medical care.

The majority of respondents were in favor of active preventive counseling by medical staff in health care facilities (65.2±3.6 per 100). Preferred topics were the principles of healthy eating (62.3±3.6 per 100 respondents), modes of

physical activity in the presence of chronic pathology and without it (54.5 ± 3.7 per 100 respondents), the principles of healthy aging (52.2 ± 3.7 per 100 respondents), prevention of complications in chronic diseases, including prevention of infarcts and strokes (57.9 ± 3.7 per 100 respondents). Patients of older age groups also have pointed out the need to obtain information and increase knowledge in matters of mutual assistance and self-help in chronic diseases (48.9 ± 3.7 per 100 respondents), in the area of rehabilitation after complications of diseases (45.5 ± 3.7 per 100 respondents).

The problem of territorial access to health care, older respondents supported the need to expand the latest approaches of health and social care institutions to interact with the elderly people because of the limitations of physical activity. 68.5 ± 3.5 per 100 respondents of older age groups have spoken up for active introduction of electronic technologies in the process of medical care. The need to increase digital literacy was confirmed by 59.6 ± 3.7 per 100 respondents. The purposes of expanding knowledge and application of mobile technologies by the elderly were the use of information services on health (56.2 ± 3.7 per 100), emergency medical care (61.2 ± 3.7 per 100), receiving reminders about the appointment counseling (53.9 ± 3.7 per 100), assistance in compliance with the medication regimen (49.4 ± 3.7 per 100). The results of the surveys show the demand for electronic technologies in meeting the medical and social needs of the elderly in order to expand access to medical and social services.

The material condition of older people was studied, for the ability to preserve an adequate standard of living and health is largely determined by socio-economic determinants. The study found its sufficiency in 24.7 ± 3.2 per 100 respondents. At the same time, 65.7 ± 3.6 per 100 elderly respondents rated their wealth below the average level, which does not allow to meet the urgent needs, and 4.5 ± 1.6 – as insufficient to provide the appropriate food. Higher levels of material security were found in working respondents compared to those who were on well-deserved rest, and in families compared to single people. The social activity of older people was studied, drawing attention to the risks of social isolation of older people and its negative impact on health. The results of the research showed that 41.0 ± 3.7 per 100 elderly people supported and participated in social activities. At the same time, 34.8 ± 3.6 per 100 respondents indicated problems in communicating with other people. Three quarters of respondents indicated a good microclimate in families, and two thirds of respondents indicated good relations with friends. However, only a quarter of respondents noted satisfaction with meeting and communicating with others.

Among the socio-economic activities aimed at maintaining the quality of life and health of older people the respondents have pointed out an increase in material support for the disabled (78.1 ± 3.1 per 100 respondents), the expansion of social activities (48.3 ± 3.7), initiating joint training programs and skills development in the elderly people, involvement of technical means and auxiliary

devices (61.8 ± 3.6), introduction of modern information and communication technologies (67.4 ± 3.5), increasing the accessibility of public transport and its convenience (75.3 ± 3.2), the use of the principles of universal design, such as ramps, low steps, etc. (64.6 ± 3.6), improving urban infrastructure for walking, recreation in green areas, etc. (58.4 ± 3.7).

DISCUSSION

The generalization of the obtained data indicates unfavorable tendencies to deterioration of the health of the population of older age groups during the seventeen-year period. This is confirmed by the growth rates of primary morbidity and prevalence of diseases of the endocrine, hematopoietic, nervous, genitourinary systems. The rate of increase in the prevalence of all diseases among the elderly population reached 22.8%, and for some types of pathology the increase was twice. The leading types of pathology are chronic non-communicable diseases, primarily cardiovascular, which account for 50% of all diseases among older age groups, as well as the identified trends are quite comparable with global and European, which are noted in the WHO and WHO Regional Office for Europe's Public Health Issue.

Among the urban population of older age groups there is a tendency to increase the primary incidence of diseases of the senses, in particular, the ear and mammary gland, the eye and its appendages, as well as diseases of the circulatory system, respiratory and digestive organs. Of particular concern is the deterioration in mental health, which is confirmed by a 2-fold increase in the incidence of mental and behavioral disorders. The situation with regard to injuries of the elderly is unfavorable, as indicated by the increase in the frequency of injuries (traumas), poisonings and other consequences of external causes.

The major scales of illnesses in the elderly are confirmed by health self-evaluation data, according to which 31.5 ± 3.5 per 100 respondents had health problems, and every tenth respondent rated them as significant. At the same time, the burden of disease was based on non-communicable diseases, among which most often indicated hypertension, allergies, heart disease, diabetes, osteoarthritis, arthritis, depression, malignant neoplasms, bronchial asthma, cataracts. This pathology requires special attention from the medical staff, taking into account its course in the elderly.

The multifaceted evaluation of the older people's health indicates the priority of effective strategies to combat non-communicable diseases, which should include preventive, diagnostic, therapeutic and rehabilitation components.

A study of the lifestyle and behavior of people over retirement age revealed a lack of awareness of their own responsibility for the health of a third of respondents, a significant spread of self-medication, non-compliance with medical appointments, and so on. More than 40% of elderly people have an insufficient level of physical activity or irregular diet, a third – do not follow the principles of

nutrition. As a result, and for other reasons, more than a quarter of respondents are overweight. Other risk factors for developing non-communicable diseases include high blood pressure, high cholesterol and blood-sugar.

This is evidence of low medical activity of a large part of the elderly population: this is revealed by the untimely undergoing medical examinations (56.2 ± 3.7 per 100 respondents) and its ignoring (29.8 ± 3.4).

The needs of the elderly in health services are determined by their health problems, the peculiarities of the organization of the treatment and diagnostic process and the functional capabilities of elderly patients. Given the above, according to the elderly, it is necessary to expand the practice of preventive counseling on topical issues of health and disease prevention, their complications. There is a strong demand for health information and education services. Older people consider the development of such forms of medical care as inpatient care at home, one-day surgery, rehabilitation care, specialized counseling and emergency medical care.

Improving living conditions and improving the health of the working-age population is linked to improved socio-economic determinants, supported by more than three-quarters of respondents. In the context of combating social isolation and loneliness of the elderly, respondents preferred collective measures, such as joint training programs or the certain skills development in older people, the use of technical means, assistive devices, the use of modern information and communication technologies. An important aspect in reducing social isolation is the creation of a favorable environment, which includes accessible public transport, the use of the principles of universal design, the provision of walking conditions, and so on.

The identified features and trends in the health of older people, their needs for medical and social services are the basis for justifying measures to improve medical and social programs for the elderly.

CONCLUSIONS

The health of the elderly population is characterized by high levels of morbidity, mainly chronic non-communicable diseases, and negative tendencies to increase them. The basis of the burden of disease is formed by diseases of the circulatory system, as well as diseases of the digestive, respiratory, endocrine and ophthalmic diseases. Adverse trends in older people's health are deteriorating mental health and an increase in the incidence of traumas. One third of people over retirement age underestimate their own health.

The behavioral and biological risk factors for diseases, including hypodynamics, malnutrition, tobacco use, high blood pressure, high cholesterol and blood-sugar, and overweight, contribute to the negative health trends of the elderly population. Among the elderly there is self-medication, non-compliance with doctor's prescriptions.

The characteristics of health and the results of the study of the opinion of the elderly indicate the need to improve health and social care. There is a great need to expand

preventive counseling on various issues of maintaining and promoting health and preventing diseases and their complications, introduction of electronic medical and communication technologies, development of advanced forms of medical care, improvement of rehabilitation and emergency care services.

There is a need to improve the socio-economic determinants, especially to increase the material security of the elderly. Among the measures to reduce social isolation and loneliness, there is a high demand for joint training programs for the elderly people, the certain skills development, the use of technical means, assistive devices, and the formation of a healthy environment.

Meeting the needs of the elderly in medical and social services will improve the quality of life and health, will contribute to the well-being of the elderly as an important component of health.

REFERENCES

1. World Health Statistics 2020. Monitoring health for the SDGs. 2020. <https://apps.who.int/iris/bitstream/handle/10665/332070/9789240005105-eng.pdf>.
2. World population prospects: the 2019 revision. Volume II: Demographic Profiles. New York: United Nations, Department of Economic and Social Affairs, Population Division; 2019. https://population.un.org/wpp/Publications/Files/WPP2019_Volume-II-Demographic-Profiles.pdf.
3. Health 2020. A European policy framework and strategy for the 21st century. Copenhagen: WHO EURO; 2011, 190 p.
4. World report on ageing and health. Geneva: WHO; 2015, 260 p.
5. World population ageing 2019. Highlights. NY: United Nations, Department of Economic and Social Affairs; 2019, 44 p.
6. European health report 2018 «More than numbers — evidence for all». Copenhagen: WHO EURO; 2018, 164 p.
7. Healthy settings for older people are healthy settings for all: the experience of Friuli-Venezia Giulia, Italy. Copenhagen: WHO EURO; 2018, 90 p.
8. Decade of healthy ageing baseline report. Decade of healthy ageing: baseline report. Geneva: WHO; 2020, 220 p.
9. Naselennia Ukrainy za 2017 rik. Demografichni shchorichnyk [Population of Ukraine for 2017. Demographic Yearbook]. K.: Derzhstat; 2018, 138 s. (In Ukrainian).
10. Naselennia Ukrainy za 2003 rik. Demografichni shchorichnyk [Population of Ukraine for 2017. Demographic Yearbook]. K.: Derzhstat; 2004, 365 s. (In Ukrainian).
11. Number of existing population of Ukraine as of January 1, 2020. Statistical publication. Kyiv: State Statistics Service of Ukraine; 2020, 82 p.
12. Gruzieva T.S., Diachuk M.D., Inshakova H.V., Zamkevych V.B. Modern demographic trends in Ukraine as a realization of preventional strategies. *Wiad. Lek.* 2019;72(10): 2033–2039.
13. Creating age-friendly environments in Europe A tool for local policy-makers and planners. Copenhagen: WHO EURO; 2016, 68 p.
14. The Global Network for Age-friendly Cities and Communities Looking back over the last decade, looking forward to the next. Geneva: WHO; 2018, 48 p.
15. WHO priorities for action towards a Decade of Action on Healthy Ageing (2021–2030). Geneva: WHO; 2017, 56 p.
16. Global strategy and action plan on ageing and health. Geneva: WHO; 2017. <https://www.who.int/ageing/WHO-GSAP-2017.pdf?ua=1>.

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ORIGINAL ARTICLE

MODERN EPIDEMIOLOGICAL ASPECTS OF THE PROBLEM OF UROGENITAL MYCOPLASMIS AMONG THE FEMALE POPULATION OF UKRAINE

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ABSTRACT

The aim: To study and analyze the dynamics, age, and regional characteristics of the incidence of urogenital mycoplasmosis in Ukraine during 2014–2019 and to substantiate medical and organizational approaches to improving the prevention of urogenital mycoplasmosis among women.

Materials and methods: To study the dynamics, age, and regional characteristics of the prevalence and incidence of urogenital mycoplasmosis in women, reference and statistical materials of the State Statistics Service of Ukraine, reference materials and data from reporting forms No. 9, 34, 35 of the Center for Medical Statistics for 2014–2019 were used.

Results: The current trends in the dynamics of the incidence of urogenital mycoplasmosis among female population in Ukraine during 2015–2019 are determined, its age features are established, the regional distribution of administrative territories of Ukraine according to the incidence of urogenital mycoplasmosis is substantiated, medical and organizational approaches to improving menopause among women are substantiated.

Conclusions: The results of the study showed that although urogenital mycoplasmosis is most often diagnosed among women of childbearing age, the risk of infection exists for women of all ages, which indicates the urgency of providing effective measures to prevent it. A wide range of regional indicators of incidence of urogenital mycoplasmosis in women was established: from 0.9 per 100 thousand female population in the Zakarpattia region to 230.9 per 100 thousand in Kharkiv region, with in excess of the average Ukrainian indicator in a number of oblasts by 1.8–3.2 times. There is a tendency towards redistribution during 2010–2018 of the age structure of patients with urogenital mycoplasmosis: against the background of a slight decrease in the proportion of age groups from 0 to 14, 15–19, 20–29 years there is an increase in the proportion of other age groups, but the first rank place, as in previous years, is retained by the age group of 20–29 years: 48.4% in 2010, 39.1% in 2018). A statistically reliable correlation connection between age and the level of incidence of urogenital mycoplasmosis among women is not revealed.

KEY WORDS: urogenital mycoplasmosis, female population, prevention

Wiad Lek. 2021;74(3 p.II):665–668

INTRODUCTION

According to the World Health Organization, more than 1 million cases of sexually transmitted infections (STIs) are registered in the world every day. It is diagnosed every year 376 million cases of infection with one of the most common STIs: chlamydia, gonorrhea, trichomoniasis, and syphilis [1]. In Ukraine, about 400,000 new cases of STIs are diagnosed annually. These diseases, in particular, syphilis, chlamydia, gonorrhea, trichomoniasis, urogenital mycoplasmosis, and other STIs, adversely affect reproductive health, leading to infertility, miscarriage, stillbirth, and more. However, official statistics, both in Ukraine and in other countries, do not reflect the real situation of the STI burden, which remains a persistent health threat [2–4]. The strategic priorities of the UN, WHO, and other international organizations are to implement effective measures to combat the spread of STIs to address reproductive health problems, including improving their prevention, optimizing the quality of national and global surveillance, ensuring accessibility, quality and effectiveness medical care to these categories of patients [5].

THE AIM

The aim of the work is to study and analyze the dynamics, age, and regional characteristics of the incidence of urogenital mycoplasmosis among women in Ukraine during 2014–2019 and to substantiate medical and organizational approaches to improving the prevention of urogenital mycoplasmosis among women.

MATERIALS AND METHODS

To study the dynamics, age, and regional characteristics of the prevalence and incidence of urogenital mycoplasmosis in women, reference and statistical materials of the State Statistics Service of Ukraine, reference materials and data from reporting forms No. 9, 34, 35 of the Center for Medical Statistics for 2014–2019 were used (22 units). Descriptive statistics methods were used for statistical processing and analysis of the obtained information [6–13].

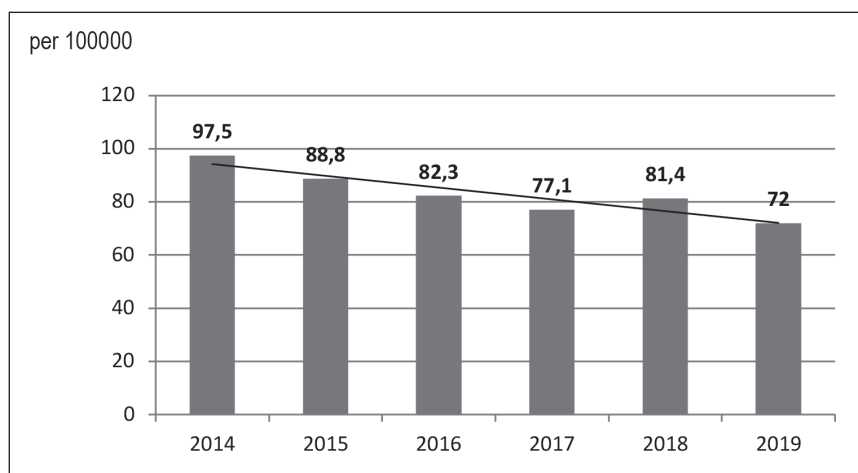


Fig. 1. Dynamics of the incidence of urogenital mycoplasmosis of the female population of Ukraine during 2014-2019 (per 100000).

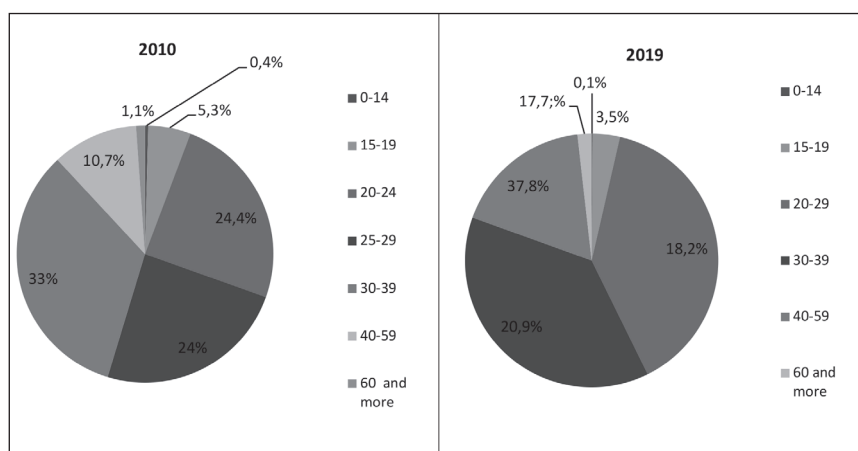


Fig. 2. The age structure of women with urogenital mycoplasmosis diagnosed for the first time in their life (2010, 2019),%.

RESULTS

The analysis showed that despite the tendency to reduce the incidence of women in the entire spectrum of STIs, the most common diseases among women are trichomoniasis and urogenital mycoplasmosis with incidence rates in 2019-123.7 and 72.0 per 100 thousand women respectively.

It is established that during 2014-2019 in Ukraine there was a reduction in the incidence of urogenital mycoplasmosis in women by 16.5% (Fig. 1). There was a slower rate of reduction in the incidence of urogenital mycoplasmosis in women compared with trichomoniasis and other STIs.

The structural distribution of women with newly diagnosed urogenital mycoplasmosis according to 2018, represented by age groups: 0-14 years – 0.1 ± 0.02%; 15-19 years – 3.5 ± 0.14%; 20-29 years – 39.1 ± 0.38%; 30-39 years – 37.8 ± 0.38%; 40-59 – 17.7 ± 0.3%; 60 and older – 1.8 ± 0.1%, indicates a predominance of patients aged 20-29 years.

Comparative analysis of the age distribution of women with newly diagnosed urogenital mycoplasmosis according to 2010 and 2019 revealed a tendency to a certain redistribution in the age structure of patients: against a slight reduction in the proportion of age groups from 0 to 14 years; 15-19 p; 20-29, an increase in the share of other age groups was recorded, with the preservation of the first ranking place of the age group 20-29 (48.4% in 2010, 39.1% in 2018) (Fig. 2).

Further study of the levels of primary morbidity of women of different ages for urogenital mycoplasmosis by correlation analysis revealed the presence of an inverse, weak, statistically unlikely correlation between the age of patients and the incidence of urogenital mycoplasmosis ($\rho = -0.29$, $p > 0.05$).

To determine the possible impact of age on the incidence of the female population on urogenital mycoplasmosis, we evaluated the actual indicators of incidence of urogenital mycoplasmosis in 2010 and 2018 and age-standardized indicators. The analysis allowed us to conclude that there is no influence of age on the incidence of women with urogenital mycoplasmosis.

Official statistics show that the vast majority of women are first diagnosed with urogenital mycoplasmosis diagnosed during preventive medical examinations and other types of dispensary work. These indicators are characterized by significant regional fluctuations – from 4.7% in the Zakarpattia region to 78.1% in Cherkasy, but their highest levels are in Cherkasy (78.1%), Kharkiv (74.4%), Zhytomyr (71.4%), and Donetsk (64.5) oblasts, which illustrates the high efficiency of preventive examinations.

Analysis of regional indicators of women's incidence of urogenital mycoplasmosis revealed a wide range at the regional level: from 0.9 per 100 thousand female popula-

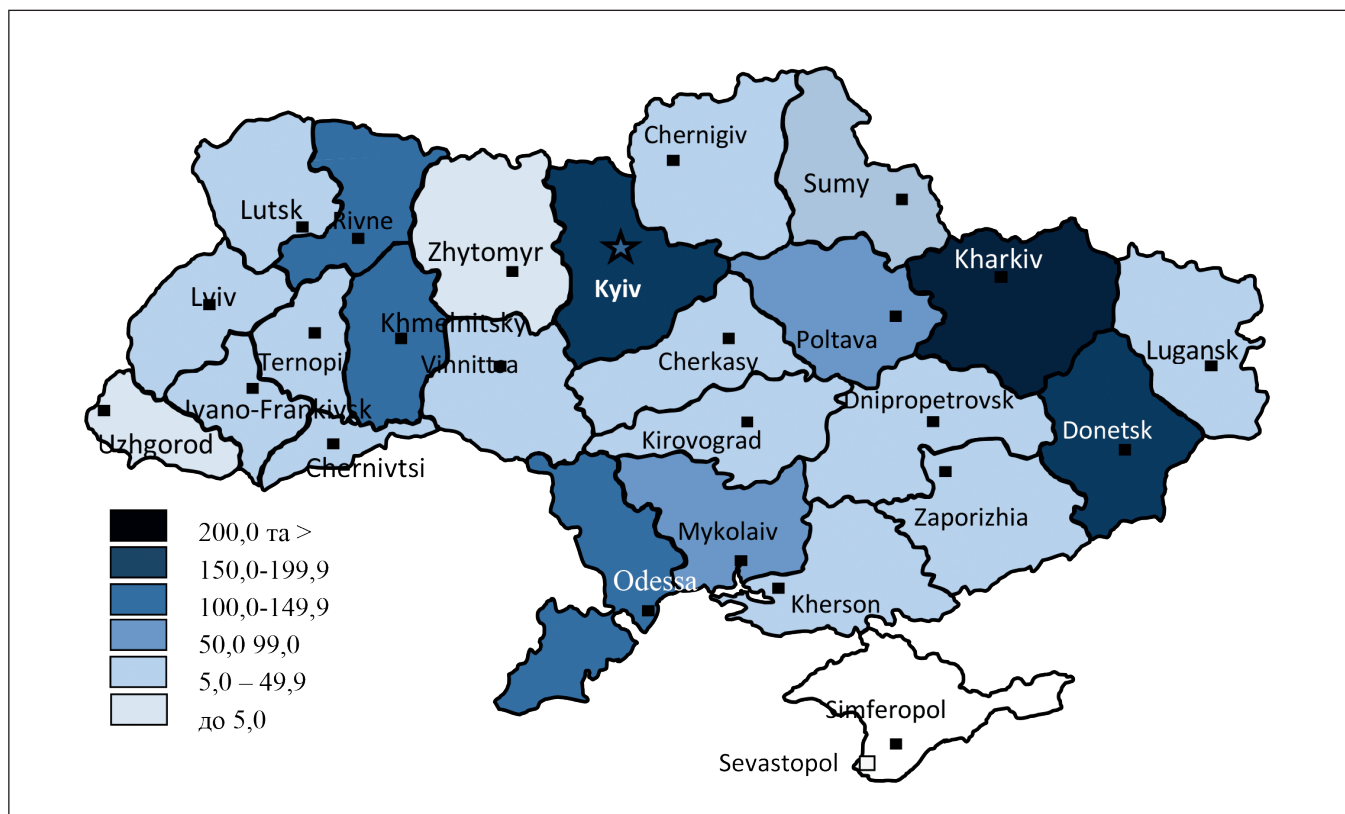


Fig. 3. Distribution of administrative territories of Ukraine by indicators of incidence for urogenital mononucleosis of the female population of Ukraine in 2019 (per 100000)

tion in the Zakarpattia region to 230.9 per 100 thousand female population in Kharkiv. It is established that in some oblasts, in particular Rivne, Khmelnytskyi, Kyiv, and Donetsk oblasts, the incidence of urogenital mycoplasmosis is 1.8-2.5 times higher than the average Ukrainian rate (72.0 per 100,000), in Kharkiv oblast this difference is 3.2 times (Fig. 3).

DISCUSSION

The study testified to the urgency of the problem of the prevalence of urogenital mycoplasmosis among the female population of Ukraine and the need to provide effective measures to prevent it. It has been found that women of all ages are at risk, but it is most common in women of childbearing potential, which has a negative effect on their reproductive health. Therefore, it is necessary to provide measures to prevent this disease, as well as other STIs.

In our opinion, the effective prevention of urogenital mycoplasmosis among population, as well as other STIs, needs a systemic solution within the relevant national / regional program/plan to preserve and promote reproductive health.

This will provide an integrated approach and intersectoral solution to the problem of prevention with the participation of public authorities and local governments, all sectors, and strata of society. It is extremely important to introduce effective epidemiological surveillance and monitoring, to ensure complete accounting of STIs in health care

institutions of various forms of ownership, to strengthen the preventive focus of health care, to increase the effectiveness of health education and sex education. An important task is to improve the availability and quality of the entire range of preventive, diagnostic, and treatment services for the population in order to improve reproductive health.

CONCLUSIONS

The results of the study showed that although urogenital mycoplasmosis is most often diagnosed among women of childbearing age, the risk of infection exists for women of all ages, which indicates the urgency of providing effective measures to prevent it.

A wide range of regional indicators of incidence of urogenital mycoplasmosis in women was established: from 0.9 per 100 thousand female population in the Zakarpattia region to 230.9 per 100 thousand in Kharkiv region, with in excess of the average Ukrainian indicator in a number of oblasts by 1.8-3.2 times.

There is a tendency towards redistribution during 2010-2018 of the age structure of patients with urogenital mycoplasmosis: against the background of a slight decrease in the proportion of age groups from 0 to 14, 15-19, 20-29 years there is an increase in the proportion of other age groups, but the first rank place, as in previous years, is retained by the age group of 20-29 years: 48.4% in 2010, 39.1% in 2018). A statistically reliable correlation connec-

tion between age and the level of incidence of urogenital mycoplasmosis among women is not revealed.

The obtained results indicate the need for further study of this problem, in particular, risk assessment of urogenital mycoplasmosis at the regional level, development of effective prevention measures, improving the availability and quality of medical care according to the modern standards.

Effective prevention of urogenital mycoplasmosis, like other STIs, requires an integrated solution, a systemic, intersectoral approach within the framework of an appropriate national / regional program/plan for the preservation and promotion of reproductive health.

Prospects for further research will consist in studying the regional characteristics of the incidence of urogenital mycoplasmosis in women, assessing their quality of life, improving the availability and quality of medical care.

REFERENCES

1. Selected practice recommendations for contraceptive use. Third edition 2016. Geneva: WHO; 2016, 66 p.
2. Vautrin H., Senn N., Cohidon C. Primary prevention of sexually transmitted infections in Switzerland: practices of family physicians and their determinants – a national cross-sectional survey. *BMJ*. 2020; 10(9): e032950. doi: 10.1136/bmjopen-2019-032950.
3. Mavrov H. I., Shcherbakova Y. V., Osinska T. V. Novitni metody strymuvannya infektsiy, shcho peredayut'sya statevym shlyakhom [Novel methods of containment of sexually transmitted infections]. *Infection Diseases*. 2019;1:4-13. doi:10.11603/1681-2727.2019.1.9933 (in Ukrainian).
4. Komar O. M., Pidlisna, I. V. Analiz pokaznykiv naybil'sh rozpovsyudzhenykh zakhvoryuvan', shcho peredayut'sya statevym shlyakhom, u Vinnyts'kiy oblasti [Analysis of the indicators of the most distributed sexually transmitted diseases in Vinnytsia region]. *Bulletin of Social Hygiene and Health Protection Organization of Ukraine*. 2019; 2:5–9. doi:10.11603/1681-2786.2019.2.10474. (in Ukrainian).
5. HRP annual report 2018. Geneva: WHO; 2019, 45 p.
6. Indicators of treatment and prevention of patients with skin and sexually transmitted diseases in Ukraine in 2018 /K., Center for Medical Statistics of the Ministry of Health of Ukraine. 2019.
7. The state of health of the female population in 2018. K., Center for Medical Statistics of the Ministry of Health of Ukraine. 2019. URL: <http://medstat.gov.ua/ukr/MMXIX.html>.
8. Statistical data of the system of the Ministry of Health of Ukraine for 2014-2019. K., Center for Medical Statistics of the Ministry of Health of Ukraine. URL: <http://medstat.gov.ua/ukr/statdan.html>.
9. Zhuk I.M. Statistical Yearbook of Ukraine for 2014. Kyiv, State Statistics Service of Ukraine. 2015, 586 p.
10. Werner I.E. Statistical Yearbook of Ukraine for 2016. Kyiv, State Statistics Service of Ukraine. 2017. 611 p.
11. Werner I.E. Statistical Yearbook of Ukraine for 2017. Kyiv, State Statistics Service of Ukraine. 2018. URL: http://www.ukrstat.gov.ua/druk/publicat/kat_u/2018/zb/11/zb_seu2017_e.
12. Werner I.E. Statistical Yearbook of Ukraine for 2018. Kyiv, State Statistics Service of Ukraine. 2019. 482 p. URL: http://www.ukrstat.gov.ua/druk/publicat/kat_u/2019/zb/11/zb_yearbook_2018_e.
13. Werner I.E. Statistical Yearbook of Ukraine for 2019. Kyiv, State Statistics Service of Ukraine. 2020. 465 p.

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ORIGINAL ARTICLE

MOLECULAR EPIDEMIOLOGY APPROACH TO TACKLE TREATMENT FAILURE IN DRUG RESISTANT TUBERCULOSIS (DR-TB)

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ABSTRACT

The aim: To analyze molecular epidemiology features of *M. tuberculosis* in Kyiv oblast; and to identify the safest mode of TB treatment, which will allow clinicians to minimize the risk of drug-resistant strains nosocomial transmission.

Materials and methods: 55 isolates of *M. tuberculosis* were collected in January–April, 2018 from 31 patients with new cases and 24 patients with re-treatment cases of sputum culture-positive pulmonary TB, in Kyiv oblast, Ukraine. DNA samples extracted from all the isolates were used for 15-loci MIRU-VNTR molecular typing with further *M. tuberculosis* strains comparison by means of MIRU-VNTRplus web tool (<http://www.miru-vntrplus.org>).

Results: Phylogenetic tree that reflects strains interrelationship reveals four main clusters, the largest of which spans 34 isolates. The presence of two big subclusters with 10 and 7 identical genotypes inside the largest cluster strongly suggests their tight epidemiologic relationship. Smaller clusters consist of five (Harlem), three (URAL), and two unidentified isolates. 10 singletons were detected, among which LAM, URAL and Cameroon lineages were identified; in these cases, epidemiological connection was presumably ruled out.

Conclusions: High clustering level of isolates of *M. tuberculosis* suggests possible contact between patients from whom these isolates were obtained. Predominance of Beijing family in the clusters is associated with high DR-TB level, at least in eastern European countries. Similarity of the clusters isolated from different patients in a household or a hospital suggests high probability of recent disease transmission. Clustering genotypes from households and hospital wards can be a surrogate criterion of infection control effectiveness.

KEY WORDS: *Mycobacterium tuberculosis*, drug resistance, MIRU-VNTR, tuberculosis

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INTRODUCTION

Drug resistance critically jeopardizes outcomes of tuberculosis (TB) treatment. As of 2020, a treatment success rate in drug-resistant tuberculosis cases (DR-TB) was 57% globally and 59% in the European region. TB is the 10th leading cause of death worldwide and, since 2007, it has been the leading cause of death from a single infectious agent, ranking above HIV/AIDS cases. Among 30 countries of high tuberculosis burden, which account 87% of global DR-TB cases, nine are located in eastern European region, and Ukraine is among them. Among 11,210 patients who started treatment for DR-TB globally, and were also resistant to fluoroquinolones, only 47% completed treatment successfully and 24% died; treatment failed for 11%, and 18% were lost to follow-up or their treatment outcome was not evaluated. India, the Russian Federation and Ukraine accounted for 73% of this cohort of patients [1]. Thus, DR-TB is a significant public health threat that is of particular importance in Ukraine.

Currently outpatient TB treatment is recognized as a preferred model, which is the safest and the most patient-oriented [2]. Long hospital stay does not improve treatment success [3], but does increase the potential for exposure to unrecognized or inadequately-treated DR-TB. From 2014 to 2018, 14 of the 15 eastern European

and central Asia (EECA) countries reduced the number of bed days per patient. The relative size of the reduction (which is influenced by both the percentage of TB patients hospitalized and the average length of stay if hospitalized) ranged from 11% in Romania to 75% (54 to 14 days) in Armenia. Ukraine is an exception with the average number of days in hospital increase by 12% in 2017, remained stable in 2018 [4]. As of 2020, Ukraine reported an average of 85.6 days per patient [5].

This risk is especially high in the cases when *M. tuberculosis* belongs to Beijing genotype, which is known to be associated with a higher transmission rate [6]. The molecular epidemiology data on *M. tuberculosis* strains circulating in Ukraine are scarce. Studies performed in southern and eastern Ukraine suggest an increasing prevalence of Beijing family, which was identified in 30.5% and 54.8% of new and retreatment cases respectively in a sample from Odesa and Mykolaiv oblast in 2007 [7], and in 81% of the cases from Kharkiv oblast in 2018 [8]. Whereas the abovementioned regions are located at the transport routes connecting Asia and Europe that can partly explain high prevalence of an Asia-originated Beijing strain [9], TB molecular epidemiology in the central and western parts of Ukraine remains unclear.



Fig. 1. Dendrogram of analysed DNA samples interrelationship according to MIRU-VNTR typing

THE AIM

We hypothesized that patients in hospital for TB treatment are being exposed to and infected with DR-TB. Given that the city of Kyiv as a capital of Ukraine, and Kyiv oblast are experiencing the most active migration in the country, we presumed that Beijing family prevalence in this region can be also high, and therefore

the risk of nosocomial TB and DR-TB transmission is significant.

The study aim was (i) to preliminary analyze molecular epidemiology features of *M. tuberculosis* in Kyiv oblast; and (ii) to identify the safest mode of TB treatment, which will allow clinicians to minimize the risk of drug-resistant strains nosocomial transmission.

Table I. General statistic results of bioinformatics analysis for MIRU-VNTR imprinting

Samples number		55							
Clustering level		38%							
Alleles diversity									
0424	0,48	0802	0,38	1955	0,61	2401	0,31	3690	0,31
0577	0,40	0960	0,47	2163b	0,59	2996	0,55	4052	0,72
0580	0,02	1644	0,25	2165	0,54	3192	0,61	4156	0,29
Assignment of identified isolates									
Beijing		Unknown		Haarlem		URAL		LAM	
61,82%		25,45%		7,27%		3,64%		1,82%	

MATERIALS AND METHODS

55 isolates of *M. tuberculosis* were collected in January-April, 2018 from 31 patients with new cases and 24 patients with re-treatment cases of sputum culture-positive pulmonary tuberculosis. All patients were the residents of Kyiv oblast. 45 (84%) of the patients had DR-TB. All patients had a history of hospitalisation in TB clinic of at least 3 weeks, and sputum to isolate DNA was collected during the treatment monitoring procedures, normally after one month of treatment for DR-TB casves and after two months for drug-susceptible cases. Patients' age ranged from 17 to 79 years old (median 47), with 84% male and 16% female.

M. tuberculosis genome typing technique. Molecular epidemiology monitoring was performed using Mycobacterial Interspersed Repetitive Unit-Variable Number of Tandem Repeat (MIRU-VNTR) typing. The method distinguishes the *M. tuberculosis* strains by the difference in the number of copies of tandem repeats at specific regions of the *M. tuberculosis* genome and so enables fast and high-resolution genotyping of *M. tuberculosis* isolates [10]. Polymerase chain reaction (PCR) utilizing forward and reverse primers tailored for each MIRU-VNTR loci results in production of corresponding PCR-amplicons. As the size of a DNA base pairs of each PCR-amplicon is the sum of the size of the tandem repeat plus the offsets at both ends, the number of copies of tandem repeats can be calculated according to the following formula:

$$\text{Amplicon Size} = \text{Offset Size} + (\text{Copynumber} \times \text{Repeat Size})$$

$$\text{Copynumber} = (\text{Amplicon Size} - \text{Offset Size}) / \text{Repeat Size}$$

M. tuberculosis DNA sampling and handling. DNA samples were isolated by CTAB-technique [11] from solid media cultures of mycobacteria obtained from TB patients and stored under refrigeration at 21°C until genotyping procedure, which was performed at GenoScreen Innovative Genomics research centre (GenoScreen Corporation, Lille, France). For PCR-amplification core set of 15 VNTRs was selected (MIRU-VNTR loci: 0424, 0577, 0580, 0802, 0960, 1644, 1955, 2163b, 2165, 2401, 2996, 3192, 3690, 4052, 4156) that are both sufficiently and complementary discriminatory [12]. All samples were treated to amplify these 15 markers using 3 quadruplex and 3 simplex PCRs with fluorescent primers specific for the flanking regions of the targeted loci. Amplified fragments were separated by capillary electrophoresis to determine the PCR product sizes.

In case of failure or double alleles, analysis was repeated for corresponding markers using simplex PCRs. As the length of the repeat units is known, sizes reflect the numbers of repeated sequences in the amplified loci. The final result is a portable numerical genotype, corresponding to the repeat number in each locus.

Genotyping datamation. Further bioinformatics analysis was performed by means of MIRU-VNTRplus web tool (<http://www.miru-vntrplus.org>) for polyphasic genotyping of *M. tuberculosis* complex bacteria, which comprise a reference database containing genotyping data of 186 strains representing the major MTBC lineages [13]. The comparison with the reference database allows identification of a phylogenetic lineage of the analysed strains.

RESULTS AND DISCUSSION

Statistical data analysis for 55 processed DNA samples presented in Table I.

Phylogenetic tree that reflects strains interrelationship reveals four main clusters, the largest of which spans 34 isolates (Fig. 1). The presence of two big subclusters with 10 and 7 identical genotypes inside the largest cluster strongly suggests tight epidemiologic relationship. Smaller clusters consisted of five (Harlem), three (URAL), and two unidentified isolates. A total of 10 singletons were detected, among which LAM, URAL and Cameroon lineages were identified; in these cases, epidemiological relationship was presumably ruled out.

Among 55 patients whose genotypes were analysed, 34 (62%), were identified as Beijing cases and had close epidemiological relations, more likely due to contracting the infection from one source. This suggests that Beijing family is a dominating genotype of *M. tuberculosis* in Kyiv oblast among new and re-treatment cases. As a result, high risk of tuberculosis transmission in hospitals and households arises. In addition, studies from eastern Europe present high association of Beijing genotype and risk of DR-TB [14] in contrast with some studies from Asia [15]. Therefore, prevention interventions become crucial in Ukraine due to high DR-TB burden and risk for contact persons to contract a DR-TB strain, which requires longer and more toxic treatment with poorer results.

This risk increases a need for meticulous contact tracing of each bacteriologically confirmed TB patient, which

optimally should cover not only household contacts, but also close contacts, i.e. those who share an enclosed space with the index case, such as a place of social gathering, workplace or facility, for extended time periods within the day during 3 months before commencement of the current treatment episode [16].

TB hospitals are the possible place of the DR-TB strains exchange. Given that the majority of TB facilities in Ukraine were built in 1960s and do not meet current infection control standards, this risk is significant. Molecular epidemiology study performed in Latvia where TB hospitals are of the similar time of construction and layouts, demonstrated high association of DR-TB with Beijing genotype (OR 41.67), previous hospitalisation (OR 18.33) and previous TB treatment (OR 17.68). Another finding of this study is that direct epidemiological links in hospitals were found for almost one third (32%) of DR-TB Beijing cases [14].

Thus, Ukraine urgently needs the paradigm shift with the priority to outpatient treatment in line with the current WHO recommendations. This is the only way to prevent TB and DR-TB transmissions in hospitals. New all-oral DR-TB treatment regimens, which WHO introduced in 2020 [2], enable convenient outpatient treatment without injections for both drug-susceptible and DR-TB cases from the first days of commencement. As it is known that patients who receive TB treatment regimen, which is tailored according to the individual drug resistance patterns, stop spreading the disease after 2-3 weeks of treatment [17], outpatient TB treatment is safe. However, patients with treatment failure can spread the disease and be a source of infections in hospitals and households. This is the reason why early treatment start and meticulous laboratory monitoring are regarded as infection control measures and the prerequisite of a safe treatment mode [18].

MIRU-VNTR typing as a relatively cheap and easy-to-perform method can be discriminative enough surrogate of whole genome sequencing (WGS) to follow the disease transmission in households and hospitals, as WGS requires much more investments and experienced personnel [19, 20]. Therefore, freezing of a culture at the treatment start to ensure the possibility of MIRU-VNTR genotyping in a case of poor treatment response might be a solution to differentiate a superinfection with other genotype of *M. tuberculosis* during the treatment course, from a case of treatment failure. Comparison of the MIRU-VNTR results for the initial and the most recent strain can confirm superinfection if the genotypes are different, and treatment failure in a case of the genetic similarity. In addition, clustering of genotypes obtained from patients with confirmed superinfection who have stayed in same wards is a sign of poor infection control and nosocomial transmission.

CONCLUSIONS

High clustering level of isolates of *M. tuberculosis* suggests possible close contact among patients from whom

these isolates were obtained. Predominance of Beijing family in the clusters is associated with high DR-TB level, at least in eastern European countries. Similarity of the clusters isolated from different patients in a household or a hospital suggests high probability of recent disease transmission. Clustering genotypes from households and hospital wards can be a surrogate criterion of infection control effectiveness.

REFERENCES

1. WHO. Global tuberculosis report 2020. (WHO/HTM/TB/2020).
2. WHO consolidated guidelines on tuberculosis: Module 4: Treatment: Drug-resistant tuberculosis treatment. WHO. 2020.
3. Tuberculoz v Ukraini. Analitichno-statystychni dovidnyk za 2019 r. Centr Hromadskogo zdorov'a MOZ Ukrainy. 2020 (in Ukrainian). https://phc.org.ua/sites/default/files/users/user90/TB_surveillance_statistical-information_2019_dovidnyk.pdf.
4. WHO. Global tuberculosis report 2019 (WHO/HTM/TB/2019).
5. WHO. Global tuberculosis report 2018 (WHO/HTM/TB/2018).
6. Liu Y., Zhang X., Zhang Y. et al. Characterization of Mycobacterium tuberculosis strains in Beijing, China: drug susceptibility phenotypes and Beijing genotype family transmission. BMC Infect Dis. 2018;18:658. doi: 10.1186/s12879-018-3578-7.
7. Nikolayevskyy V.V., Brown T.J., Bazhora Y.I. et al. Molecular epidemiology and prevalence of mutations conferring rifampicin and isoniazid resistance in Mycobacterium tuberculosis strains from the southern Ukraine. Clin Microbiol Infect. 2007;13(2):129–138. doi: 10.1111/j.1469-0691.2006.01583.x.
8. Daum L.T., Konstantynovska O.S., Solodiankin O.S. et al. Next-generation sequencing for characterizing drug resistance-conferring Mycobacterium tuberculosis genes from clinical isolates in the Ukraine. J Clin Microbiol. 2018;56(6):e00009–18. doi: 10.1128/JCM.00009-18.
9. Pichat C., Couvin D., Carret G. et al. Combined genotypic, phylogenetic, and epidemiologic analyses of Mycobacterium tuberculosis genetic diversity in the Rhône Alpes region, France. PLoS One. 2016;11(4):e0153580. doi: 10.1371/journal.pone.015358029-138.
10. Skenders G., van Soolingen D. Revised by Niemann S. and Nikolayevskyy V. Molecular typing of Mycobacterium tuberculosis complex isolates. In: European Centre for Disease Prevention and Control. Handbook on TB laboratory diagnostic methods for the European Union, Stockholm: ECDC. 2016: 83–91.
11. van Soolingen D., de Haas P.E., Hermans P.W., van Embden J.D. DNA fingerprinting of Mycobacterium tuberculosis. Methods Enzymol. 1994;235:196–205. doi: 10.1016/0076-6879(94)35141-4.
12. Supply P., Allix C., Lesjean S., et al. Proposal for standardization of optimized mycobacterial interspersed repetitive unit-variable-number tandem repeat typing of Mycobacterium tuberculosis. J Clin Microbiol. 2006;44(12):4498–4510. doi: 10.1128/JCM.01392-06.
13. Weniger T., Krawczyk J., Supply P. et al. MIRU-VNTRplus: a web tool for polyphasic genotyping of Mycobacterium tuberculosis complex bacteria. Nucleic Acids Res. 2010;38:326–331. doi: 10.1093/nar/gkq351.
14. Nodieva A., Jansone I., Broka L. et al. Recent nosocomial transmission and genotypes of multidrug-resistant Mycobacterium tuberculosis. Int J Tuberc Lung Dis. 2010;14(4):427–33.
15. Liu Y., Jiang X., Li W. et al. The study on the association between Beijing genotype family and drug susceptibility phenotypes of Mycobacterium tuberculosis in Beijing. Sci Rep. 2017;7:15076. doi: 10.1038/s41598-017-14119-z.

16. Fair E., Miller C.R., Ottmani S.E. et al. Tuberculosis contact investigation in low- and middle-income countries: standardized definitions and indicators. *Int J Tuberc Lung Dis.* 2015;19(3):269–72. doi: 10.5588/ijtld.14.0512.
17. Dharmadhikari A.S., Mphahlele M., Venter K. et al. Rapid impact of effective treatment on transmission of multidrug-resistant tuberculosis. *Int J Tuberc Lung Dis.* 2014;18(9):1019–1025. doi: 10.5588/ijtld.13.0834.
18. Van Cutsem G., Isaakidis P., Farley J. et al. Infection control for drug-resistant tuberculosis: early diagnosis and treatment is the key: Table 1. *Clin Infect Dis.* 2016;62:238–243. doi: 10.1093/cid/ciw012.
19. Rasoahantrisoa R., Rakotosamimanana N., Stucki D. et al. Evaluation of spoligotyping, SNPs and customised MIRU-VNTR combination for genotyping *Mycobacterium tuberculosis* clinical isolates in Madagascar. *PLoS One.* 2017;12(10):e0186088. doi: 10.1371/journal.pone.0186088.
20. Liu Y., Zhang X., Zhang Y. et al. Characterization of *Mycobacterium tuberculosis* strains in Beijing, China: drug susceptibility phenotypes and Beijing genotype family transmission. *BMC Infect Dis.* 2018;18(1):658. doi: 10.1186/s12879-018-3578-7.

Research programme “Use of novel technologies for tuberculosis diagnosis and treatment” of Ministry of health of Ukraine (2018-2020, № state registration 0118U001213).

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ORIGINAL ARTICLE

PATIENTS' SATISFACTION WITH DENTAL CARE (ON THE RESULTS OF SOCIOLOGICAL RESEARCH)

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ABSTRACT

The aim: To determine the level of patients' satisfaction with the received dental care in regional dental clinic and to make proposals for improving the quality of dental care based on the survey results.

Materials and methods: 221 copies of the questionnaires completed by the respondents; sociological method (questionnaire), medical-statistical, analysis and bibliosemantic methods were used.

Results: Patients expressed high satisfaction with the quality of dental care according to the criteria of geographical accessibility (4.28 ± 0.05 points), the conditions in the doctor's office (4.63 ± 0.04 points), safety of dental interventions (4.54 ± 0.04 points) and their effectiveness (4.58 ± 0.04 points), the attitude of the doctor to the patient (4.75 ± 0.03 points), the clarity of information for the patient (4.52 ± 0.04 points). However, the satisfaction of patients with the cost of dental services was only 3.76 ± 0.05 points.

Conclusions: Patients' satisfaction with the financial accessibility of dental care was found to be lower compared to satisfaction with other healthcare quality components. This information can be used to make management decisions on revising the coverage of the cost of dental services from the state budget and other sources of funding.

KEY WORDS: healthcare quality; patients' satisfaction; financial accessibility of dental care

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INTRODUCTION

WHO's conceptual approaches to intensification the delivery of health services to people require a strengthening of health systems. Close interaction of patients with healthcare tools and processes should be an essential component of these systems [1]. Patients make an important contribution to the evaluation of the quality of care. This can help health care managers identify opportunities to improve health care, increase public confidence in the health care setting, and analyze the causes of differences between patients' expectations and their level of satisfaction with health care [2, 3].

A number of health care quality regulation tools have been introduced in Ukraine since the end of the last century: licensing of medical practices, accreditation and certification of healthcare institutions, standardization of medical technologies. Thus, 95 healthcare institutions, including 26 state-owned, 30 communal and 39 private-owned, received the highest accreditation category and certified their quality management systems in 2017. Certification was carried out in accordance with the requirements of national standards for quality management systems, authentic ISO 9001 series standards [4].

There are eight powerful independent institutions of dental profile, among those institutions that have received certificates: regional dental clinics in Kharkiv, Dnipro, Odessa, Chernihiv, Khmelnytsky, dental polyclinic of the Ministry of Health of Ukraine, located in Chernomorsk (Odessa region), Dental practical training medical center

of Shupyk National Medical Academy of Postgraduate Education (Kyiv), French Dental Center (Kyiv).

The requirements of the standard include, in particular, the assessment of patients' satisfaction with dental care in the above institutions. Satisfaction data can be used to design interventions to improve the quality of dental care.

THE AIM

To determine the level of patients' satisfaction with the received dental care and to make proposals for improving the quality of dental care based on the survey results. To achieve the goal of the study, the task was to conduct a sociological survey among patients of the regional dental clinic in Chernihiv and to analyze the results.

MATERIALS AND METHODS

Methods of sociological (questionnaire), medical-statistical, bibliosemantic and analysis were used in the study. National Standard «DSTU ISO 10004: 2013 Customer Satisfaction. Monitoring and Evaluation Guidelines (ISO 10004: 2012, IDT)» has been used as a methodological basis for sociological research.

The survey was conducted during the last three months of 2018.

A necessary condition for the patient to be a participant in the survey was observation by a dentist of the dental

Table I. Socio-demographic respondents' specifications

Registration Number	Description	Frequency	
		N	%
1	total	221	100,0
	including:		
1.2	male	97	43.9
1.3	female	124	56.1
2	urban residents	118	53.4
3	villagers	103	46.6
Registration Number	Description	Mean, ± SD, years	
4	average age of all respondents	45.8±12.6	
5	age male	43.5±12.2	
6	age female	47.6±12.7	

clinic for 1 year or more. A total of 229 people aged 18 and older took part in the survey; 221 copies of the questionnaires completed by the respondents was used. This was equal to 45.0% of patients from the average number of people who visited the dental clinic during the last quarter of 2013-2017. The patient selection was random.

The methodology of creating the questionnaire is founded on the generally accepted methodology and involved orientation towards the achievement of the established goals of sociological research; availability of instructions for the respondents to use the questionnaire; first location general questions and then location more specific questions; placement of difficult questions after more simple ones; a clear, specific, unambiguous wording of the questions.

The self-administered structured questionnaire was created according to basic characteristics of healthcare quality. The following quality characteristics were reviewed: geographical accessibility, clinical effectiveness (the result of dental care), financial accessibility, safety, patient-orientation. These target questions were used because is known their significant impact on patients' satisfaction.

According to these characteristics, respondents were asked to provide answers to the following questions:

1. How satisfied you are with the location of our clinic (how convenient it is for you to get from home to us).
2. How satisfied are you with the schedule of doctors (how convenient it is for you to visit a doctor on such a schedule).
3. How satisfied are you with the conditions in the doctor's office (cleanliness, lighting, air temperature, condition of the furniture, etc.).
4. How satisfied are you with the results of the treatment you received at the clinic.
5. How satisfied are you with the cost of paid services in our clinic (how much is this cost available to you).
6. How satisfied are you with the safety of dental procedures in the clinic (how much do you consider yourself protected from the possibility of injury, infection, allergic reactions, moral damage).
7. How satisfied are you with the doctor's attitude towards you (how friendly was the attitude towards you).

8. How satisfied are you with the clarity of the information you received from your doctor about your dental problem.
9. How satisfied are you in overall with the quality of medical care in our clinic.
10. If your relatives / acquaintances need dental care, would you recommend them to contact our clinic?

A five-level digital measurement scale of responses was applied: points 1= Very poor, 2= Poor, 3= Fair, 4= Good, 5= Excellent.

The poll was conducted after obtaining informed consent of the patient to participate in the study, which is indicated in the introductory part of the questionnaire. The survey was conducted after the end of treatment.

Patient identification by surname, first name and date of birth was not carried out. This guaranteed the anonymity of the respondents.

The authors calculated descriptive statistical parameters: mean, ± standard deviation (SD) and frequency (N, %) by using the licensed Microsoft Office Excel 10 software.

Ethics commission Shupyk National Medical Academy of Postgraduate Education concluded the study complies with the current standards and principles of the "Code of Ethics of the Ukrainian Doctor", current regulations of Ukraine and the requirements of the Declaration of Helsinki (18.01.2021 protocol of Ethics commission No 1).

RESULTS AND DISCUSSION

Table I is presented socio-demographic respondents' specifications.

It is shown that the number of women – 124 (56.1%) was more than the number of men – 97 (43.9%) in the group of respondents. The average age of men was 43.5 ± 12.2 years, average age of women was 47.6 ± 12.7. These data indicated a higher rate of visits by women to the dentist and an earlier development of oral pathology in men. The group included 118 (53.4%) urban residents and 103 (46.6%) villagers due to the fact that the dental clinic of Chernigov, where the study was conducted, provides dental care to the population of the entire region.

Table II. The date of patients' satisfaction with the received dental care

Questionnaire number	Characteristics	Score in points, mean, \pm SD
1	Geographical accessibility	4.28 \pm 0.81
2	Convenience of the schedule of reception of the doctor	4.56 \pm 0.60
3	Conditions in the doctor's office	4.63 \pm 0.53
4	Results of the treatment patient received at the clinic	4.58 \pm 0.59
5	Cost of paid services in the clinic	3.76 \pm 0.80
6	Safety of dental procedures in the clinic	4,54 \pm 0,53
7	Doctor's attitude towards patient	4.75 \pm 0.49
8	Clarity of the information patient received from the doctor about dental problem	4.52 \pm 0.54
9	Overall patient's satisfaction with dental care in the clinic	4.39 \pm 0.51
10	Recommendations for acquaintances / relatives to use the services of this clinic	Some negative answers

Table II shows the mean points of patients' satisfaction with the received dental care.

The spread of the average values of satisfaction for these characteristics was in the range of 3.76–4.75. Overall patients' satisfaction with dental care in the clinic was 4.39 \pm 0.51. This demonstrated a high level of patients' satisfaction, ranging from fair to good. This position was confirmed by the willingness of almost all patients to recommend the clinic to their friends and / or relatives in need of dental care. At the same time, patients were the least satisfied with the cost of dental services, since this quality characteristic was assessed as only 3.76 \pm 0.80 points. This indicated the problem of financial accessibility of some respondents to dental services.

Assessments of patients' satisfaction with dental care in a regional clinic in Ukraine generally correspond to assessments obtained in similar studies in clinics in other countries and show high results. At the same time, the assessment of individual quality characteristics varies in comparison with the overall assessment.

The authors' data [5] show the high patients' satisfaction of the treatment process, doctor's attitude, organization and results of dental care, and its safety. However, the condition of the infrastructure components of the clinic received low marks.

According to research [6] low accessibility of dental care within the clinic reduced overall patients' satisfaction. The same studies have shown that the appearance of the clinic has an impact on patient satisfaction and can be used as a measure of satisfaction.

As a result of the research [7] proposed additional criteria for the quality of dental care: the attitude of non-medical personnel, the quality of patient reception, the organization of emergency dental care, and patient education on prevention of oral diseases.

Research [8] received confirmation of patients' satisfaction in the case of payment for dental services on preferential terms.

The relationship between the patient and the dentist, the qualifications of the doctor, the conditions of treatment and its accessibility shape the patient's perception of the quality of dental care [9].

According to the authors [10], patients are more satisfied with the medical care provided by female dentists and young doctors. Patients showed a high degree of satisfaction with the available dental care, adequate pain relief and an adequate amount of dental care.

The results of the study in Ukraine confirm the variety of criteria for the quality of dental care. In particular, financial accessibility is a very important component of patients' satisfaction. Health care reform is currently taking place in Ukraine. Only emergency dental care for the entire population and planned care for children is included in the package of state-guaranteed dental services for the population. Therefore, the results of the study can be used as information support for making managerial decisions on revising the financial coverage of dental services.

The research results are original, but representative only for the dental clinic in Chernigov. Therefore, it is necessary to continue sociological research in dental institutions in other regions of Ukraine. It is desirable to investigate the relationship of patient satisfaction with their socio-demographic characteristics.

CONCLUSIONS

The results of the study showed a high level of patients' satisfaction with dental care. However, survey data showed that satisfaction with financial inclusion was significantly lower than satisfaction with other quality components. This information can be used to make management decisions about providing financial coverage for dental services from the state budget and other funding sources.

REFERENCES

1. People-centred health services delivery: concept note. WHO Regional Office for Europe; 2014, 19 p.
2. DSTU ISO 10004:2013 (ISO 10004:2012, IDT) Natsionalnyi standart Ukrainy. Upravlinnia yakistiu. Zadovolenist zamovnykiv. Nastanovy shchodo monitorynhu ta otsiniuvannia [DSTU ISO 10004: 2013 (ISO 10004: 2012, IDT) National standard of Ukraine. Quality management. Customer satisfaction. Monitoring and evaluation guidelines]. Kyiv. Ministry of Economic Development of Ukraine; 2014, 29 p. (in Ukrainian).

3. DSTU EN 15224:2019 Systemy upravlinnia yakistiu. EN ISO 9001:2015 u sferi okhorony zdorovia (EN 15224:2016, IDT) [DSTU EN 15224: 2019 Quality management systems. EN ISO 9001: 2015 for healthcare (EN 15224: 2016, IDT)]. Kyiv, State Enterprise "UkrNDNTS"; 2020, 109 p. (in Ukrainian).
4. Zvit Holovnoi akredytatsiinoi komisii pry MOZ Ukrainy za 2017 rik [Report of the Main Accreditation Commission at the Ministry of Health of Ukraine for 2017]. URL: http://moz.gov.ua/uploads/1/5004-zvit_gak_2017.pdf. (in Ukrainian).
5. Iqbal W., Faran F., Yashfika A.B. et al. Evaluation of Dental Care through Patient Satisfaction Feedback – A Cross Sectional Study at Dental Institute of OJHA Hospital, Karachi, Pakistan. *Adv Dent & Oral Health*. 2018; 8(4): 555743. DOI: 10.19080/ADOH.2018.08.555743.
6. Ali D.A. Patient satisfaction in dental healthcare centers. *Eur J Dent* 2016;10:309-14. doi: 10.4103/1305-7456.184147.
7. Luo N.J.Yu., Liu P.P., Wong M.C. Patients' satisfaction with dental care: a qualitative study to develop a satisfaction instrument. *BMC Oral Health*. 2018; 18: 15. Published online 2018 Jan 30. doi: 10.1186/s12903-018-0477-7.
8. Bhat N., Sultane P., Chhabra S. et al. Assessment of Patient Satisfaction toward Dental Care Services of Patients visiting Dental Schools in Udaipur, Rajasthan, India. *International Journal of Oral Care and Research*. 2017; 5(1):34-41. doi: 10.5005/jp-journals-10051-0079.
9. Akbar F. H., Pasiga B. Patient Satisfaction Level with Health Care Quality at Dental Hospital of Hasanuddin University. *Advances in Social Science, Education and Humanities Research (ASSEHR)*, volume 127. 8th International Conference of Asian Association of Indigenous and Cultural Psychology (ICAAIP). 2017: 253-258.
10. Lin Y., Hong Y.A., Henson B.S. et al. Assessing Patient Experience and Healthcare Quality of Dental Care Using Patient Online Reviews in the United States: Mixed Methods Study. *J Med Internet Res*. 2020; 22(7):e18652.

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ORIGINAL ARTICLE

HEALTH CARE EXPENDITURES OF 179 COUNTRIES WITH DIFFERENT GNI PER CAPITA IN 2018

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ABSTRACT

The aim: To study the difference in health care expenditures in groups of countries with different GNI per capita.

Materials and methods: In 4 groups of countries with different GNI per capita were analyzed indicators of Current health expenditure per capita (\$) (CHE), Domestic general government health expenditure per capita, PPP (\$) (GGHE \$) and GGHE%, Domestic private health expenditure per capita, PPP (\$) (PHE) and PHE%, Out-of-pocket expenditure (%) (OOP), Current health expenditure (% of GDP) (CHE% GDP).

Results: The group of high-income countries differs by CHE, GGHE \$, GGHE%, PHE \$, PHE%, OOP, CHE% GDP ($p < 0.001$), the group with incomes above the average – by CHE, GGHE \$, PHE \$, PHE%, CHE%GDP ($p < 0.001$). Groups with lower average income and low income do not differ in CHE, GGHE\$, PHE\$, PHE%, OOP ($p > 0.05$). GNI per capita has a positive effect on GDP%GDP, CHE, GGHE, PHE in the high-income group and negatively affects the OOP ($p < 0.05$), GNI per capita has a positive effect on CHE, GGHE in the above-average income group, GNI per capita has a positive effect on CHE, GGHE, GGHE%, PHE and negatively affects OOP ($p < 0.05$) in the income group below average. GNI per capita has a positive effect on the OOP and negatively affects the CHE%GDP ($p < 0.05$) in the low-income group.

Conclusions: Each group of countries, depending on per capita income, has its own health care costs.

KEY WORDS: Health financing, GNI per capita, Out-of-pocket expenditure, health expenditure

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INTRODUCTION

Among Sustainable Development Goals (SDGs) by 2030, the UN organization points out the need of ensuring healthy lifestyle and promoting well-being for all humans of any age (goal 3) [1]. The indicators of achieving this goal are increase of life expectancy and reduction of mortality by ensuring equal access to health services within strengthened health care systems [2]. The WHO believes it is necessary to significantly increase funding for health care in order to achieve sustainable global health [3]. This particularly regards the low-income countries and the below-average income ones [4]. In the period from 2014 to 2040, an increase of health care expenditures by 2.62 times from US \$ 9.2 trillion to US \$ 24.2 trillion is expected [5]. The growth rate of health care expenditures depends on the country's income. The highest growth rates of health care expenditures are expected in countries with above-average income (5.3%), and the lowest rates are expected in the group of low-income countries (1.8%) [5]. Growth rates in countries of above-average income are determined by government expenditures [5, 6, 7]. From 2014 to 2040, the share of private health care expenditures in the world is suggested to decrease from 22.8% to 21.4% [5]. Global trends in health care expenditures are characterized by certain peculiarities. Thus, medical coverage depends on the income of the countries; government expenditures are

playing the central role in the structure of the financial resources within health care system; high government expenditures ensure financial protection of population in case of catastrophic treatment costs; out-of-pocket expenditures are reduced; external financing (assistance) is less than 1% of global health expenditures and is significant in low-income countries; the growth rate of health care expenditures depends on the growth rate of gross national product [5, 6, 7, 8, 9, 10, 11, 12, 13].

According to the literature sources, the health care expenditures increase reduces global burden of diseases in the countries [14, 15] and provides for their economic growth [12, 16]. Health care expenditures result in better health servicing, which can strengthen human capital and improve productivity, thereby contributing to economic performance [17]. However, health care expenditures must be economically justified [18]. The actual level of health expenditures in the countries of the Organization for Economic Co-operation and Development (OECD) makes up 5.48% of gross domestic product (GDP). The optimal health care expenditure is 7.55% of GDP [18]. Higher costs are not economically feasible [18]. According to Lancet Commission on Investing in Health, it is predicted that health care expenditure might increase by 1% at the expense of the country's GDP growth or government expenditure growth as a share of the country's GDP [4]. It

Table I. Indicators of current health care expenditures in 4 groups of countries with different GNI per capita, 2018

Financial indicators	1 (n = 54)	2 (n = 51)	3 (n = 51)	4 (n = 23)	p
	M 25th – 75th percentile	M 25th – 75th percentile	M 25th – 75th percentile	M 25th – 75th percentile	
CHE% GDP	7,605 ³ (6,331-9,975)	6,061 ³ (5,244-8,224)	4,734 ¹² (3,532-6,292)	6,165 (3,973-7,692)	<0.001
CHE\$	2091.5 ²³⁴ (1249.3-4912.7)	471.5 ¹³⁴ (323.0-615.1)	102.7 ¹² (71.1-174.5)	40.2 ¹² (29.5-53.6)	<0.001
GGHE\$	2216.4 ²³⁴ (1432.6-3657.7)	527.6 ¹³⁴ (345.3-819.9)	109.0 ¹² (63.7-213.4)	9.24 ¹² (15.7-42.5)	<0.001
GGHE%	71.7 ²³⁴ (58.8-78.6)	58.6 ¹³⁴ (46.4-68.3)	40.3 ¹²⁴ (28.2-58.5)	23.7 ¹²³ (16.0-30.2)	<0.001
PHE\$	950.9 ²³⁴ (657.7-1335.1)	379.0 ¹³⁴ (243.6-539.6)	113.8 ¹² (54.5-203.8)	47.3 ¹² (27.8-92.6)	<0.001
PHE%	28.2 ²³⁴ (21.4-41.2)	40.2 ¹ (29.3-51.0)	50.2 ¹ (27.9-59.4)	44.5 ¹ (36.3-67.1)	<0.001
OOP	18.4 ²³⁴ (12.7-29.5)	32.3 ¹ (19.6-42.1)	39.4 ¹ (23.3-53.5)	41.6 ¹ (28.4-59.5)	<0.001

Source: <https://data.worldbank.org/indicator>

Mⁿ: M - median of the indicator, ⁿ- significant differences in groups, p <0.001

is projected that in the period up to 2035, GDP growth in countries may provide an increase of health care expenditures [19, 20]. However, many low- and middle-income countries continue to underinvest in health care [4].

In its 2018 report, Public Health Expenditure: A Closer Look at Global Trends, the WHO recommends examining trends in the specifics of health care financing in countries with different income and expenditure levels [7].

THE AIM

The aim of the study was to examine the differences in health care expenditures in groups of countries with different GNI per capita and the impact of GNI per capita on financial indicators in these groups of countries.

MATERIALS AND METHODS

The article presents an analysis of indicators of health care expenditures in 4 groups of countries with different GNI per capita. The health expenditure indicators were obtained from The World Bank Data (<https://data.worldbank.org/indicator>) for 2018. This database contains financial indicators for 264 countries. In 2018, full set of information on financial indicators was available for 179 countries, which were divided into 4 groups by GNI per capita, Atlas method (current US \$) (<https://www.vsemirnyjbank.org/ru/news/press-release/2013/07/02/new-country-classification>).

According to the World Bank classification, group 1 includes 54 high-income countries (GNI per capita US \$ 12616 and >), group 2 includes 51 above-average income countries (GNI per capita US \$ 4086 – 12615), group 3 includes 51 countries with below-average income (GNI per capita 1036 – 4085 US \$), and group 4 of 23 low-income countries (1035 US \$ and <). For the purpose of analysis,

we selected 7 indicators of health care expenditures: Current health expenditure per capita (current US \$) (SHE), Domestic general government health expenditure per capita, PPP (current international \$) (GGHE \$), Domestic general government health expenditure (% of current health expenditure) (GGHE%), Domestic private health expenditure per capita, PPP (current international \$) (PHE \$), Domestic private health expenditure (% of current health expenditure) (PHE%), Out-of-pocket expenditure (% of current health expenditure) (OOP), Current health expenditure (% of GDP) (CHE% GDP).

Medians and quartiles (QI – QIII) were calculated to compare financial indicators in 4 groups. Median operation and interquartile range of 25th – 75th percentile were used for better comparison of each country. Financial parameters were expressed in US currency. A nonparametric Kruskal-Wallis test was used to determine the differences in financial indicators in the groups. Pearson's correlation coefficient was used to determine the relationship between each group of indicators of interest. Statistically significant results were associated with a 'p value' of <0.05. The data analysis was performed using the license analysis package MedCalc v.19.4.1 (MedCalc Software Inc, Broekstraat, Belgium, 1993–2020).

RESULTS

The medians of 7 financial indicators SHE, GGHE \$, GGHE%, PHE \$, PHE%, OOP, CHE% GDP and the differences of these indicators in groups of countries with different GNI per capita are presented in Table I.

Four groups of countries with different incomes differ significantly only in the median GGHE% (p <0.001). In the group of high-income countries, the median GGHE% is 71.7%, in the group of countries with above-average

Table 2.. Pearson correlation coefficients between GNI per capita and financial indicators in groups of countries with different incomes, 2018

Financial indicators	GNI per capita									
	179 countries		1 gr, n = 54		2 gr, n = 51		3 gr, n = 51		4 gr, n = 23	
	r	p	r	p	r	p	r	p	r	p
CHE% GDP	0.35	<0.05	0.39	<0.05	-0.15	> 0.05	0.09	> 0.05	-0.49	< 0.05
CHE\$	0.94	<0.05	0.89	<0.05	0.63	<0.05	0.68	<0.05	0.22	> 0.05
GGHE\$	0.93	<0.05	0.81	<0.05	0.55	<0.05	0.64	<0.05	0.55	<0.05
GGHE%	0.50	<0.05	0.15	> 0.05	0.23	> 0.05	0.49	<0.05	0.29	> 0.05
PHE\$	0.74	<0.05	0.55	<0.05	0.19	> 0.05	0.38	<0.05	0.33	> 0.05
PHE%	-0.29	<0.05	-0.14	> 0.05	-0.12	> 0.05	-0.28	> 0.05	0.25	> 0.05
OOP	-0.39	<0.05	-0.41	<0.05	-0.05	> 0.05	-0.283	<0.05	0.31	> 0.05

income – 58.6%, in the group of countries with below-average – 40.3% and in the group of low-income countries – 23.7%. In the structure of health care expenditures in groups of high-income and above-average incomes, government expenditures predominate. In the structures of health care expenditures in the group of countries with below-average income and in the group of low-income countries, private expenditures predominate (50.5 and 44.5%, respectively). However, only the group of high-income countries differs significantly from other countries in the median PHE% ($p < 0.001$). In this group, the median PHE% is 28.2%. The median share of health expenditures from gross domestic product (GDP) differs significantly only in the group of countries with below-average income from all groups ($p < 0.001$). In this group, the median CHE% GDP is the lowest (4.734%, (3,532-6,292)). In other groups, this figure is higher (7.605%, 6.061% and 6.165% respectively). The group of high-income countries significantly differs in 7 financial indicators (CHE, GGHE \$, GGHE%, PHE \$, PHE%, OOP, CHE% GDP) from other groups of countries ($p < 0.001$). This group of countries has the largest medians on 5 financial indicators (CHE, GGHE \$, GGHE%, PHE \$, CHE% GDP) and the smallest medians on 2 financial indicators (PHE%, OOP) ($p < 0.001$).

The group of countries with above-average income differs from other groups of countries in the medians of 5 financial indicators (CHE, GGHE \$, PHE \$, PHE%, CHE% GDP) ($p < 0.001$). The medians (CHE, GGHE \$, PHE \$, PHE%) in the above-average income group are lower than in the high-income group and higher than in the below-average income group and in the low-income group ($p < 0.001$). The groups of countries with below average income and low income do not significantly differ in the medians of 5 financial indicators CHE, GGHE \$, PHE \$, PHE%, OOP ($p > 0.05$). However, these groups of countries differ significantly in GNI per capita. In the income group below the average, the GNI per capita is \$ 2370, in the low-income group – \$ 720. However, the 5 financial indicators in these countries do not differ significantly, except for the share of government spending on health (GGHE%) and the share of GDP on health (CHE% GDP). In the group of countries with income below the

average median GGHE% (40.3%) is significantly higher than in the group with low income (23.7%) ($p < 0.001$). Groups of countries with below-average income and a group of countries with low income significantly differ in medians CHE, GGHE \$, GGHE%, PHE \$ from the group of high income and above average ($p < 0.001$). There were no differences in the median PHE% and OOP ($p > 0.05$) in the groups with above-average income, below-average income and low income. The median PHE% (28.2%) and the median OOP (18.4%) are the lowest in the group of high-income countries compared to other groups of countries ($p < 0.001$).

Table II presents separately the Pearson correlation coefficients (r) between GNI per capita and financial indicators in four groups of countries with different incomes. In each group, some differences were found between GNI per capita and financial indicators. In the group of high-income countries, a positive correlation was found between GNI per capita and 4 financial indicators (CHE% GDP (0.38), CHE (0.89), GGHE (0.81), PHE (0.55)) and negative correlation with OOP (-0.41) ($p < 0.05$). In this group there is no correlation between GNI per capita and GGHE% (0.15), PHE% (-0.14) ($p > 0.05$). In the group of countries with above-average income, a correlation was found between GNI per capita and only 2 financial indicators (CHE (0.63), GGHE (0.55)) ($p < 0.05$). Other financial indicators are not correlating with GNI per capita ($p > 0.05$). In the group of countries with below-average income, a positive correlation was found between GNI per capita and 4 financial indicators (CHE (0.68), GGHE (0.64), GGHE% (0.49), PHE (0.39)) and a negative correlation with OOP (-0.283) ($p < 0.05$). In this group, there is no correlation between GNI per capita and CHE% GDP (0.09) and PHE% (-0.281) ($p > 0.05$). In the group of low-income countries, a positive correlation was found only between GNI per capita and GGHE (0.55) and a negative correlation with CHE% GDP (-0.49) ($p < 0.05$). In this group there is no correlation between GNI per capita and other financial indicators. OOP has a negative correlation with GNI per capita in the group of high-income countries and in the group of countries with below-average income ($p < 0.05$). In other groups of the countries correlation was absent ($p > 0.05$).

DISCUSSION

Our study found some differences in health care expenditures in high-income, above-average, below-average, and low-income country groups. Each group is characterized by correlation of GNI per capita and financial indicators of health care expenditures.

The four groups of countries with different incomes differ significantly only in the share of government expenditures in the structure of health care expenditures in the country. Government expenditures play the central role in health care expenditures [7, 10]. In our study, it was found that the structure of health care expenditures in high-income and above-average countries is dominated by government expenditures (71.7% and 58.6%), and in groups of countries with below-average and low-income incomes private expenses predominate (50.5% and 44.5%). According to the literature sources, in low-income countries, private expenditures predominate as well in the structure of health care expenditures [11]. In the group of low-income countries, external funding in the structure of health care expenditures is about 30%. low-income countries spend little on health care, waiting for the arrival of foreign aid [5].

According to Jakovljevic M. et al, in order to achieve index 80 of effective coverage of health services, the combined cost of health care (public, private costs and external assistance) must be at least 1398 dollars per capita. [21] According to our data, such expenditures are observed only in the high-income group and in the above-average income group. To estimate the cost of health care in the country, the share of expenditures in the country's GDP is important. According to the literature, the optimal share of health care expenditures in GDP is 7.55% [19]. In our study, it was found that only in the group of high-income countries, this indicator has a median of 7.605% (6.331-9.975). The lowest median CHE% GDP is in the group of countries with below average income (4.734% (3,532-6,292)). It should be noted that the groups with high income, below average and low income on this indicator do not differ significantly (7.605%, 6.061%, 6.165%) ($p > 0.05$).

In our study, we found that the group of high-income countries differs significantly from other groups in all financial indicators. In this group, the largest GNI per capita (12616 and > US \$) and the highest median current health expenditure per capita (US \$ 2091.5 (1249.3-4012.7), the median government expenditure per capita) (US \$ 2216.4 (1432.5-3657.7), median share of public spending on health care (71.7% (58.8-78.6), median of private spending per capita) (\$ 950.9 (657,7-1335,1)). At the same time, this group is characterized by the lowest median share of private expenditures (28.2% (21.4-41.2) and the median share of expenditures from patients' pockets (18.4%) (12,7-29,5). That means that a high level of GNI per capita provides high government expenditures on health care, low shares of private spending in the cost structure, and low shares of direct spending out of patients' pockets. The obtained results are confirmed by the literature [22, 23].

It is known that the data on the population private expenditures on high quality medical services are a key

indicator of financial protection against the catastrophic consequences of treatment and an indicator of achieving the goals of SDGs [1]. As for literature sources in the European Union, the domestic private expenditures on health care make up about 25% of total expenditures [6]. Almost all countries of the European Union belong to the group of high-income countries. In our study, only in the group of high-income countries, this indicator is 28.2%. Groups of countries with above average income (4086 – 12615 US \$), with income below average (1036 – 4085 US \$) and low income (1035 US \$ and <) do not differ significantly in the share of private health care expenditures (40,2%, 50.2%, 44.5% respectively) ($p > 0.05$). In addition, these groups of countries do not differ in the share of patient direct out-of-pocket expenditures (32.3%, 39.4%, 41.6%) ($p > 0.05$). That means that in these groups the shares of private health care expenditures and the shares of direct expenditures from patients' pockets are almost the same. However, private health care expenditures in dollars per capita in the above-average group (\$ 379.0) differ significantly from those in the below-average income (\$ 113.8) and low-income groups (\$ 47.3) ($p < 0.05$). Private health care expenditures in dollars per capita in groups with below-average and low-income incomes do not differ ($p > 0.05$).

Our research results indicate that in the group of 179 countries GNI per capita significantly affects all financial indicators of health care expenditures in the country ($p < 0.05$). GNI per capita has a positive effect on the share of health care expenditures in GDP, on current health care expenditures, on government expenditures and private expenditures, and also has a negative impact on the share of private expenditures in the structure of health care expenditures health and direct out-of-pocket expenditures ($p < 0.05$).

However, in each group of countries with different GNI per capita, there is a certain difference in financial indicators, as well as a difference in the impact of GNI per capita on health care expenditures. We found a significant impact of GNI per capita on 5 out of the 7 financial indicators in the groups of high-income and below-average income countries. That means that the growth of GNI per capita in these groups of countries will affect almost all financial indicators. The increase in GNI per capita in these groups leads to an increase in current health care expenditures, government expenditures in dollars and the share of government expenditures, private expenditures in dollars, as well as a decrease in the share of direct out-of-pocket patient expenditures. In these groups, GNI per capita does not affect the share of government expenditures and the share of private expenditures on health care. That means that health care expenditures are most dependent on GNI per capita in groups of high-income and below-average income countries.

In other groups, the increase in GNI per capita has a positive effect only on 2 financial indicators (current and government expenditures in dollars) in the above-average income group and on 2 indicators (government

expenditures in dollars and the share of expenditures in GDP) in the low-income group. The increase in GNI per capita does not affect other financial indicators in these groups of countries. That means that in these groups, only government expenditures depend on GNI per capita, while private expenditures and direct out-of-pocket expenditures do not depend on changes in GNI per capita. In addition, in the group of low-income countries, it was found that with an increase in GNI per capita there is a decrease in the share of health care expenditures in the country's GDP.

CONCLUSIONS

The study identified the impact of GNI per capita on health care expenditures in groups of high-income, above-average, below-average and low-income countries. GNI per capita has a significant impact on most financial indicators (5 out of 7) in the high-income and below-average income groups. GNI per capita has a significant impact on only 2 financial indicators, including government expenditures in dollars per capita, in the above-average and low-income groups. The central core of health care expenditures in high-income and above-average countries is government health care expenditures, while in below-average income and low-income groups, private expenditures predominate. The obtained results can be used in strategic planning of health care expenditures in countries with different GNI per capita.

REFERENCES

- Goals in the field of sustainable development. Official UN website. <https://www.un.org/sustainabledevelopment>.
- Global strategy on human resources for health: Workforce 2030/ World Health Organization. 2016. <https://apps.who.int/iris/bitstream/handle/10665/250368/9789241511131-eng.pdf?sequence=1>.
- National Health Workforce Accounts: A Handbook / World Health Organization. https://www.who.int/hrh/documents/handbook_health_workforce_14a.pdf?ua=1.
- Watkins D.A., Yamey G., Schäferhoff M. et al. Alma-Ata at 40 years: reflections from the Lancet Commission on Investing in Health. *The Lancet*. 2018;392(10156): 1434-1460.
- Dieleman J., Campbell M., Chapin A. et al. Evolution and patterns of global health financing 1995–2014: development assistance for health, and government, prepaid private, and out-of-pocket health spending in 184 countries. *The Lancet*. 2017;389(10083):1981-2004.
- Wielechowski M., Łukasz G. Health care financing in the European Union countries – structure and changes. *Acta Scientiarum Polonorum. Oeconomia*. 2020; 19(1):71-80.
- Xu K., Soucat A., Kutzin J. et al. Public Spending on Health: A Closer Look at Global Trends. Geneva: World Health Organization. 2018.
- Dieleman J. L., Campbell M., Chapin A. et al. Future and potential spending on health 2015–40: development assistance for health, and government, prepaid private, and out-of-pocket health spending in 184 countries. *The Lancet*. 2017; 389 (10083): 2005-2030.
- Mackenbach J. P., Looman C.W.N. Life expectancy and national income in Europe, 1900-2008: an update of Preston's analysis, *International Journal of Epidemiology*. 2013;42(4):1100–1110.
- Ke X., Saxena P., Holly A. The determinants of health expenditure: a country-level panel data analysis. Working paper of the Results for Development Institute. WHO. 2011. https://www.who.int/health_financing/documents/report_en_11_deter-he.pdf?ua=1.
- Gerdtham Ulf-G., Bengt J.. International comparisons of health expenditure: Theory, data and econometric analysis, *Handbook of Health Economics*. *Handbook of Health Economics*. 2000;1: 11-53.
- Stepovic M., Rancic N., Vekic B. et al. Gross Domestic Product and Health Expenditure Growth in Balkan and East European Countries—Three-Decade Horizon. *Front. Public Health*. 2020;8:492.
- World Health Organization. Current Health Expenditure (CHE) as Percentage of Gross Domestic Product (GDP) (%). 2020. <https://apps.who.int/gho/data/view.main.GHEDCHEGDP2011REGV?lang=en>.
- Bloom D.E., Cafiero E.T., Jané-Llopis E. et al. The Global Economic Burden of Noncommunicable Diseases. Geneva: World Economic Forum. 2011..
- Jakovljevic M., Jakab M., Gerdtham U. et al. Comparative financing analysis and political economy of noncommunicable diseases. *J Med Econ*. 2019;22(8):722-727.
- Ivanková V., Kotulič R., Gonos J., Rigelský M. Health Care Financing Systems and Their Effectiveness: An Empirical Study of OECD Countries. *Int J Environ Res Public Health*. 2019;16(20):3839. doi: 10.3390/ijerph16203839.
- Raghupathi V., Raghupathi W. Healthcare Expenditure and Economic Performance: Insights from the United States Data. *Front Public Health*. 2020; 8:156. doi: 10.3389/fpubh.2020.00156.
- Wang F. More Health Expenditure, Better Economic Performance? Empirical Evidence from OECD Countries. *Inquiry*. 2015; 52:0046958015602666. doi: 10.1177/0046958015602666.
- Barroy H., Sparkes S., Dale E., Mathonnat J. Can Low- and Middle-Income Countries Increase Domestic Fiscal Space for Health: A Mixed-Methods Approach to Assess Possible Sources of Expansion. *Health Systems & Reform*. 2018;4(3):214-226. doi: 10.1080/23288604.2018.1441620.
- Atun R., Silva S., Knaul F.M. Innovative financing instruments for global health 2002-15: a systematic analysis. *Lancet Glob Health*. 2017;5(7): 720-726. doi: 10.1016/S2214-109X(17)30198-5.
- GBD 2019 Universal Health Coverage Collaborators. Measuring universal health coverage based on an index of effective coverage of health services in 204 countries and territories, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet*. 2020;396(10258):1250-1284. doi: 10.1016/S0140-6736(20)30750-9.
- Musgrove P., Zeramdini R., Carrin G. Basic patterns in national health expenditure. *Bull World Health Organ*. 2002;80(2):134-42.
- Ortiz-Ospina E. Financing Healthcare. Published online at OurWorldInData.org. Retrieved from: '<https://ourworldindata.org/financing-healthcare>'. 2017.

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ORIGINAL ARTICLE

RESEARCH OF THE ACTUAL ENERGY CONSUMPTION OF THE MILITARY PERSONNEL OF THE ARMED FORCES OF UKRAINE TO SUBSTANTIATE THE CORRECTION OF THEIR DAILY DIET

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ABSTRACT

The aim: Is to determine the actual energy costs of servicemen on the qualification course of special operations of the Armed Forces of Ukraine to substantiate the adequate nutritional and energy value of their diet.

Materials and methods: The actual average daily energy consumption of 85 servicemen of the qualification course (hereinafter – Q-course) of special operations of AF of Ukraine was determined by time-table and instrumental methods. By laboratory, calculation and questionnaire methods, the compensatory possibilities of their actual nutrition were assessed.

Results: The data obtained indicate that the highest indicators of energy expenditures among servicemen were during the first phase of selection of the Q-course at the level of an average value of 6853 ± 963.9 kilocalories (hereinafter – kcal) per day. At the same time, the calorie content of actual food consumed only by 55.7% provided compensation for the average daily energy costs.

In this regard, we have developed and implemented "Organizational and Methodological Guidelines for Rational Nutrition of Servicemen of SOF of AF of Ukraine".

Conclusions: The actual nutrition of the military personnel on the Q-course of SOF of AF of Ukraine does not fully compensate for their real energy losses. The nutritional and energy value of the daily diet requires revision and bringing it into line with the actual energy consumption, depending on the preparation phases.

KEY WORDS: Special Operations Forces, qualification course, energy costs, diet

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INTRODUCTION

The features of the professional activities of military personnel present increased demands on their health. First of all, this concerns the divisions of the units of SOF, which undergo special training to solve specific tasks in any conditions [1, 2]. The fulfillment of the most difficult combat and educational-training tasks for this category of servicemen is associated with high daily energy costs due to physical and psycho-emotional stress, which requires adequate food intake for its compensation. Energy costs and their adequate compensation are a significant indicator of the combat effectiveness of personnel [3, 4]. The authors [5, 6] pay special attention to the study of the issue of the energy needs of servicemen during the training process during the training of SOF. At the same time, the problem of compensation of the energy costs of military personnel, including SOF, in the armed forces of foreign countries remains not fully studied.

The above-mentioned issue was mostly not studied at all in Ukraine, since SOF as a separate component of the Ukrainian Armed Forces were created only in 2016 with the support of NATO member countries [7].

In this regard, scientific research was carried out to study the daily energy consumption and the completeness of its replenishment due to the nutrition of the military personnel of the Ukrainian Armed Forces. The research was carried out as part of the planned research work in 2018 – 2019 on the basis of one of the training centers during the qualification course for special operations of the Armed Forces of Ukraine.

THE AIM

Determine the actual energy costs of military personnel on the qualification course for training SOF of AF of Ukraine to substantiate the adequate nutritional and energy value of their diet.

MATERIALS AND METHODS

The training of cadets on the Q-course lasts twenty-three weeks and consists of five phases. The preparation takes place in a continuous cycle, i.e. two courses per calendar year.

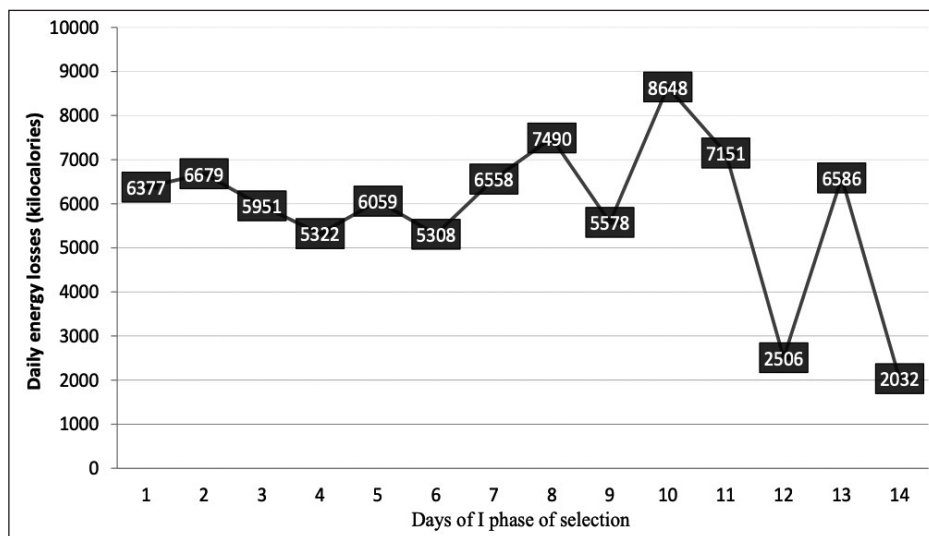


Fig. 1. Average energy losses of servicemen during I phase of Q-course

Scientific research was carried out in three directions. The first investigated the actual average daily energy consumption of servicemen at different phases of the Q-course. For this, the time-table method for determining the daily energy losses was used. The study involved 85 servicemen of the IX qualification course. During the day, the time used for each type of work or rest performed was recorded in detail. At the same time, the tabular coefficient of physical activity corresponding to each type of activity was taken into account, as well as the average indicators of the basic metabolic rate of military personnel, obtained by the calculation method according to the method of WHO [8, 9].

When cadets performed various distance tasks (cross-training, marching, topography with orientation on the terrain, etc.), the time-table method for determining the body's energy losses was supplemented by an instrumental method by using special chest and wrist cardiac sensors from Polar and Garmin.

The second direction of research included the study of the issue of adequacy of replenishing the actual average daily energy expenditure of servicemen on the Q-course at the expense of the diet provided to them. The determination of the indicators of the energy and nutritional value of the daily diet was carried out by the calculation method according to the weekly layouts of the products of the military unit using reference tables of the chemical composition of food products [10]. Selected samples of the daily diet and individual dry rations were analyzed by the laboratory method (the norm is 15 – a daily field set of products). In a laboratory study, the protein content in the selected portions of ready meals was determined by the Kjeldahl method [11], the fat content was determined by the extraction method using the Soxhlet apparatus [12]. The actual amount of carbohydrates was determined by the calculation method [13].

The task of the third line of research was to study, using the questionnaire-survey method, the subjective assessment of the state of their nutrition by servicemen and its compliance with the tasks performed on the Q-course. In total, 111 anonymously completed questionnaires were

received from male military personnel, of which 85 cadets of the qualification course and 26 military instructors. The age range of the respondents was from 20 to 46 years old.

The data obtained was processed using traditional statistical methods. For all data, statistical processing was carried out: descriptive statistics (calculation of arithmetic means for the initial values and percentages, as well as their errors) and checking for normality. Since the data obeyed a normal distribution, the comparison was carried out using the parametric Student's t-test with the calculation of the corresponding t and p.

RESULTS

The determination of the indicators of the average daily energy expenditures of servicemen on the Q-course made it possible to establish that they are a variable value and depend on the training activities performed in different phases of the course according to the training program, as well as on the individual characteristics of the organism of servicemen.

According to our research data, the highest average daily energy expenditures among Q-course cadets were recorded during the two-week phase I of selection, which was caused by the impact of heavy and exhausting physical and mental stress. The characteristic of the average daily energy consumption of servicemen for 14 days of the first phase of the selection of the Q-course is shown in Fig. 1.

Average daily energy consumption for the two-week phase I was 6853 ± 963.9 kcal (excluding two days of rest).

The averaged data of cadets' energy consumption at different phases of the Q-course are shown in Fig. 2.

At the same time, the maximum average daily energy consumption indicators of Q-course servicemen during phase I (6853 ± 963.9 kcal) were statistically significantly higher than the corresponding energy consumption indicators for phases II and IV of the Q-course ($p < 0.01$).

There were no significant differences in the indicators of energy consumption at the I, III, and V phases of the Q-course (Fig. 2), which can be explained by the similarity

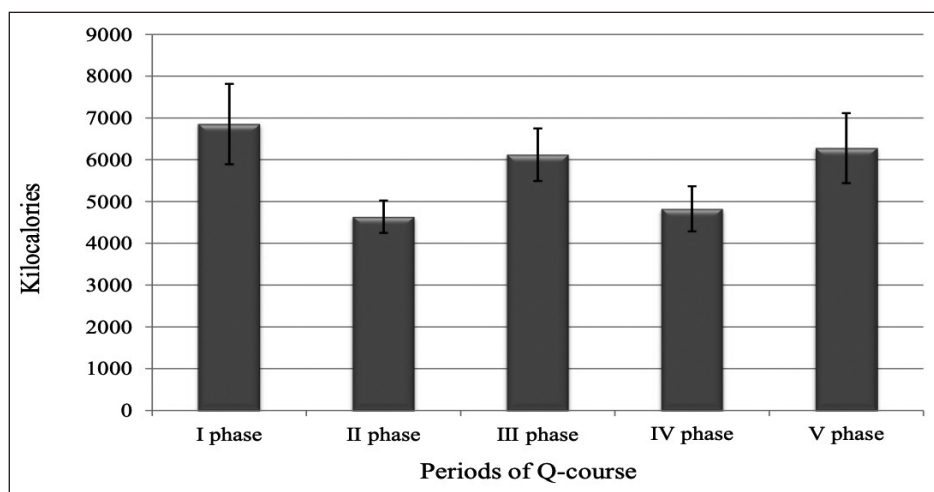


Fig. 2. Average energy losses of servicemen on different phases of Q-course

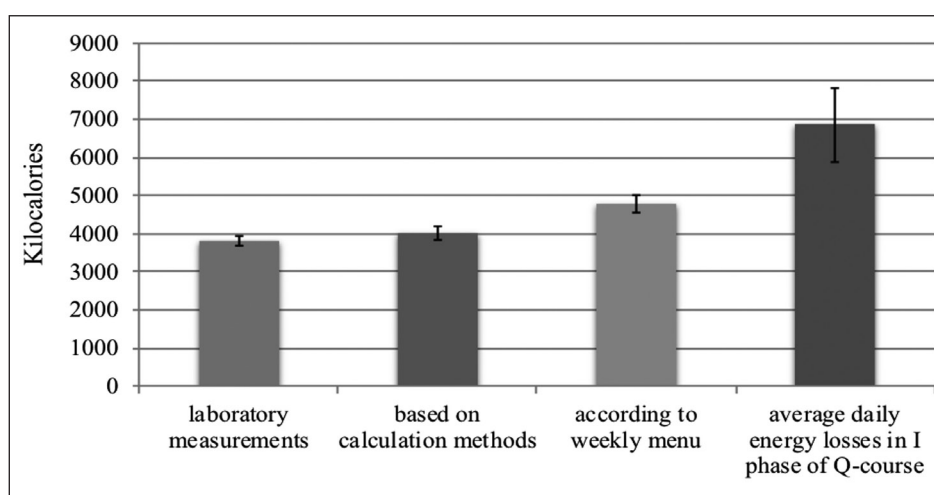


Fig. 3. Average daily data of energy value of actual ration of servicemen compared with energy losses in I phase of Q-course

in the severity and intensity of physical activity in these periods of training. Thus, the obtained indicators of the average daily energy consumption of the Q-course cadets during the III phase of the course amounted to 6120 ± 627.3 kcal, and during the V phase of the final training – 6277 ± 837.2 kcal.

Despite the small difference in the obtained indicators of energy consumption of cadets in phases I, III, and V, the body's reaction to them, obviously, was different, since, at the beginning of the Q-course (in phase I), adaptive mechanisms to new conditions of life were not yet formed. Besides, in the first phase, the body of servicemen was deliberately subjected to great (sometimes maximum possible) physical and stress loads to select the most resilient and healthy ones.

In general, throughout the entire duration of the Q-course, the average daily energy consumption of servicemen amounted to 5741.8 ± 671 kcal.

Taking into account the indicators of the average daily energy consumption of cadets in the II (4635 ± 385.4 kcal) and IV phases (4824 ± 541.3 kcal) of the Q-course, we can talk about the possibility of compensating them by the actual diet according to the Product Catalog (AD) for this category of people, nutritional standards and compliance with the traditional three-time meal plan.

During phases I, III, and V, it becomes necessary to revise the qualitative and quantitative characteristics of the diet to replenish the high (within 7000 kcal) energy costs of the Q-course cadets, as well as to change their diet.

The second direction of research included the assessment of the AD of military personnel during their stay on the Q-course to determine its adequacy to the physical and psycho-emotional loads of cadets and its ability to compensate for real energy costs during the training phases.

It has been established that during training on the Q-course at the training ground of the military unit, the cadets are provided with three hot meals a day, which are prepared in a stationary canteen, and then delivered in thermoses by cooks by motor transport. The food intake by the personnel is organized according to the daily routine in an adapted stationary room, which is equipped with a food delivery line and a dining room. In this case, food for Q-course servicemen is carried out according to the enhanced version (at a price coefficient of 1.2 of the cost of daily food). During the days when the cadets' classes under the Q-course preparation program took place in isolation from the location, food was provided at the expense of norm No. 15 – a daily field set of products (the so-called dry ration).

The results of laboratory studies of AD dishes, which were selected for analysis, indicated that the content of the

Table I. Diet Composition Data Based on Key Nutrients and Calories

Nº	Essential nutrients and energy	Laboratory method	Calculation method	Product layout
1	Proteins, g	166,9±8,7	174,1±12,2	-
2	Fat, g	112,9±14,1	128,8±23,4	-
3	Carbohydrates, g	533,1±49,6	540,1±51,7	-
4	Caloric content, kcal	3815,7±141,2	4015,6±168,4	4776,3±250,7

main nutrients and energy in the studied dishes did not fully correspond to the data obtained by calculation when evaluating the layouts of products.

At the same time, the results of the analysis of the content of basic nutrients and energy in the diets of servicemen of the Q-course revealed a moderate, statistically insignificant decrease in the real content (according to laboratory analysis) of the average statistical indicators of proteins, fats, carbohydrates, and energy value in comparison with the calculated data according to the weekly distribution of products (Table I), which testifies to the incomplete correspondence of the AD of military personnel to the established nutritional composition of the distribution of products, determined by the calculation method.

The reason for the incomplete correspondence of the indicators of the nutrient (proteins, fats, carbohydrates) composition and energy value is most likely a violation of the cooking technology.

Since during phase I the servicemen experienced the greatest (for all periods of the Q-course) need to compensate for energy costs due to adequate food intake, more attention was paid to the comparative analysis between the used and consumed energy by cadets in this phase.

Comparison of the data of the average daily calorie content of the cadets during the I phase, indicated in the weekly layout of the products of the military unit, with the results of analyzes using laboratory and calculation methods against the background of the actual average daily indicator of energy costs in this phase are shown in Fig. 3.

A statistically significant difference of more than 20% ($p < 0.01$) was found between the real ones, i.e. laboratory-confirmed indicators of the energy value of AD (3815.7 ± 141.2 kcal) and declared in the layouts of the products of the military unit (4776.3 ± 250.7 kcal) during the first phase of training.

In addition, the results of laboratory analysis revealed a significant ($p < 0.001$) difference between the indicators of the energy value of the AD consumed and the average daily energy expenditures of military personnel with the greatest physical and psycho-emotional stress during the 14-day phase I of the selection of the Q-course (6853 ± 963.9 kcal), indicating only partial (by 55.7%) replenishment of energy due to the daily diet. At the same time, a negative energy balance arises in the body, which can pose a threat to the health of cadets, cause a decrease in physical and mental performance, and contribute to the negative impact of adverse environmental factors on the body.

When assessing the actual nutrition of military personnel throughout the entire duration of the Q-course of SOF of AF of Ukraine, the calculation method for the layouts

of products established statistically significant ($p < 0.01$) difference between the indicators of the average daily energy consumption with food (4424.7 ± 135.5 kcal) and the average daily indicators energy consumption during the course duration (5741.8 ± 671 kcal).

During field trips, more than 1 day apart from the base camp, Q-course servicemen are provided with daily field food kits – Daily Field Set of Products – Diet (DFSP – D) in an assortment (from DFSP – D1 to DFSP – D14) with a caloric value of at least 3500 kcal [14].

DFSP – D is designed to provide adequate nutrition during the day, in conditions where cooking hot food is impossible. It consists of assorted ready-to-eat meals in four-layer retort bags that ensure the safety and quality of food for 24 months.

On days when nutrition was carried out in an autonomous mode exclusively due to individual dry rations, an energy imbalance appeared in the cadets' bodies, since the daily energy value of DFSP – D averaged 3600 kcal, which statistically significantly ($p < 0.01$) differed from the average daily energy consumption for all periods of the Q-course – 5741.8 ± 671 kcal.

In the third direction of research, the results of questioning the cadets of the Q-course showed that only $12,3 \pm 9,7\%$ of them were completely satisfied with the food, while $73,9 \pm 17,4\%$ were only partially satisfied ($p < 0,001$), and $13,8 \pm 10,7\%$ were not completely satisfied ($p > 0,05$).

The reason for this, according to $53,6 \pm 22,4\%$ of the respondents, was the insufficient variety of prepared dishes. At the same time, the majority of candidates ($86,2 \pm 10,7\%$) noted satisfaction with the taste properties of food. However, only $2,4 \pm 2,1\%$ of the respondents believed that the food provided to them can fully compensate for their physical activity, while $59,5 \pm 21,7\%$ of the respondents ($p < 0,05$) noted that such food only partially compensates for the load. $44 \pm 22,2\%$ of candidates constantly, and $31,4 \pm 19,4\%$ – quite often ($p > 0,05$) had a feeling of hunger between meals in the first phase of selection. Disorders in the work of the gastrointestinal tract after eating were indicated by $47,1 \pm 22,4\%$ of the respondents, in a third of whom they appeared in the form of heartburn.

$43,2 \pm 22,1\%$ of the respondents spoke in favor of the need for a complete revision and change of nutrition on the Q-course, $53,1 \pm 22,4\%$ – for a partial revision of the daily diet ($p > 0,05$). According to $68 \pm 19,6\%$ of respondents, it is necessary to introduce new food products and dishes into the diet to expand the range of food consumed $62,5 \pm 21,1\%$ of candidates insisted on the necessity of introducing vitamin and mineral complexes in addition to food. When

asked which food groups it is advisable to improve the daily diet, 81,5±13,6% of the respondents noted confectionery, 71,4±18,4% – fruits (berries) and nuts, 52,9±22,4% – dairy products, 47,1±22,4% – natural juices, 40±21,6% – meat and meat products, 24,3±16,6% – vegetables.

DISCUSSION

As a result of the research, the real energy costs of servicemen on the Q-course of SOF of AF of Ukraine were determined for the first time, which made it possible to reveal the inconsistency of their actual power supply to full compensation of energy costs. This issue demanded an immediate solution to bring the nutritional and energy value of the Q-course servicemen's nutrition to adequate, relatively their energy consumption, indicators.

Therefore, based on the results obtained, we have developed, approved, and introduced into the practical activities of the command of SOF of AF of Ukraine “Organizational and methodological guidelines for the rational nutrition of servicemen of SOF of AF of Ukraine”, which set out the basic requirements for their nutrition on the Q-course of SOF of AF of Ukraine. The Guidelines substantiate the nutritional and energy needs of servicemen, reflect the differences in the nutrient composition of the daily diet associated with high physical and psycho-emotional stress at various stages of training. The results of the work made it possible to develop daily rations adequate to the actual energy consumption, as well as to propose for practical use new approaches to the organization of diet and drinking regimes for cadets on the Q-course of SOF of AF of Ukraine.

All of the above allows us to conclude that the set goals of scientific research have been achieved. However, to carry out such research in the future in the Armed Forces of Ukraine, it is necessary to develop a methodological and material base, since our research was characterized by cumbersomeness and laboriousness, which created certain difficulties for their implementation under time constraints.

At the same time, the prospects of these studies, in our opinion, are beyond doubt, since it is the indicators of the actual energy consumption of servicemen that should be the basis for substantiating the physiological needs of different categories of military specialists in nutrients and energy, followed by the formation of appropriate compensating food rations, which will allow to preserve their health and combat effectiveness at the proper level.

CONCLUSIONS

1. The actual diet of servicemen from the average daily (for the entire Q-course) energy value of 4424.7 ± 135.5 kcal does not fully compensate for their average daily energy consumption during their stay on the course (5741.8 ± 671 kcal).
2. Nutritional and energy value of the daily diet requires revision and bringing it into line with the actual energy consumption of Q-course servicemen, depending on the phases of training.

3. Fulfillment of the provisions of the “Organizational and methodological guidelines for the rational nutrition of servicemen of SOF of AF of Ukraine” developed by us will eliminate the nutritional and energy deficit of the actual diet of the Q-course cadets, and, consequently, preserve their health and combat effectiveness.

REFERENCES

1. Naumov Yu. Enciclopedia specnaza stran mira [Encyclopedia of special forces of the world]. – H.: Family Leisure Club Publishing House. 2011; 629 p. (in Russian).
2. Furtes O.O. Komplektyvannia syl specialnykh operacii: peredovyi dosvid inozemnykh armii [Completion of special operations forces: advanced experience of foreign armies]. Bulletin of the National University “Lviv Polytechnic”. 2010; 670: 177–183. (in Ukrainian).
3. Margolis L.M., Rood J., Champagne C. et al. Energy balance and body composition during us army special forces training. *Appl. Physiol. Nutr. Metab.* 2013; 38: 396–400.
4. Tharion W.J., Lieberman H.R., Montain S.J. et al. Energy requirements of military personnel. *Appetite.* 2005; 44: 47–65.
5. Margolis L.M., Crombie A. P., McClung H. L. et al. Energy Requirement of US Army Special Operation Forces During Military Training. *Nutrients.* 2014; 6(5): 1945–1955.
6. Palamar B.I., Gruzieva T.S. Criteria of economic effectiveness of preventive measures of chronic non-infectious diseases. *Wiadomości Lekarskie.* 2018; 71: 897–906.
7. Zakon Ukrainy “Pro vncennyya zmin do deyakych zakoniv Ukrainy schodo Syl special'nykh operacii Zbroynykh Syl Ukrainy” № 1420-VIII vid lypnya 16, 2016 [Law of Ukraine “On Amendments to Certain Laws of Ukraine Concerning the Special Operations Forces of the Armed Forces of Ukraine” № 1420-VIII from June 16, 2016]. Bulletin of the Verkhovna Rada of Ukraine. 2016; № 31: 546 p. (in Ukrainian).
8. Lyapin V.A., Solomka T.N., Kovalenko E.V. Gigienicheskaya ocenka pitaniya: ychebnoe posobie [Hygienic assessment of nutrition: a tutorial]. Omsk: Publishing house of Siberian State University of Physical Culture. 2012; 136 p. (in Russian).
9. Tsypryan V.I., Velyka N.V., Yakovenko V.G. Metodyka ocinky harchovogo statusu lyudyny ta adekvatnosti indyvidyval'nogo harchyvannya [Methods for assessing human nutritional status and adequacy of individual nutrition]. Teaching method. 1999; 60 p. (in Ukrainian).
10. Skurikhin I.M., Volgareva M.N. Himicheskyyi sostav pischevyykh prodyctov: spravochnik [Chemical composition of food: a reference book]. Book 1: VO “Agropromizdat”; 1987, 223 p. (in Russian).
11. Myaso i mysoprodykty. Metody opredeleniya belka: GOST 25011-2017 [Meat and meat products. Protein determination methods: state standart]. Moscow: Standartinform; 2017, 14 p. (in Russian).
12. Myaso i mysoprodykty. Metody opredeleniya zhira: GOST 23042-2015 [Meat and meat products. Methods for determination of fat: state standart]. Moscow: Standartinform; 2016, 11 p. (in Russian).
13. Yatsula G.S., Slobodkin V.I., Bereza V.Ya. et al. Sanitarno-gigienicheskie metody issledovaniya pischevyykh prodyctov i vody [Sanitary and hygienic methods of study of food and water]. *Zdorov'ya.* 1991; 288 p. (in Russian).
14. Raciony dobovogo polyovogo nabory prodyktiv – DPNP-R. Texnichni umovy TU U 10.8-00034022-201:2018 [Rations of daily field set of products – DFSP – D. Technical conditions 10.8-00034022-201:2018]. Valid from 04.10.18. Ministry of Defense of Ukraine. 2018, 45 p. (in Ukrainian).

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ORIGINAL ARTICLE

VALUE ATTITUDE TO HEALTH AS THE BASIS OF AN ACTIVE LIFE POSITION OF AN INDIVIDUAL

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ABSTRACT

The aim: Studying of the aspects that influence the formation of future teachers' values to health as the basis of an active life position of an individual.

Materials and methods: To update the didactic aspects of the problem, we used the methods of analysis of normative and scientific sources, system analysis and generalizations, the results of our own empirical studies, materials of the questionnaire, active modeling of students' health value formation.

Results: The formation of a value attitude to the problem of health in future teachers is carried out under the following conditions: awareness of the importance of the value of health; changing the attitude of the individual to his/her own health and the health of others; knowledge of the factors influencing health, a conscious desire to lead a healthy lifestyle and make efforts to care for health, the use in the educational process of the operational model of forming students' value attitude to health by mastering the content of the course "Health-saving technologies in education" in order to form the ability of a systematic understanding of health-saving activities.

Conclusions: The formation of the value attitude of teachers to the problem of health involves taking into account all components of health and is possible provided within the condition of continuity of educational impact on the individual.

KEY WORDS: health attitude, physical education, motivation, mental health

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INTRODUCTION

It is an indisputable fact that health is the basis and necessary condition of human life. Health is the most important value for a person. And just as indisputable is the maxim about the importance of forming a valued attitude to health. The interest in health is due to the tendency to deteriorate in today's complex socio-economic and environmental conditions [1]. Health is one of the most important indicators of the quality of education. The need of society to train preschool teachers who are able to implement the health paradigm in their own professional activities, implies the need to form in students a valued attitude to health. The concept of «values of health» includes the following positions [2,3]: mastering the content of this concept, understanding it as an important characteristic of socio-economic and cultural development of society, as well as the values of human existence; mastering the means and methods of preserving, shaping and strengthening their own health and the health of children;

active dissemination of the idea of health care among children, parents, teaching staff; improvement of knowledge, skills and abilities in the field of physical education and rehabilitation.

We are convinced that the formation of a valued attitude to health, as well as responsibility for individual health is a medical and pedagogical problem [4, 5]. After all, in sight of modern research in the field of philosophy, medicine, psychology, pedagogy is a person whose foundation of life is health [5, 6, 7].

THE AIM

The aim of the work was to study the aspects that affect the formation of future teachers' value attitude to health as the basis of an active life position. The hypothesis of the study is that an active life position of an individual can be formed by means of values to health, as the main component of human existence. Therefore, we need to determine the conditions for the formation of values of teachers to the problem of health. These include exploring the importance of health value to future educators; a change in an individual's attitude to his own health and the health of others as a result of mastering the knowledge of the factors that affect him, to explore the issues of motivation and conscious desire to lead a healthy lifestyle.

MATERIALS AND METHODS

To update the didactic aspects of the problem, we used the methods of analysis of normative and scientific sources, system analysis and generalizations, the results of our own empirical studies, materials of the questionnaire, active modeling of students' health value formation.

To achieve the aim of the research, we have conducted experimental task, during complying which we considered a belief that students' acknowledged and value relation to health depends on several factors.

The study was carried out in compliance with the main provisions of the ICH GCP and the Declaration of the

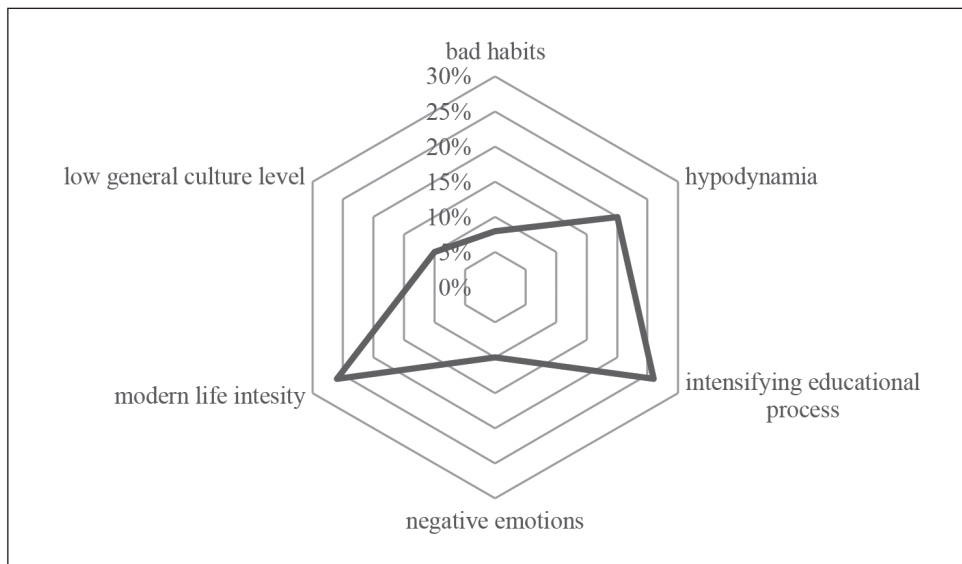


Fig. 1. Social factors which affect health (according to students' survey results)

World Medical Association “Ethical Principles for Medical Research with Human Involvement as an Object of Study” (Seoul, 2008), Council of Europe Convention for the Protection of Human Rights and Dignity of the Human Being with regard to the Application of Biology and Medicine, UN Convention on the Rights of the Child, the current regulations and laws of Ukraine, “Ethical principles of research among children and adolescents”, approved by the Sociological Association of Ukraine, the main provisions of the International project «Health Behaviour in School-aged Children» (HBSC).

An essential component of compliance with the requirements of the survey technology was the preservation of anonymity and confidentiality of student responses. School leaders have been warned that confidentiality will be maintained for each school.

We conducted experiments using empirical method of conducting scientific pedagogical researches, that is, survey method. We chose half-open type survey (except for choosing an answer, the respondents could also express their own point of view).

To process results we used mathematic registration method, which allowed revealing certain qualities in the analyzed phenomena. Statistical assessment methods were used, namely the Mann–Whitney U-test rank criterion for comparing students' attitudes to health at different times intervals. To improve clarity and convenience of further findings analysis we used graphical method of representing experimental data. We also used methods of hypothesis, systemic analysis and generalizing, which allowed drawing conclusions in our research.

RESULTS

Let's consider results of the first stage. To define conscious and value attitude in students to their own health and children health, and also their readiness to imply physical and wellness activity in future, we conducted an experimental research in form of survey, including 357 students

from different regions of Ukraine, who chose profession of preschool education. All the respondents (100%) consider up-to-date issues of health value as a basic being value and necessity to form and maintain it since early age. Unfortunately, not all the students are aware that implementing health preserving activity mostly depends on pedagogue's professional competence.

As for social factors, 10% of respondents named as one of the reasons low level of general educational culture. 26% respondents defined as a reason for negative health state impact intensity of modern life. In their answers, 20% respondents talked about hypodynamia as a negative factor. 8% respondents mentioned their bad habits (smoking) that affect health. 10% respondents pointed out as one of the important negative factors negative emotions (irritability, hatred, aggressiveness). 26% respondents believe that their health is affected by intensifying educational process (a lot of tasks which have to be done with the computer etc.).

Answers to the second survey part on the first stage shaped out issues of powerful means to maintain and enforce physical health. Most of the students consider such means to be physical exercises, good nutrition, sticking to daily timetable. Most students defined their health as satisfactory (93%), but morning exercises systematically do only 14%.

Main reasons which hinder systematical physical trainings are considered by students to be: learning load, work and learn, absence of facilities to do physical trainings, inability for rational timing, absence of motivation (Fig.2).

Survey results enabled to find out that students do not pay enough attention to search and analysis of information on means of forming and maintaining their own physical and mental health, which, in turn, is a ground for further proficiency. Meanwhile, we state that future pedagogues lack skills of critical analysis for related information and enriching with it their life and professional experience. Also, they lack a specific need for looking for such information, which is shown by lack of sufficient motivation level for some 17%. Survey findings analysis singles out

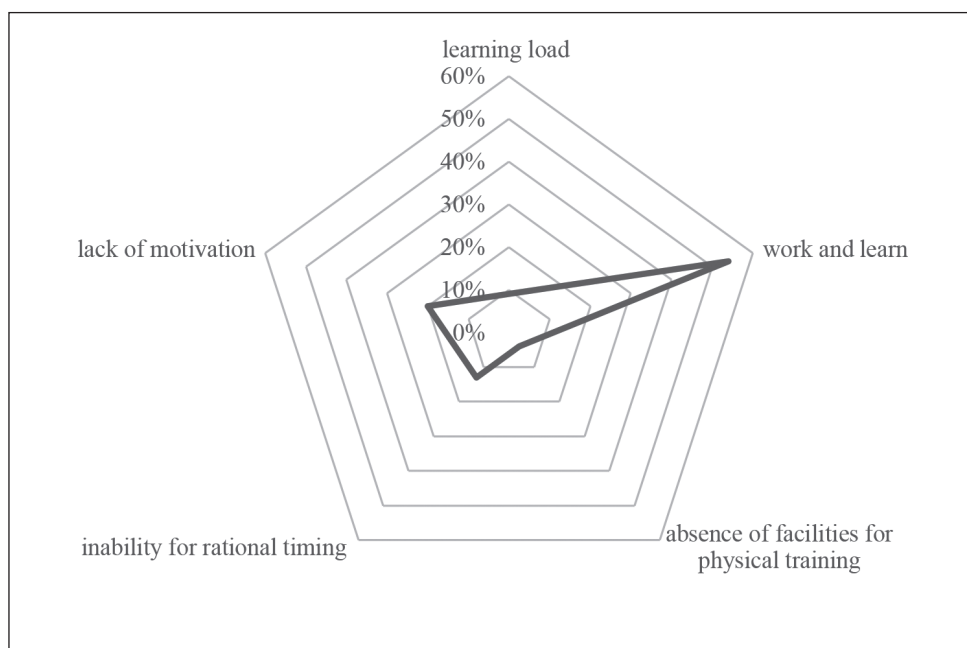


Fig. 2. Main reasons which hinder systematical physical trainings (according to students' survey)

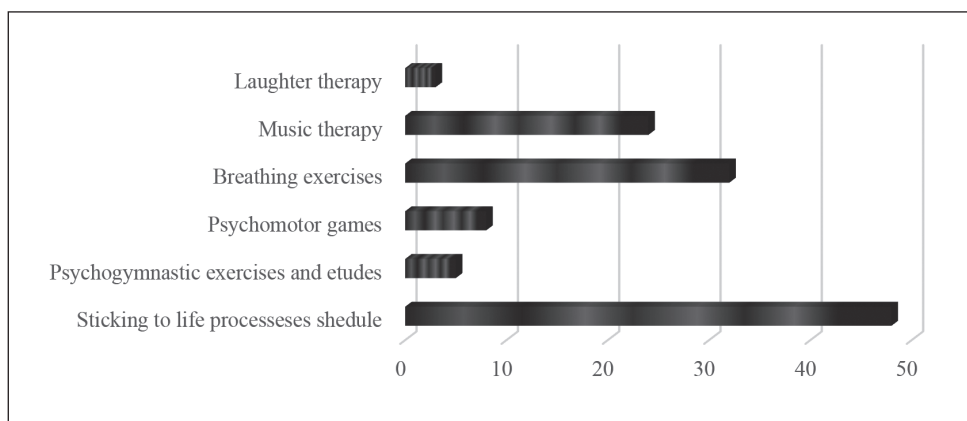


Fig. 3. Means and methods of preserving and forming mental (intellectual and emotional) children's health in preschool education institutions

an issue of consideration conditions and pedagogical instruments in future pedagogues value relation to health forming process, on the example of educational subjects teaching, in particular, methods of physical education for preschool children.

When we found out level of student's knowledge on means and methods of forming and preserving mental (intellectual and emotional) children's health in preschool education institutions on the first stage, the results were low (Fig.3).

Such methods as psych gymnastic exercises and etudes, psychomotor games and laughter therapy appeared [8] to be little-known among the students. Among the most well-known were sticking to life processes schedule, breathing exercises and music therapy, but the general knowledge indicator among the students was very low.

Second stage results. After students learned course Methods of physical education of preschool children, all the respondents answered to first survey block, that one of the human and community well-being factors is health as an integrative human being quality. In particular, received indicators allow us to make a conclusion about views

change on key factors which affect health. After studying the course, students defined as more important factors: hypodynamia and low general culture level. General increase by these factors was 11% and 9% respectively. This result proves unquestionable educational impact onto forming views and relations, because educational contents and direction of the course focused not only on forming professional competence, but also on worldview rethinking of health preserving issue.

Another factor to pay attention to is negative emotions [9]. Factor increase level is 6%, which proves insufficient students' recognizing the importance of emotional health forming, which is reflected in emotional reactions and adequate behavior. Thus, we can draw a conclusion, that students do not fully recognize, that to realize wellness life position it is important to exclude from own behavior self-destroying habits and negative thinking.

An interesting factor to our consideration is decrease in level of parameters: modern life intensity and educational process intensifying [10]. These changes prove positive impact in forming professional competence in future pedagogues during studying the course Methods of physical

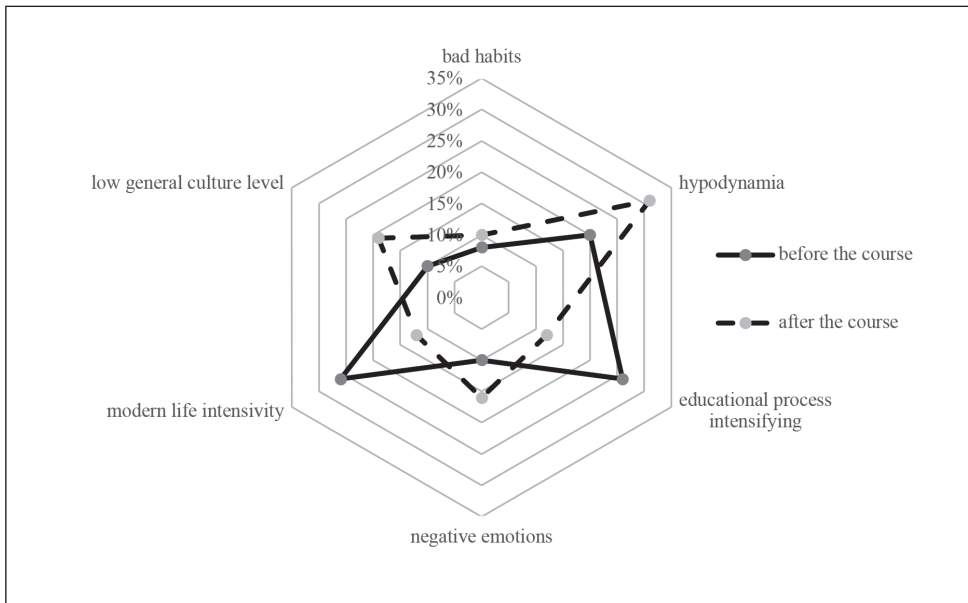


Fig. 4. Social factors that affect health level (according students' survey before and after the course)

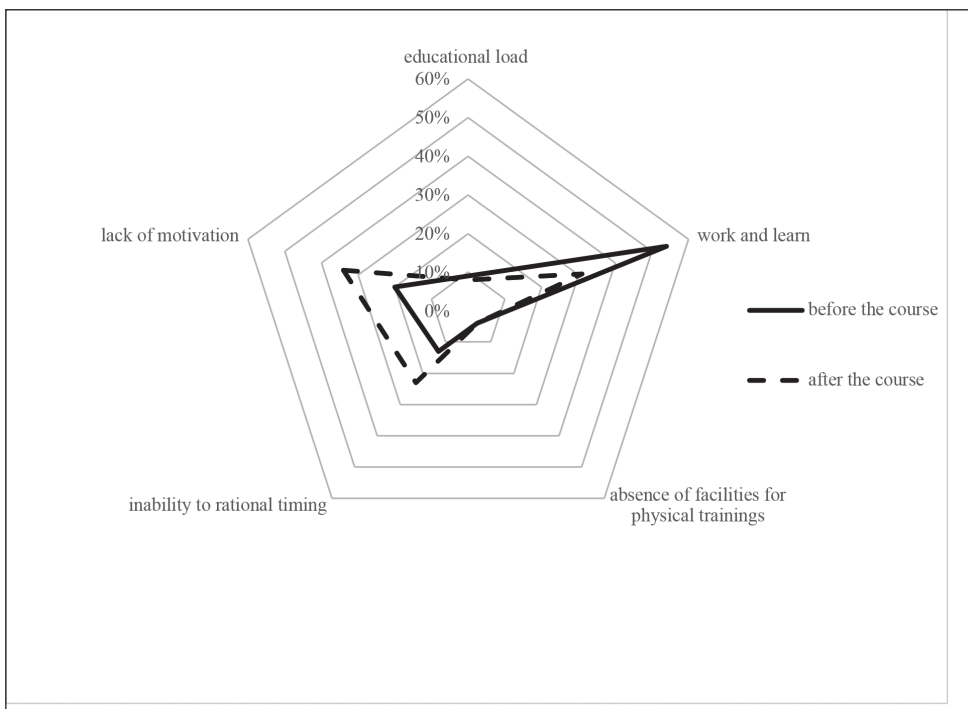


Fig. 5. Main reasons which interfere systematic physical trainings (according to students' survey results before and after the course).

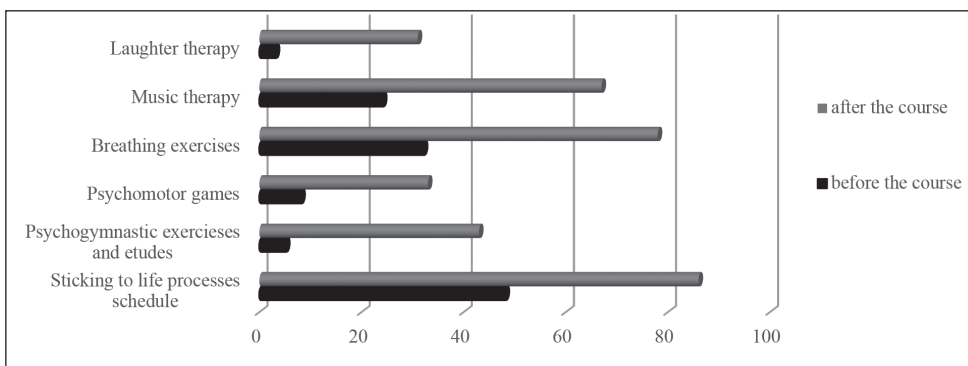


Fig. 6. Means and methods of preserving and forming mental (intellectual and emotional) children's health in preschool education institutions

education of preschool children [11]. Most of the students note, that modern life pace and educational process intensifying are not key factors which affect health level. Graphical

manifestation of relation change about influence of social factors onto health level is given below (Fig. 4).

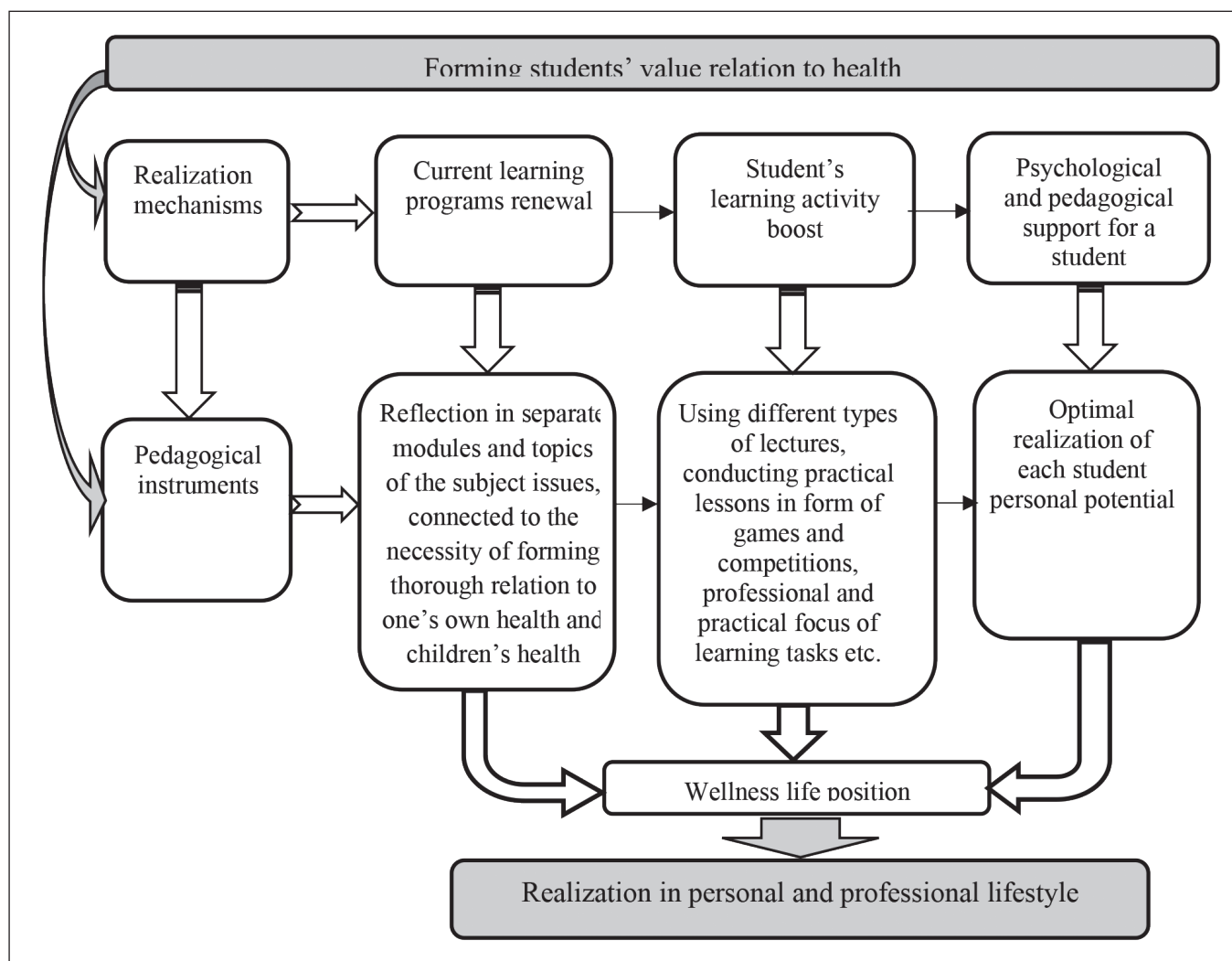


Fig. 7. Model of forming students' value relation to health..

The number of respondents, who know about ways of gathering information on health preserving and forming and physical development, is 39%. However, this index shows that students do not pay enough attention to studying the results of modern researchers' works and preschool education institutions pedagogues on health preserving.

Comparative analysis of responds to survey second part questions showed that most of the students believe physical culture to be an influential mean to form and enforce health, full physical development, increasing organism workability. On the other hand, take systematical physical exercises began only 24% respondents, which is 6% more than at the start of the experiment. Main drawbacks to systematic physical trainings majority considers work and learn and lack of motivation, although the tendency on these parameters is drastically opposite. The increase in these parameters was 14% and 10% respectively. In turn, such result can be explained by gaining professional knowledge in the branch of physical culture lessons organizing process. Indicators of relations shift in this issue are presented below (Fig. 5).

It is interesting to know that 85% respondents consider physical culture and wellness work with children in pre-

school education institution surroundings to be a priority direction, as health and full physical development are the basis to child's development as a personality.

In response to the third survey part 32% respondents mentioned that they cannot in full prepare effective means of impact on children's physical development and provide adequate psychological and pedagogical follow-up for different physical education work form. This index proves insufficient level of students' knowledge in professional activity bases in the branch of children's physical education and wellness, mastering the system of skills in preschool children physical education methods.

The issue of forming mental health in preschool children by means of health preserving technologies is processed only by 56% of students, although all the respondents understand the importance of providing psychological comfort. The results of students' knowledge in fields of breathing exercises, music therapy, psychomotor games, psychogymnastic etudes etc. rose, but none of the indexes reached 100%, which proves relative negligence in students' relation to this issue (Fig. 6).

Comparative analysis of responds results to the third part questions of the first and second surveys showed the fol-

lowing results: most of the students understand importance and necessity to provide psychological comfort for their own health and children's health. However, average number of respondents having some knowledge about mental health forming increased only to 36% comparing to 20%.

A significant part of respondents (65%) do not think about the importance of complex usage of children physical education means and appropriate connection of health preserving technologies in order to provide complex impact onto a child. Because of lack of professional and life experience students cannot acknowledge the fact that the more varied physical education and wellness means are used in preschool education, the more dynamic and effective will be the process of optimal health forming and providing full personal development of the child be.

In terms of our research we should note that students changed their opinion on the importance of having information on means of preserving and forming own physical and mental health and children's health. They note a certain need in search for such information to enrich educational experience. Although, we have to say, that the students are not really motivated to search the information on health preserving in modern scientific sources and preschool education practice analysis [12].

It is positive that most of the students realize prioritizing physical culture and wellness work with children in preschool education institution surroundings. It is connected to processing contents component of the subject Methods of physical education of preschool children, carrying out practical lessons in a preschool education institution, and passing pedagogical practice [13, 14].

We found out that a significant part of respondents do not respect complex usage of children's wellness means and cannot properly estimate facilities to perform physical education and wellness of the children. It is related to the fact that the students have only a limited teaching experience and lack professional experience in preschool education institution surroundings.

According to the results, not all the students realize that performing health preserving activities mostly depends on pedagogue's professional competence.

It explains the fact that it is necessary to increase education quality, enforce professional and practical aspect of students' training, provide facilities to transform theoretic knowledge into effective practical actions.

DISCUSSION

Research analysis points out the issue of necessity to develop forming mechanisms in students of acknowledged value relation to health forming issue [15].

Let's look at conditions and pedagogical tools of forming future pedagogues' value relation to health on the example of teaching the subject Methods of physical education of preschool children.

First, it is working learning programs contents renewal, including course methods of physical education for preschool children. This subject has to change modern

preschool education relation to a child, which presupposes conditions for optimal active lifestyle with high health level. In process of teaching a subject it is important not only to provide facilities to form skills of performing different activities form in children's physical education and wellness. To realize this task effectively it is crucial to form in future pedagogues the responsible relation to their health and children's health.

Motivation of forming students' health issue value relation is psychological and pedagogical support in process of self-development and self-establishment. That is why it is expedient to solve such tasks comprehensively taking into account the basic mechanisms of formation and development of the personality by means of the pedagogical tools used in educational process (Fig. 7).

Effectiveness of achieving future pedagogues' professional training tasks in the field of health preserving depends on educational process organization. Main contents of the course focuses on forming professional activity grounds, which is based on the interest to physical culture as an important wellness means, responsibility for health, processing adequate wellness skills and ability to provide a child with psychological and pedagogical support. It is logical, that acknowledging by future pedagogues' health value as a fundamental being value is a powerful means of gaining professional experience.

CONCLUSIONS

Students' professional experience processing in making an effective influence on health preserving and forming supposes effective organization of learning activities. Taking into account contents and educational direction of the subject, it is utterly important to form students' ability to consciously perceive material, critical thinking, and hypothesis making skill.

Using various practical tasks benefits to forming not only professional skills system, but also understanding and processing learning material, it's appropriate and effective usage in different professional situations.

It is critical for forming students' professional experience to form their skills to learn and analyze modern scientific researches results in the field of children's physical education and health, physical culture and wellness practice. We are convinced, that the ability to estimate psychological and pedagogical bases of children's physical education and wellness realization technology would benefit to processing and readiness to create optimal conditions to perform health preserving activity in preschool education institutions.

According to the research results we drew a general conclusion that the main factor of sticking to healthy lifestyle is defined by students as a desire to be healthy. The habit of taking care of own health should be formed since early years, so that health becomes one of the main needs throughout the whole life. Realization of proposed mechanisms and pedagogical tools of forming students' value relation to health during the course benefits to improvement their mastering of the knowledge system in the

field of theory and methods of children's physical education and wellness, as well as practical skills to organize and carry out physical culture and wellness events and providing psychological support in children's different activity types.

Future preschool education pedagogues' professional training system supposes their mastering of a skills system necessary to provide optimal conditions of preschool children education and development. Besides, another task of this training is forming future pedagogues' practical skills in organizing educational process, which is grounded on an important rule – interconnection and interrelation between children's education, development and health.

REFERENCES

- Määttä S., Lehto R., Nislin M. et al. Increased health and well-being in preschools (DAGIS): rationale and design for a randomized controlled trial. *BMC Public Health*. 2015;15:402.
- Bohinich O. Priorityty u sferi fizychnoho rozvytku dytyny doshkilnoho viku. Optymizatsiia fizychnoho rozvytku dytyny u vitchyzniani systemi osvity [Priorities in the field of physical development of a child of preschool age, Optimization of the child's physical development in the domestic education system]: a monograph. Zaporizhzhia: Zaporizhzhya Regional Institute of Postgraduate Teacher Education. 2010, p.124-148. (in Ukrainian).
- Lisnevskaya N.V. Pedagogichni umovy stvorennia zdoroviazberihaiuchoho seredovyscha v doshkilnomu navchalnomu zakladi [Pedagogical conditions for creating a healthy environment in a preschool institution]. Institute of Education Problems The National Academy of Educational Sciences of Ukraine. Kyiv. 2016. (in Ukrainian).
- Gruzjeva T. S., Galienko L.I., Pelo I. M. et al. Health and lifestyle of students' youth: status, problems and ways of solution. *Wiadomości Lekarskie*. 2018;71(9): 1753-1758.
- Palamar B. I., Vaskivska H. O., Palamar S. P. Didactic aspects of cognition of human as a bio-psycho-socio-cultural personality. *Wiadomości Lekarskie*. 2017;70(5): 959-963.
- Harashchenko L. Shliakhy vdoskonalennia fakhovoi pidhotovky maibutnikh vykhovateliv do zdoroviazberizhuvalnoi diialnosti [Ways to Improve the Training of Future Educators to Health-Saving Activities]. *Bulletin of Luhansk Taras Shevchenko National University. Pedagogical Sciences* 2020;7 (338): 195 – 201. doi: 10.12958/2227-2844-2019-1(324)-2-195-201. (in Ukrainian).
- Vaskivska H. O., Palamar S.P., Kondratiuk S.G. et al. Psychodidactic determinants of the development of children of preschool age. *Wiadomości Lekarskie*. 2018;71(6): 1207-1215.
- Kondratiuk S., Kushnir I. Teoretychni osnovy vykorystannia ihor psykholohichnoho spriamuvannia v roboti z ditmy doshkilnoho viku [Application of psychologically aimed games in preschool education institution, theoretical basis]. *Educological discourse*. 2020; 3: 92-106. doi: 10.28925/2312-5829.2020.3.7. (in Ukrainian).
- Vaskivska H.O., Palamar S.P., Vlasenko O.M. Health in the civic students' value system: empirical analysis. *Wiadomości Lekarskie*. 2019;72(10): 1947-1952.
- Harashchenko L. Rozvytok idei zdoroviazberizhennia u fizychnomu vykhovanii ditei v doshkilnykh zakladakh Ukrainy (druga polovyna XX – pochatok XXI stolittia) [The development of the healthcare idea in physical education of children in preschools in Ukraine (the second half of XX – the beginning of the XXI century)]. Borys Grinchenko Kyiv University. Kyiv. 2014. (in Ukrainian).
- Palamar S., Nezhyva L., Vaskivska H. et al. Health-Saving Competence of Future Primary School Teachers: Indicators of Development III International Scientific Congress Society of Ambient Intelligence. 2020;129: 307-315.
- Andriushchenko T.K. Teoretyko-metodychni zasady formuvannia zdoroviazberizhuvalnoi kompetentnosti v ditei doshkilnoho viku [Theoretical and methodological principles of formation of health competence in preschool children]. South Ukrainian National Pedagogical University named after K. D. Ushynsky, 2015. (in Ukrainian).
- Bielenka H., Bohinich O., Mashovets M. *Zdorovia dytyny – vid rodyny* [Child's health – from the family]. Kyiv: SPD Bohdanova A. 2006. (in Ukrainian).
- Harashchenko L., Polovina O. Eco-education of children of pre-school age: health-security approach. Volume 3. *Sciencce Publishing*. London. 2019: 281: 93-105.
- Bobyrytska V. I. Theoretical and methodological bases of formation of healthy way of life for future teachers in the process of science study. Institute of Pedagogy and Psychology of Vocational Education Academy of Educational Sciences of Ukraine. Kyiv. 2006. (in Ukrainian).

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ORIGINAL ARTICLE

MELATONIN AND GRHELIN AS “EARLY” PROGNOSIS MARKERS OF PROGRESSION OF ARTERIAL HYPERTENSION AND OSTEOARTHRITIS IN THE CASE OF THEIR COMORBIDITY

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ABSTRACT

The aim: Of the study was to investigate the effect of melatonin on the serum levels of ghrelin in patients with hypertension combined with osteoarthritis in order to identify them as informative and reliable markers of early diagnosis of progression of these comorbid diseases.

Material and methods: To achieve the goals and objectives of this study, 60 patients with hypertension combined with osteoarthritis were involved and examined, in particular, serum ghrelin and melatonin levels were determined twice and divided into two groups.

Results: It was found that in patients of group I on the background of the four-week main course of treatment with the addition of melatonin (3 mg 1 time per day before bedtime), the average value of ghrelin increased by an average of ± 2.05 ng/ml ($p < 0.05$). In patients of group II, who, in addition to their usual treatment, did not receive additional melatonin, the dynamics of ghrelin growth was lower, on average increased by ± 0.54 ng/ml ($p < 0.05$). It was also found that the higher the BMI, the lower the serum ghrelin in the examined patients ($r = -0.56$, $p < 0.01$).

Conclusions: The data obtained show the correlation between ghrelin and melatonin concentrations ($r = +0.72$, $p < 0.001$) in patients with hypertension associated with OA. Therefore, indicators of their levels can be used as “early” reliable prognostic markers of development and progression of these mentioned comorbid pathologies.

KEY WORDS: hypertension, osteoarthritis, melatonin, ghrelin, body mass index

Wiad Lek. 2021;74(3 p.II):697-701

INTRODUCTION

Today, the most important health problem of the population of Ukraine in terms of non-communicable diseases are diseases of the circulatory system (CS), among which arterial hypertension (AH) occupies a leading place. It is known that it is the “trigger” of almost all pathologies of the human heart and blood vessels, as well as a risk factor for serious illnesses or complications that lead to significant social and economic consequences.

Another major cause of disability and invalidity in the world, after cardiovascular disease, is joint disease, especially osteoarthritis (OA), the clinical manifestations of which are observed in almost 20% of the world's population. OA, along with coronary heart disease (CHD), alcoholism, diabetes, and depression, are among the 5 diseases that cause the long-lasting health problems [1].

Restriction of physical activity in patients with OA is known to be an important factor in increasing the risk of cardiovascular disease (CVD) and obesity. Chronic pain, causing a neuroendocrine response, is often the cause of complications in patients with CVD. This may be due not only to the common pathogenetic mechanisms of OA development, but also to the use of nonsteroidal anti-inflammatory drugs (NSAIDs) used to treat it.

Osteoarthritis is often pathogenetically associated with components of the metabolic syndrome (MS) (insulin resistance, type II diabetes, obesity, hyperlipidemia, hypertension and coronary heart disease), which accelerates the progression of joint pathology. The combined course of these diseases is an important medical and social problem even in economically developed countries, in connection with which the study of clinical and pathogenetic features of the combination of OA with MS is particularly relevant [2].

In this regard, researchers are now paying considerable attention to the biochemical and molecular mechanisms underlying the development of the above pathologies. Their efforts are aimed at early detection of these diseases and the appointment of adequate comprehensive therapy.

Modern scientific sources have shown that low plasma ghrelin levels are associated with insulin resistance and hypertension and may affect blood pressure (BP). The inverse dependence of ghrelinemia and insulin resistance was also determined: the higher its level, the less pronounced insulin resistance [3]. Thus, low levels of ghrelin may be an indicator of the risk of type II diabetes and hypertension, which confirms the relevance of our study.

Despite the presence of a wide range of highly active drugs, which in accordance with clinical protocols and

recommendations are prescribed for the treatment of hypertension (ACE inhibitors, angiotensin II receptor blockers, calcium antagonists, diuretics, etc.), as well as the use of high-tech surgical advances (implants cardiac resynchronization therapy, etc.), the search for new effective and at the same time safe means of pharmacotherapy and highly informative and reliable biomarkers of the studied pathologies continues [4]. On the one hand, this is due to the prediction of an increase in the incidence of hypertension in the world, lesion due to this pathology of other organs and systems, combined with OA, and on the other – insufficient study of molecular targets and mechanisms of individual sensitivity to drugs of different composition.

In our opinion, one of the possible variants of the pathogenetic approach to the treatment of this combined pathology may be melatonin, which is known to act as a biological clock and cardioprotector, and also has antiischemic and antihypertensive effects [5], regulates blood pressure, heart rate (HR), coronary and cerebral circulation. In addition, it has been experimentally demonstrated that melatonin has a chondroprotective potential and may be involved in the pathogenesis of OA due to its effect on circadian rhythms of chondrocytes [6].

THE AIM

The aim of our study examine the effect of melatonin on the serum levels of ghrelin in patients with arterial hypertension combined with OA, in order to identify them as informative and reliable markers of early diagnosis of the progression of these comorbid diseases.

MATERIALS AND METHODS

In accordance with the purpose and objectives of our dissertation research, a total of 130 patients of different ages and genders, patients with hypertension and OA were examined. Of these, 60 patients had arterial hypertension combined with OA, who were divided into two groups. Thus, group I consisted of 30 patients with arterial hypertension combined with OA, who took melatonin for a month, in addition to the main treatment. Group II included 30 patients who had comorbid conditions of arterial hypertension and OA and who were not given melatonin in their usual treatment. AH without concomitant OA was observed in 30 patients who made up group III. Group IV included 30 people with OA without concomitant arterial hypertension. The control group consisted of 10 healthy people.

The study described in this article involved 70 patients ($n = 70$ (100%)), of whom 60 were people of different ages (65.7 ± 1.3 years) and sex (47 women, 13 men) with AH, combined with OA, and the following average office blood pressure: systolic blood pressure (SAT) – 147.34 ± 3.24 mm Hg, diastolic blood pressure (DBP) – 88.18 ± 2.15 mm Hg, pulse (PBP) – 72.4 ± 1.35 beats/min. At the same time, the combination of diseases lasted for more than five years.

Criteria for inclusion of patients in the study were: verified diagnosis of hypertension stage II, 1 – 2 degrees in

combination with a verified diagnosis of OA Ro-stage II, SFK I – II. The study did not include patients with concomitant autoimmune diseases, stage III hypertension, heart failure (FC III – IV), OA X-ray stage III – IV, as well as those who took corticosteroids or cyclosporine before the study or planned to take them during its holding. There were no smokers among the subjects. NSAIDs were not a criterion for exclusion from the study groups. The control group consisted of 10 healthy people.

Patients were examined according to the study program, in particular, serum ghrelin and melatonin levels were determined twice and divided into two groups. The first group consisted of 30 patients with arterial hypertension combined with OA, who agreed to take melatonin in addition to the main treatment for a month. The second group consisted of 30 people who had comorbid diseases with arterial hypertension and OA and who were not supplemented with melatonin in their usual treatment. The control group consisted of 10 healthy people. All patients voluntarily agreed to participate in the study.

Determination of ghrelin concentration in the serum of patients was performed using a set of reagents Human GHRL (ghrelin) ELISA Kit (Elabscience, USA) by enzyme-linked immunosorbent assay according to the instructions using a multichannel microspectrophotometer AutoPlex ELISA & CLIA Anayzer (92980) (Monobild, USA).

The concentration of melatonin in the serum of patients was determined using a set of reagents Melatonin ELISA (IBL International, Germany) enzyme-linked immunosorbent assay according to the instructions using a multi-channel microspectrophotometer AutoPlex ELISA & CLIA Anayzer (92980) (Monobild, USA).

In addition, all subjects were determined body mass index (BMI) by the method of Kettle: the ideal indicator – $18.5 - 24.9$ kg / m², excess body weight – $25 - 29.9$ kg / m², obesity I – $30.0 - 34.9$ kg / m²; obesity II degree – $35 - 40$ kg / m², obesity III degree – more than 40 kg / m².

In addition, the relationship between BMI and serum ghrelin levels was determined.

All obtained data were processed by methods of variation statistics using the program Statistica 10.

RESULTS

According to the study plan, melatonin and ghrelin levels were first determined in 60 patients with combined pathology. Then, in addition to the main treatment, patients of group I were prescribed a monthly course of melatonin at a dose of 3 mg / day, and it was recommended not to drink alcohol, coffee and drugs that affect the melatonin-forming function of the pineal gland (corticosteroids, cyclosporine). All patients in this group were re-tested for serum melatonin and ghrelin levels after completion of melatonin therapy. Patients in group II also re-determined the following indicators.

In the course of the research it was found that in patients of group I on the background of the four-week main course of treatment with melatonin, the average value of ghrelin

Table I. Melatonin and ghrelin levels in the serum of patients with arterial hypertension combined with OA (M±m)

Indicator	Group I before treatment n = 30 (42.8%)	Group I after treatment n = 30 (42.8%)	Group II before treatment n = 30 (42.8%)	Group II after treatment n = 30 (42.8%)	Control n = 10 (14.3%)
Melatonin, pg/ml	38.88±5.16*	120.52±5.84 **	58.51±7.37*	72.77±9.10**	125.43±8.13
Ghrelin, ng/ml	2.31±0.08*	4.36±0.09 **	3.07±0.16*	3.64±0.10**	4.64±0.05

Note: * - the difference is significant compared to almost healthy individuals ($p < 0.05$). ** - the difference is significant compared to the rate in persons before treatment ($p < 0.05$).

Table II. Correlation between melatonin and ghrelin levels in the serum of patients with arterial hypertension combined with OA

Group	Correlation coefficient (r)	Significance level (p)
Group I	0,72	< 0,001
Group II	0,59	< 0,01

increased from 2.31±0.08 ng/ml to 4.36±0.09 ng/ml, i.e. an average of 2.05 ng/ml ($p < 0.05$). In patients of group II, who, in addition to their usual treatment, did not receive additional melatonin, the dynamics of ghrelin growth was lower: its rate increased from 3.08±0.16 ng/ml to 3.62±0.10 ng/ml (on 0.54 ng/ml) ($p < 0.05$).

The level of melatonin in patients of group I before treatment averaged 38.88±5.16 pg/ml, after – 120.52±5.84 pg/ml, and their difference was 81.64 pg/ml ($p < 0,05$). At patients of group II the indicator of level of melatonin at the beginning of research made 58.51±7.37 pg/ml, and after – 72.77±9.10 pg/ml (their difference – 14.26 pg/ml) ($p < 0,05$). The results of the study are given in Table I.

As you can see, the data in Table I and indicate a good effect of the proposed therapy, as the concentration of ghrelin in the serum of patients in group I increased by 57% and approached the control group. And in the serum of patients of group II, the concentration of ghrelin increased by only 15%, which confirms our hypothesis. The dynamics of ghrelin levels is shown in Fig. 1.

Table 2 shows the results of a study of the relationship between melatonin and ghrelin in the serum of patients with hypertension associated with OA, after the addition

of melatonin to the main treatment (group I), and without the addition of melatonin to the main treatment (group II).

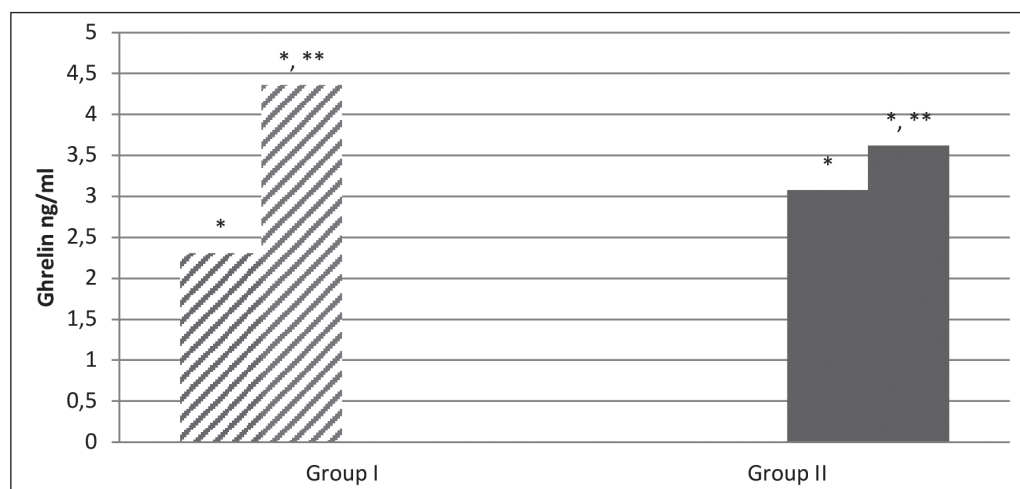
The dependence of the concentration of ghrelin on the level of melatonin in the serum of patients of group I is given in Fig. 2.

The image in Fig. 2 shows that the level of ghrelin is directly related to the level of melatonin, which, in our opinion, allows us to use them as "early" markers of development and progression of these comorbid pathologies.

The data in Table II show that the correlation coefficient (r) between the studied indicators for group I was +0.72 – a direct strong connection, which gives grounds to talk about the effectiveness of adding melatonin to the main treatment. It is assumed that in the case of cardiovascular pathology, the manifestations of cardioprotection of melatonin are associated with antioxidant, antistress, antidepressant properties, as well as immunomodulatory effects of the drug.

The average value of BMI in the subjects is 30.76±0.54 kg/m², which is much higher than normal (N = 18.5-24.9). Overweight was found in 43.3% of patients, grade I obesity in 41.7%, grade II obesity in 10%, grade III obesity in 3.3%. BMI was within the norm in only 1.7% of subjects. In the control group, the average BMI was 22.27±0.72 kg/m². The distribution of patients with hypertension combined with OA, according to BMI is shown in Fig. 3.

The study found that the higher the BMI, the lower the serum ghrelin in the examined patients ($r = -0.56$, $p < 0.01$). This also indicates that ghrelin plays an important role in the pathogenesis and clinical course of such comorbid pathologies as hypertension and OA.

**Fig. 1.** Dynamics of ghrelin levels.

Note: * – the difference is significant compared to almost healthy individuals ($p < 0,05$). ** – the difference is significant compared to the rate in persons before treatment ($p < 0.05$).

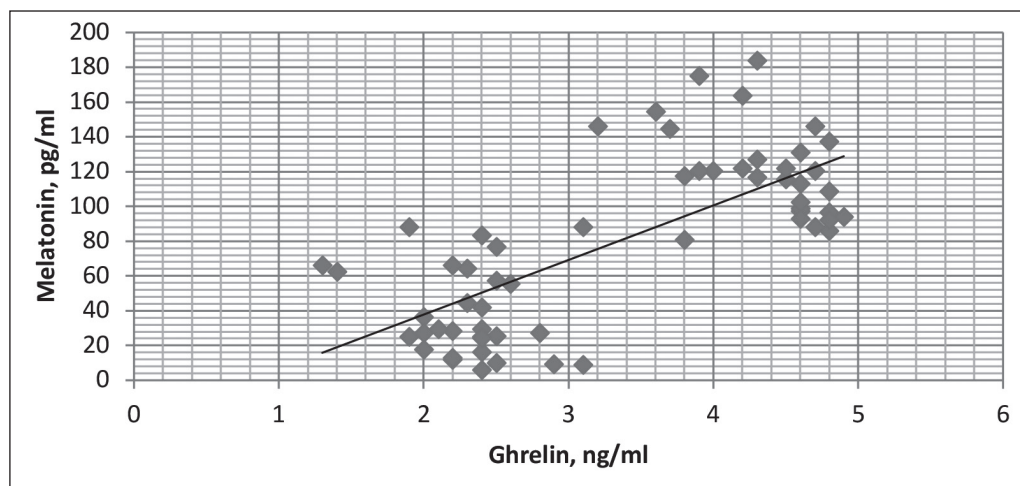


Fig. 2. Dependence of ghrelin concentration on the level of melatonin in the serum of patients of group I.

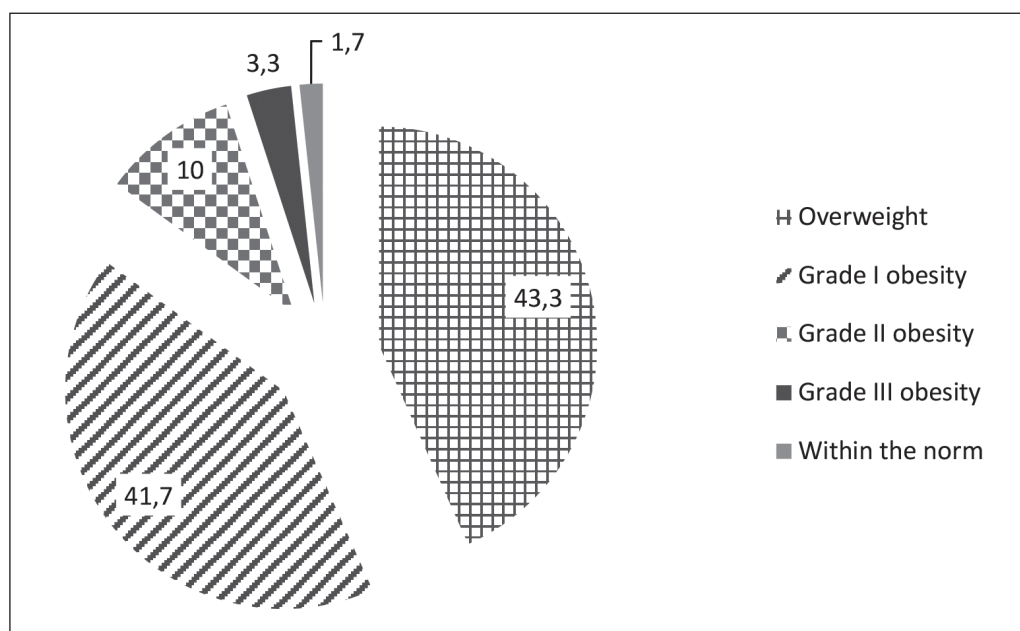


Fig. 3. Distribution of patients with hypertension combined with OA, according to BMI.

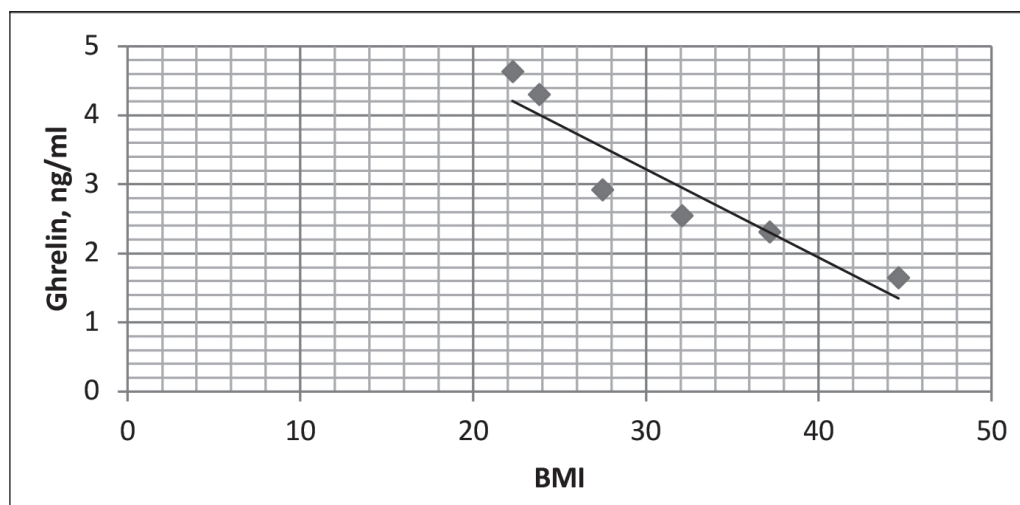


Fig. 4. Relationship between BMI and serum ghrelin levels.

The dependence of ghrelin levels in the serum of the studied patients (n = 70 (100%)) on BMI is shown in Fig. 4. Consequently, ghrelin levels are inversely related to BMI in patients.

DISCUSSION

It is known that ghrelin regulates energy metabolism and human eating behavior. It, as a gastrointestinal hormone, has various biological properties and effects: it stimulates

the release of growth hormone, improves appetite, causes anabolic effects, affects carbohydrate metabolism and the work of the cardiovascular system [7]. It is this set of functional properties and led to our interest in this hormone.

We would like to note that according to scientific sources, and the results of our research, ghrelin levels are inversely correlated with body mass index (BMI), body fat index, obesity, leptin, obestatin and insulin levels, adipocyte count [8]. It is known that ghrelin increases in response to weight loss due to low-calorie diets, lifestyle modifications, cancer cachexia, neuropsychiatric anorexia, chronic insufficiency – heart, kidney, liver. Ghrelin levels are thought to increase during fasting and have an antidepressant effect. The vasodilatory effect of ghrelin and its participation in the regulation of systemic hemodynamics and blood pressure have also been established. The hormone reduces the manifestations of endothelial dysfunction in patients with metabolic syndrome by increasing the bioavailability of nitric oxide [4]. In case of weight gain, the level of ghrelin in the blood decreases.

Given all the above, we decided that it would be appropriate before this study for all patients to determine BMI to establish the relationship between BMI and serum ghrelin levels.

CONCLUSIONS

1. The obtained data indicate the correlation between concentrations of ghrelin and melatonin ($r = +0.72$, $p < 0.001$) in patients with hypertension associated with OA.
2. The role of ghrelin in the pathogenesis of hypertension combined with OA is important and obvious.
3. Indicators of ghrelin and melatonin levels can be used as "early" reliable prognostic markers of development and progression of the mentioned comorbid pathologies.
4. Melatonin (3 mg 1 time a day before bedtime), as a component of complex therapy of arterial hypertension combined with OA, facilitates the course of these diseases due to its cardioprotective, antihypertensive and chondroprotective effects.
5. Ghrelin level correlates with BMI in patients with arterial hypertension combined with OA ($r = -0.56$, $p < 0.05$). Further studies of the effect of ghrelin and melatonin on the course of arterial hypertension and OA in the case of their comorbidity will help to improve treatment tactics and thus positively affect the quality of life of patients, reduce the number of cases of disability.

REFERENCES

1. Moroz A. V. Problema komorbidnosti u khvorykh na osteoartroz [The problem of comorbidity in patients with osteoarthritis]. Krymskyi terapevtychnyi zhurnal. 2013;2:149-156. (in Ukrainian).
2. Ilashchuk T. O., Sobko D. I. Arterialna hipertenzia ta osteoartroz: osoblyvosti poiednanoho perebihu (ohliad literatury) [Arterial hypertension and osteoarthritis: features of a current circumstances (literature review)]. Klinichna ta eksperymentalna patolohiia 2019;1(67):113-120. (in Ukrainian).
3. Bol'shova O. V., Malinov's'ka T. M. Serum Ghrelin level in adolescents with hypothalamic dysfunction associated with obesity. In: International Conference on Childhood Obesity. Lisbon; 2017, 89 p.

4. Zaichenko H. V., Horchakova N. O., Savchenko N. V. et al. Hrelin yak potentsiinyi biomarker ta likarskyi zasib [Ghrelin as a potential biomarker and drug]. Visnyk problem biolohii i medytsyny. 2020;1(155):39-44. (in Ukrainian).
5. Dorohoi A. P. Melatonin – osnovnyi hormon perednoi doli epifizu (shyshkovydnoi zalozy). Biolohichne i klinichne znachennia hormonu v kardiolohichnii praktysi [Melatonin – main hormone of anterior lobe of the epiphysis (pineal glandular). Its biological and clinical significance in cardiological practice]. Ukrainian Journal of Cardiology. 2006;2:96-102. (in Ukrainian).
6. Humeniuk O. V., Stanislavchuk M. A., Zaichko N. V. Osoblyvosti klinichnogo perebihu osteoartrozu kolynnykh suhlobov zalezno vid rivnia ekskretsii 6-sulfatoksymelatoninu z secheiu [Features of the clinical course of osteoarthritis of the knee joints depending on the level of excretion of 6-sulfatoxymelatonin in the urine]. Halytskyi likarskyi visnyk. 2018;25(3):7-11. (in Ukrainian).
7. Kudriavtsev A. A. Rol ta mistse hrelinu v patolohii zakhvoriuvan orhaniv shlunkovo-kyskovoho traktu [The role and place of ghrelin in the pathology of diseases of the gastrointestinal tract.]. Skhidnoevropeyskyi zhurnal vnutrishnoi ta simeinoi medytsyny. 2019;2:90-100.
8. Varela L., Vázquez M. J., Cordido F. et al. Ghrelin and lipid metabolism: key partners in energy balance. J Mol Endocrinol. 2011;46(2):43-63. DOI: 10.1677/JME-10-0068.

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ORIGINAL ARTICLE

RESOURCES TO IMPROVE THE EFFECTIVENESS OF PERIODONTAL TREATMENT IN PATIENTS WITH DIABETES MELLITUS

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ABSTRACT

The aim: Is to characterize the «Medico-sociological map» developed by us to identify systemic and local risk factors for periodontal disease in patients with type I and II diabetes mellitus as a resource to improve the treatment of generalized periodontitis.

Materials and methods: We have developed a Medic-sociological map to identify systemic and local risk factors for periodontal disease in patients with type I and type II diabetes mellitus. Methods of accumulation of primary dental and endocrinological information, review and analytical methods. Statistical methods for comparing empirical data and their generalization.

Results: Thanks to the «Medico-sociological map» developed by us, systemic and local risk factors for the development of periodontal tissue diseases in patients with type I and II diabetes mellitus have been identified. Factors for improving the well-being of patients in the treatment of periodontal diseases have been comprehensively studied. Patients with type 1 and type 2 diabetes mellitus have been shown to give up healthy habits (cigarette smoking) and lead a healthy lifestyle and reduce the health risks that can be caused by generalized periodontitis in combination with diabetes mellitus.

Conclusions: It has been demonstrated that resources to improve the effectiveness of periodontitis treatment in patients with diabetes mellitus include not only cooperation with endocrinologists, but also our «Medico-sociological map» to identify systemic and local risk factors for periodontal disease in patients with type I and II diabetes mellitus.

KEY WORDS: periodontitis; diabetes mellitus; «Medico-sociological map»

Wiad Lek. 2021;74(3 p.II):702-707

INTRODUCTION

Periodontitis as a concomitant disease of people suffering from type I and II diabetes mellitus has become a much more serious problem in recent decades, the elimination of which requires large efforts not only dentists but also specialists in endocrinology. The current concept of diabetes mellitus care treats comorbidities as an integral part of such people's lives.

Adequate adaptation of dental patients in the process of gradual treatment of periodontitis on the background of diabetes mellitus is increasingly largely moving into the plane of competence of dentists [1]. In patients with periodontitis, the microcirculation in the small vessels of the periodontium deteriorates, i.e. – the transport of oxygen and nutrients is disrupted, it is difficult to excrete the final products of metabolism [2]. In this context, bad habits are considered as a factor that provokes and causes additional comorbidities of people with periodontitis, patients with type I and II diabetes mellitus [3; 4].

In the course of the study, 156 patients were examined, of which 118 agreed to record information on the positions provided by our «Medico-sociological map». Thus, 75.64% of dental patients agreed to cooperate with the further use of information provided about themselves in order to increase the effectiveness of treatment and prevention of periodontal disease.

THE AIM

The aim is to characterize the «Medico-sociological map» developed by us to identify systemic and local risk factors for periodontal disease in patients with type I and II diabetes mellitus as a resource to improve the treatment of generalized periodontitis. To show that the cooperation of dentists with endocrinologists, who examine and treat dental patients with diabetes mellitus, gives a tangible positive dynamics of recovery and preservation of human health, even against the background of bad habits.

MATERIALS AND METHODS

According to the review of available electronic content, the structure and functionality of medical cards of a dental patient are studied, which are managed both in public medical institutions and in private dental clinics and specialized dental offices. In the process of performing this work, system-review, analytical methods, as well as methods of comparison, extrapolation and generalization are used.

The literature sources in which the conditions and the reasons promoting treatment and prevention of diseases of periodontal fabrics at patients with a type II diabetes mellitus are investigated are analyzed [5]; cause functional disorders of the stomatognathic system [6] and problems of general somatic pathology [7]; deepened by recession

Table I. The results of monitoring the average weekly blood glucose levels in the treatment of generalized periodontitis in patients with type I and type II diabetes mellitus.

Weeks	Minimum	Maximum	Average	The standard deviation	Coefficient of variation
1 st	5.800	12.300	7.918	1.884	0.238
2 nd	5.400	11.300	7.733	1.487	0.192
3 rd	5.200	10.100	7.185	1.220	0.170
4 th	5.000	10.100	7.045	1.267	0.180
Decryption of data (in percent)					
Mmol/l	Weeks				
	1 st	2 nd	3 rd	4 th	
<6.0	12.12	12.12	24.24	21.22	
6.0–6.5	15.15	12.12	3.03	15.15	
6.6–7.0	12.12	3.03	21.22	18.18	
7.1–7.5	12.12	24.25	24.24	12.12	
7.6–8.0	21.22	18.18	6.06	12.12	
8.1–8.5	6.06	6.06	9.09	9.09	
8.6–9.0	–	9.09	3.03	3.03	
9.1–9.5	–	–	3.03	3.03	
9.6–10.0	6.06	3.03	3.03	3.03	
10.1–10.5	–	6.06	3.03	3.03	
10.6–11.0	–	3.03	–	–	
11.1–11.5	6.06	3.03	–	–	
11.6–12.0	6.06	–	–	–	
12.1–12.5	3.03	–	–	–	

of the gums [8], etc. Researchers note: in the complex treatment of severe periodontal disease in patients with type II diabetes mellitus, it is advisable to use pectin in the form of an oral agent, a hygienic prophylactic agent and a drug that forms a dosage form with prolonged exposure in the oral cavity; treatment of periodontal tissue diseases in severe manifestations can correct the level of capillary plasma glucose and blood pressure in patients with type II diabetes mellitus; the immediate results of treatment of periodontal tissue diseases depend on complex treatment, significantly reducing the aggressiveness of both periodontitis and diabetes mellitus [5, p. 108].

Based on the materials and applied research methods, an algorithm for creating a «Medico-sociological map» as an innovative tool for improving the effectiveness of dental care for patients with type I and II diabetes mellitus was developed. This map is also designed to capture psychological characteristics [9] and provides control over the timeliness of screening [10] as an important stage in the examination and treatment of dental patients with type I and II diabetes mellitus.

RESULTS

We consider the establishment, development and preservation of subject-subjectivity in communication with

patients to be important in our dental practice. An open and interested dialogue «dentist – patient» increases the flow of informative interactions. As a result, quality contact is established and the patient's trust in the dentist's personality, in his professional preventive advice, in the process of treatment of periodontal diseases is increased. Patients with type I and II diabetes mellitus react sharply to such professional activity and communicative behavior of a dentist. These patients need not only professional treatment of periodontal diseases, but also special attention and complicity. The belief that a modern dentist should be just that, prompted us to develop a special «Medico-sociological map» to identify systemic and local risk factors for periodontal disease in patients with type I and II diabetes mellitus, which would also be a resource to improve treatment generalized periodontitis.

To this end, many questions have been implemented in the «Medico-sociological map», the answers to which give a much broader picture of patients. Here are the empirical data for only some positions.

Importance for patients of generalized periodontitis treatment in a dental clinic (only 27.12% of respondents go to the dentist; 30.51% do not pay attention to this problem; others are treated with folk remedies).

The attitude of patients to the presence of surrounding symptoms of generalized periodontitis (bleeding gums, bad

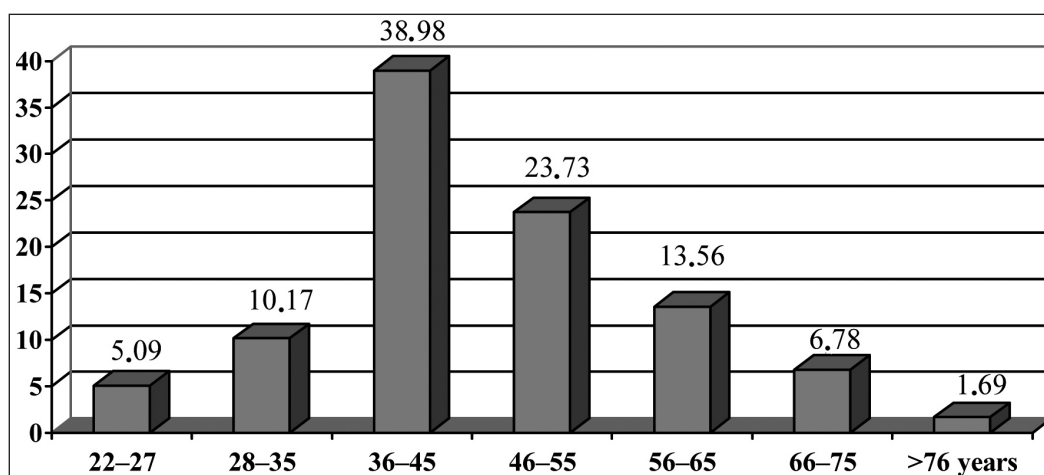


Fig. 1. Distribution of dental patients by age groups.

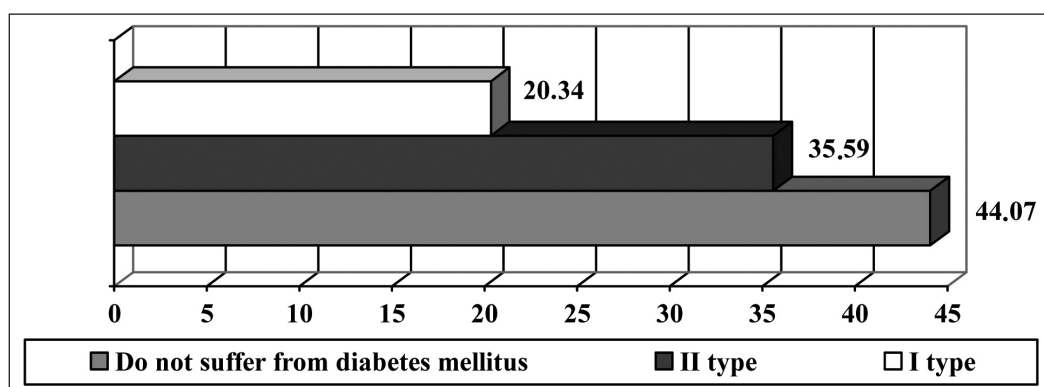


Fig. 2. Distribution of dental patients who are ill and do not have diabetes mellitus.

breath, facial appearance, etc.) (20.34% of respondents said they were indifferent to such symptoms).

Patients' trust in dentists (5.00% indicated a very high level of trust; 37.29% – high; 44.07% – average; 13.56% – below average; no one said they did not trust dentists).

The degree of adherence by patients to the advice of dentists on the prevention and treatment of generalized periodontitis (5.08% indicated a very high degree of confidence; 49.15% – high; 35.59% – average; 8.47% – below average; 1.69% – very low).

Patients' awareness of the dependence of tooth loss on stress (62.71% admitted that stress negatively affects the dental picture; 33.90% admitted that they never thought about it; 3.39% did not answer).

Awareness of patients with diabetes mellitus type I and II dependence of tooth loss on diabetes mellitus (91.67% of respondents diagnosed with type 1 diabetes mellitus are aware of this dependence; among surveyed patients diagnosed with type 2 diabetes mellitus are aware of this dependence 76.19 %).

Awareness of patients with diabetes mellitus type I and II complications of periodontitis from the presence of diabetes mellitus (100.00% of respondents diagnosed with «type I diabetes mellitus» are aware of this dependence; among surveyed patients diagnosed with «type II diabetes mellitus» are aware of this dependence 95.24 %).

The «Medico-sociological map» allows us to monitor the average weekly blood glucose levels in the treatment of generalized periodontitis in patients with type I and

type II diabetes mellitus (Table I). The recorded data are subject to careful analysis in order to determine the optimal algorithm for the treatment of generalized periodontitis in patients with type I and type II diabetes mellitus and, if necessary, providing operative consultations by an endocrinologist.

The study also found that most dental problems were in patients aged 36 to 45 years (38.98% of the total number of those who sought dental care). For comparison, in Fig. 1 provides information on dental problems in patients of different ages.

It was found that male patients (52.24%) suffer the most from dental problems, which is 5.08% more than women (47.46%).

44.07% of patients are not diagnosed with diabetes mellitus. A total of 55.93% (type I – 20.34%; type II – 35.59%) of all type of dental patients suffer from type I diabetes mellitus (Fig. 2).

Systematic work with the «Medico-sociological map» made it possible to concentrate empirical data on the duration of diabetic disease of those who sought dental care.

It was found (Table II) that most patients (36.36%) have type I and II diabetes mellitus for 6–10 years. 33.33% have been living with this diagnosis for 11–20 years. From 1 to 5 years, 27.28% suffer from diabetes mellitus. Less than one year – 3.03%.

Most dental patients with diabetic status are aged 36 to 55 years, which is 54.54% of the total number of those who sought dental care. Thus, the most able-bodied category

Table II. Distribution of patients by duration of diabetic diseases.

Duration of illness	In % to those who suffer from type I and II diabetes mellitus
Less than a 1 year	3.03
1–5 years	27.28
6–10 years	36.36
11–20 years	33.33

Table III. Distribution of data on cigarette smoking among patients with type I and II diabetes mellitus.

Alternatives	I type (%)	II type (%)
Respondent smoking cigarettes	41.67	19.04
Respondent did not smoke and does not smoke	50.00	61.92
Respondent quit smoking cigarettes	0.00	19.04
Respondent Uses alternative smoking	8.33	0.00

Table IV. Assessment of patients with diabetes mellitus, their well-being after comprehensive treatment of generalized periodontitis.

Alternatives	I type (%)	II type (%)
The treatment effect is very significant	8.33	14.29
The effect of treatment is above average	75.00	76.19
Treatment effect is negligible	16.67	9.52

of citizens has problems with diabetes mellitus and needs dental treatment and prevention of relevant diseases.

Male patients suffer the most from dental problems (52.24% of all those who sought dental care). Based on empirical data, we state: among patients with type I and II diabetes mellitus, men – 51.52%, and women – 48.48%. It is safe to say that diabetes mellitus is more common in men. These data are representative only for our groups.

Bad habits (tobacco smoking) of dental patients with type I and II diabetes mellitus: 27.27% of dental patients with type I and type II diabetes mellitus have bad habits (smoke cigarettes); 57.58% have never smoked and do not smoke; 12.12% quit smoking and 3.03% use alternative smoking.

The distribution of data on cigarette smoking among patients with type I and type II diabetes mellitus is presented in Table III.

Data infographics (Table III) are presented in Fig. 3.

Among dental patients with type I and II diabetes mellitus, those who smoke cigarettes for 1–5 years, there are none; 6–10 years – 22.22% (all – patients with type I diabetes mellitus); 11–20 years – 33.33% (in this age category smokers with type I diabetes mellitus are twice as many as smokers with type II); 21–30 years – 11.11% (all – patients with type I diabetes mellitus); 31–40 years – 33.33% (all – patients with type II diabetes mellitus); 66.67% of dental patients with type I and type II diabetes mellitus consume 16–20 cigarettes per day (ratio – 50x50); 22.22% consume 6–10 cigarettes daily (all are patients with type I diabetes mellitus); 11.11% – 21–25 cigarettes per day (all – patients with type II diabetes mellitus).

In the Table IV presents data on the well-being of dental patients with diabetes mellitus (types I and II), after long-term comprehensive treatment of generalized periodontitis.

Comprehensive treatment of generalized periodontitis in combination with preventive measures and cooperation with endocrinologists who examine and treat dental patients with diabetes mellitus, gives, according to the patients themselves, tangible results. Statistically, this has the following expression:

- in the process of treating periodontal diseases 18.18% of patients quit smoking;
- 21.21% are at the stage of quitting smoking cigarettes and switch to alternative smoking;
- among those who reduce tobacco consumption, 9.09% indicated that their well-being had greatly improved; feel an improvement of 45.45%;

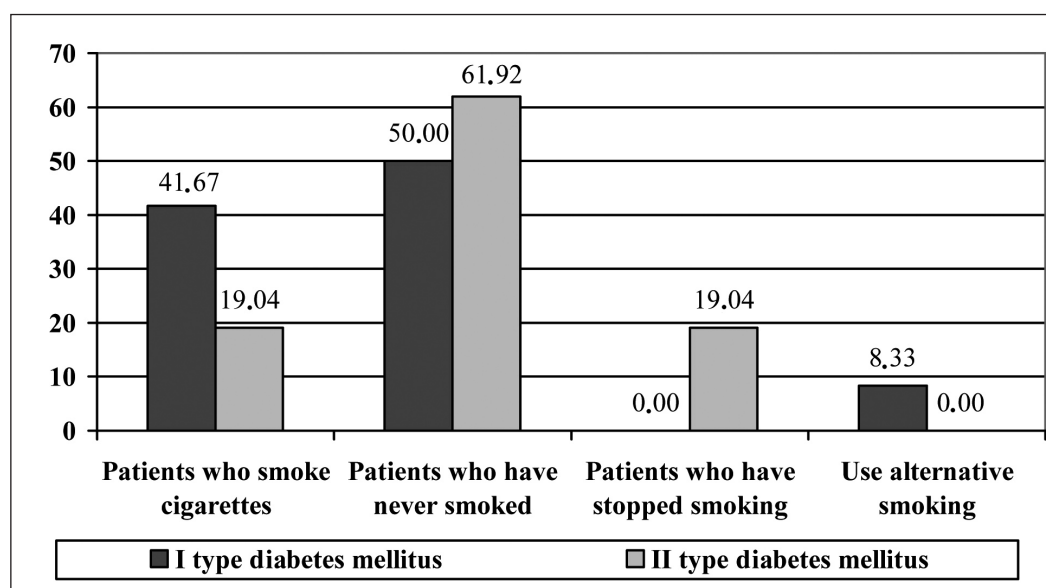


Fig. 3. Distribution of dental patients with type I and II diabetes mellitus, according to the presence of bad habits (cigarette smoking).

- among those who do not smoke cigarettes, 15.15% after a comprehensive treatment of oral diseases rated their well-being at a high level, and 54.55% said that they felt better.

DISCUSSION

Dental diseases, as it turned out in recent decades, are very often provoked by diabetes. Researchers state that, «despite the fact that the possibilities of caries treatment and prevention grow every year, the indices of dental caries incidence and prevalence in Ukraine remain high. This was confirmed by the results of the oral health status study of type 2 diabetes mellitus patients aged 40 to 60, whose caries prevalence was 100%, and incidence by the DMFT Index was high» [4, p. 1030].

At the same time, according to experts from the European Federation of Periodontology, periodontal infection with a bilateral link between glycemia and periodontitis negatively affects blood glucose levels. Although the treatment can be based on all current research results and relevant recommendations, its effectiveness depends on the close cooperation of dentists and endocrinologists [11], as well as specialists in other related fields.

A variety of programs for the prevention and treatment of dental diseases are developed and implemented. Of course, dental care for a patient should be based, first of all, on a specific situational analysis – a result of the accumulation of relevant data when visiting dental care facilities. The World Health Organization (WHO) proposes to unify examination methods, analyze and compare different clinical outcomes, and recommends to use Combined Card for dental examination [12].

The Ministry of Health of Ukraine by order of February 14, 2012 № 110 approved the Medical Card of a dental patient (form № 043 / o) [13].

Medical card is an official legal document. Carefulness of its filling (the maximum amount of information about the condition of the dental patient) is of exceptional importance not only for determining the range of treatment, but also its procedure. A legal assessment of a dentist's behavior can also be made on the basis of this card.

For our many years of dental practice, we use not only regulations approved by the Ministry of Health of Ukraine, but also tools (map) of the Department of Therapeutic Dentistry of Institute of Dentistry of Shupyk National Medical Academy of Postgraduate Education.

Knowledge and application of basic and additional methods of examination of patients in therapeutic dentistry clinic, mastering the principles of filing medical history, skills of correct and professional (interdisciplinary) interviewing of patients are very important today. The ability to competently interpret empirical data is needed to establish an adequate diagnosis, develop and implement an optimal treatment plan for patients.

That is why in the course of our study there was an urgent need to develop such toolkit to identify systemic and local risk factors for periodontal disease in patients with type I and II diabetes mellitus.

CONCLUSIONS

It has been demonstrated that resources to improve the effectiveness of periodontitis treatment in patients with diabetes mellitus include not only cooperation with treating endocrinologists, but also our «Medico-sociological map» to identify systemic and local risk factors for periodontal disease in patients with type I and II diabetes mellitus.

It has been proven that the cooperation of dentists and treating endocrinologists who examine and treat dental patients with diabetes mellitus gives a tangible positive dynamics of restoring and maintaining human health, even against the background of bad habits.

The prospects of the study include the improvement of tools for the accumulation of primary dental and endocrinological information and its testing.

REFERENCES

1. Biloklytska G., Viala S. Psychological problems in patients with periodontitis against the background of diabetes. Eurasian scientific congress. The 3rd International scientific and practical conference – Eurasian scientific congress (March 22–24, 2020) Barca Academy Publishing, Barcelona, Spain. 2020:61–62.
2. Biloklytska G., Viala S., Koval A. Marketing research on dietary supplements for periodontitis in patient diabetes. *Annals of Dental Specialty*. 2020; 8(2): 67–78.
3. Gruzieva T.S., Galienko L.I., Holovanova I.A. et al. Prevalence of bad habits among students of the institutions of higher medical education and ways of counteraction. *Wiadomości Lekarskie*. 2019; 72(3):384–390.
4. Barylo O.S., Kanishyna T.M., Shkilniak L.I. The effects of diabetes mellitus on patients' oral health. *Wiadomości Lekarskie*. 2018; 71(5): 1026–1031.
5. Kosenko S.V., Balaban I.O., Haioshko O.B. et al. Vykorystannia pektynovyh rehovyn u hvoryh na tsukrovyy diabet 2 typu v kompleksnomu likuvanni zahvoriuvan tkanyn parodonta (povidomlennia 1) [Use of pectin in patients with diabetes mellitus type 2 in the complex treatment of the periodontal disease (report 2)]. *Zaporozhye medical journal*. 2014;3(84):105–108. (in Ukrainian).
6. Beloklitskaya G.F., Luzina O.V. Shinirovaniye podvizhnykh zubov i vosstsnovleniye vklyuchennykh defektov zubnykh ryadov v kompleksnom lechenii generalisovsnogo parodontita [Splinting of mobile teeth and restoration of included dentition defects in the complex treatment of generalized periodontitis]. *Sovremennaya stomatologiya*. 2004;2:64–65. (in Russian).
7. Potapchuk A.M., Melnik V.S., Gorzov L.F., Ravis O.Yu. Problemy zahalnosomatychnoi patolohii na stomatolohichnomu pryioni [Problems of general-somatic pathology at dentistry reception]. *Aktualni problemy suchasnoi medytsyny*. 2018;2(62):212–214. (in Ukrainian).
8. Beloklitskaya G.F., Kopchak O.V. O mekhanizmax razvitiya tservikal'noy gipertenzii i vozmozhnykh putyakh yee ustraneniya [On the mechanisms of development of cervical hyperesthesia and possible ways to eliminate it]. *Sovremennaya stomatologiya*. 2006;1: 65–69. (in Russian).
9. Komnatskii B.Yu., Kulahina V.M. Psuholohichni osoblyvosti ta yakist zhyttia patsientiv zi stomatolohichnymi hvorobamy iz suputnim tsukrovym diabetom, yaki potrebuut mistsevoho znebolivannia pry terapevtychnykh i ortopedychnykh vtruchanniah [Psychological features and quality of life of patients with dental diseases with concomitant diabetes mellitus who require local anesthesia for therapeutic and orthopedic interventions]. *Ukrainian stomatolohichniy almanakh*. 2013;3:24–27. (in Ukrainian).

10. Antoshchuk R. Ya. Tsukrovyi diabet: etiologia zahvoriuvannia [Diabetes mellitus: etiology of the disease]. *Molodyi vchenyi*. 2016;6(33):277–280. (in Ukrainian).
11. Maslak E.E., Naumova V.N. Interdisciplinary cooperation between dentists and endocrinologists for identification and management of diabetes mellitus. *Diabetes mellitus*. 2019;22(1):35–43. doi.org/10.14341/DM9581.
12. Kaskova L.F, Amosova L.I., Karpenko O.O., et al. Profilaktyka stomatolohichnyh zahvoriuvan [Prevention of dental diseases]. Kharkiv: Fakt. 2011:392. (in Ukrainian).
13. Medychna karta stomatolohichnoho hvorocho. Forma pervynnoi oblikovoi dokumentatsii № 043/o [Medical card of a dental patient. Form of primary accounting documentation № 043/o]. Kyiv. 2012. http://www.medconsulting.com.ua/f/formu/110/f043_o.doc. (in Ukrainian).

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ORIGINAL ARTICLE

EATING BEHAVIOUR OF INTERNATIONAL STUDENTS IN UKRAINE

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ABSTRACT**The aim:** Investigate the eating behaviour of international students in Ukraine.**Materials and methods:** A cross-sectional quantitative research approach was taken in conducting this study. 193 international students (98 males, 95 females) filled the questionnaire assessing their diet for the past 7 days, perceived changes made to their diet since their arrival to Ukraine, knowledge of healthy dietary habits, and perceived barriers to maintaining a healthy diet. At the time of this study, the students were between the ages of 18 and 36 years, of 11 nationalities, and enrolled at both undergraduate and postgraduate levels in 12 Ukrainian tertiary institutions.**Results:** Assessment of the students' diet quality reveals that 75.1% of the students consume fruits at least 2 times/day and 73.1% consume vegetables at least 3 times/day. More students consume poultry daily and fish at least twice a week than beef and pork daily. More than half of the students consume starchy foods, mostly rice daily. Only 7.3% of the students consume up to 1 alcoholic beverage daily. Gender significantly affects the consumption of alcohol, dairy products, low fat milk and milk products, and marginally affects beef and dark chocolate.

95 % of the student have made changes to their diet since coming to Ukraine.

Conclusions: The dietary behaviour of international students in Ukraine is characterized by: high consumption of fruits and vegetables, high intake of lean meats and fish, higher consumption of unsaturated fats and oils than saturated ones, and low consumption of soft and alcoholic drinks.**KEY WORDS:** Nutrition, healthy diet, barriers, habits

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INTRODUCTION

In recent years, the importance of diet in the promotion and maintenance of health has been the focus of numerous studies [1,2]. Dietary habits are dictated by cultural, socio-economic, religious and various other demographic factors as much as personal tastes and preferences. Every culture around the world has its own unique food and dietary habits. It is therefore expected that an individual's dietary habits change when they migrate to a region with differing cultural background. Various studies have shown that students' knowledge of healthy and unhealthy diet habits, and nutritional knowledge needed improvement [3,4]. Although most of some studies look at the effects of long-term migration on dietary habits, even short-term migration or temporary translocation as in the case of international students has been shown to cause similar undesirable changes [5,6].

Unsurprisingly, after migration to a new country people often have to make adjustments to their dietary habits to match their new environment. This changes are usually due to an unavailability of foods which make up their traditional foods [7], the social context of migration, new social networks, the strength of ties maintained with country of origin, age and life phase, and work or school attendance [8]. The so-called stage of «emerging adulthood» which is defined as the period between the ages of 18 and 25 years is characterized by the development of lifelong habits includ-

ing dietary habits [9]. Most people within this age group are leaving home for the first time to higher institutions and have to take responsibility for their own feeding.

Ukraine boasts a large and steadily growing population of international students currently studying in her many higher institutions. The Ukrainian State Centre for International Education estimates that there are about 64000 international students from 147 different countries every year. The position of these international students in Ukraine as temporary migrants as well as students of higher institution therefore increases their chances of adopting unhealthy dietary habits. Even in cases where their traditional foods are available, the costs are often too high for migrants consistently incorporate them into their routine dietary practices [10]. Some changes in dietary habits also depend on an individual's duration of stay in their new environment, knowledge of local language(s) in the new environment, and degree of contact with locals. Thereby, the problem of investigate the eating behaviour of international students in Ukraine becomes especially poignant.

THE AIM

Therefore, the aim of this study is to: investigate the eating behaviour of international students in Ukraine. The object of this study is the behavioural features of nutrition of international students in Ukraine; the subject is the eat-

ing behaviours, knowledge of healthy diet, and perceived barriers to maintaining a healthy diet.

MATERIALS AND METHODS

A cross-sectional quantitative research approach was taken in conducting this study. Quantitative data in the form of food frequency and closed-ended questionnaire was produced [11]. For this study, we aimed to assess the eating behaviour of the students by analysing the frequencies of consumption of selected food items. Additionally, we sort to assess the students' knowledge of healthy dietary recommendations, perceived changes to diet, and perceived barriers to maintaining a healthy diet. For this we chose close-ended questionnaires which have been validated and used in a prior study [12] due to the high costs and time required for the development and validation of such questionnaires.

Between February and May 2019, international students enrolled in Ukrainian higher institutions were asked to fill an anonymous questionnaire. Inclusion criteria for the survey were: enrolment in a higher institution in Ukraine at the time of the survey; English language as the medium of study; and Non-Ukrainian origin.

A total of 193 undergraduate and postgraduate students filled in the questionnaires. Gender distribution was roughly even, with males being in the majority (50.8%). The age of respondents ranged from 18 to 36 years (mean 23.46 ± 3.24). Most of the participants (86.5%) were aged between 18 and 26 years. The participants were of 11 nationalities in total. Most of the participants were from Nigeria (45.6%), Ghana (14.5%) and Pakistan (14.0%). A majority of the students were studying Medicine (78.2%), mostly studying at the Vinnitsa National Medical University I.M. Pirogov (21.8%). Subjects' mean duration of stay in Ukraine at the time of this study was 42.69 ± 25.81 months, ranging from 2 to 114 months.

Participation in this survey was completely voluntary. All data were collected anonymously and stored in an unidentifiable format. The Statistical Package for the Social Sciences (SPSS for Windows, version 25, 2017, SPSS, Chicago, IL, USA) was used for data analysis. A «P» value of .05 was considered statistically significant in all analyses.

We considered various ethical concerns during the course of carrying out this study. Firstly, the issue of informed consent of the respondents. Information about the aim, objectives and scope of this study was provided at the beginning of the questionnaire after which the respondents were required to provide consent before filling in the questionnaire. All data was collected and stored in an unidentifiable format. The complete confidentiality of the respondents was therefore guaranteed. All data collected for the purpose of this study was used only for the study. All results have been reported whether positive or negative.

Certain limitations were faced over the course of carrying out this study. The first drawback was in enlisting the necessary quantity of respondents. We had no access to any databases with contacts of all international students

currently in Ukraine. We were therefore forced to resort to recruiting based on convenience. This and restrictions by time resulted in a relatively small sample size. Secondly, portion sizes were initially included in the questionnaires for data collection. Portion sizes make it possible to estimate the energy and nutrient intakes and compare against a standardized food composition database [13] However, only a negligible portion of the respondents provided usable data on portion sizes. Thus, forcing us to omit this data from the study altogether.

RESULTS

The frequencies of consumption for selected food items by international students in Ukraine show that 75.1% of the students consume 2 or more fruits daily. In addition, 73.1% consume vegetables 3 or more times daily. More students consume poultry (45.1%) when compared to the proportion of students that eat red meat (beef – 20.2%, pork – 13.5%) at least once a day. Furthermore, 58.5% percent report eating oily fish (salmon, trout, tuna, swordfish and mackerel) while 43.5% percent of the students report consuming white fish (halibut, tilapia, cod, bass, grouper, haddock) at least twice a week. A smaller proportion (21.2%) report eating other types of seafood at least twice a week. Rice, pasta and potatoes are consumed at least once daily by 54.9, 30.1 and 38.9 percent of the students respectively. Vegetable oil is consumed by 29.5% of the students less than once daily while butter and margarine are consumed daily by 5.7% of the students. Only 7.3% of the student report intake of at least one alcoholic beverage daily. 72 percent of the students report consuming less than one soft/fizzy drink daily. Over 77 percent of the students report consuming processed meat and meat products (sausages, ham and bacon) less than one time a day.

However, some of the trends which negatively impact health are also seen. Daily consumption of low-fat milk and milk products was reported by only 7.8% of the students. Daily consumption of whole milk and milk products is seen in a larger proportion (15.5%) of students. The consumption of sweets and snacks (cakes, puddings, sweet biscuits, cream crackers, sweets and toffees) at least once a day was reported by 96.9% of the students.

Comparisons between male and female students shows marginal differences in the eating frequencies of most food items. Daily consumption of low-fat milk and milk products is reported by a larger portion of female students (12.6%) than in male students (3.1%). Daily consumption of butter and margarine by female students is lower (1.1% and 2.1% respectively) than by male students (10.2 and 9.2 respectively). Consumption of at least one alcoholic beverage by male students is higher (12.2%) than their female counterparts (2.1%). Consumption of beef and pork at least once daily are reported by 25.3% and 9.5% of female students respectively compared to 15.3% and 17.3% for male students. A similar trend is observed for chocolate consumption with 1.1% and 8.4% of female students reporting daily consumption of at least one dark and white

chocolate respectively. Daily consumption of at least one dark and white chocolate is reported by 6.1% and 3.1% of male students respectively.

Comparison of the three age groups also reveal certain trends in the eating behaviours of the students. More of the older students report consuming at least two fruits a day with 86.5% of the students aged 26 years and above (Group C), 80.6% of students between from age 23 to 25 years (Group B), and 62.2% of the students aged 22 years and below (Group A). In a similar fashion, 26.9% of students in Group C report eating pork at least once daily while 11.9% in Group B and 5.4% in Group A report doing so. In Group C, 32.7% of the students also report eating processed meat or meat products daily compared to 10.8% and 26.9% in Groups A and B respectively. Additionally, 73.1% of students in Group C eat oily fish at least twice a week while 47.3% and 59.7% of students in Groups A and B respectively report doing so.

When asked if they have made changes to their diet since arriving in Ukraine, 94.8% of the students agree that they have made changes. 36% of the students are of the opinion that they eat less fruits and vegetables since first arriving in Ukraine while another 34.7% believe they eat more and 29.5% say they consume the same amount. A large portion of the students (48.7%) believe that they drink less soft/fizzy drinks while 32.6% believe they drink more soft/fizzy drinks than they did before coming to Ukraine and 18.7% drink just as much as they did.

For fried foods, 40.4% of the students believe they eat less since they came to Ukraine while 36.3% say they consume more and the other 23.3% believe they consume the same amount. 42 percent of the students are of the opinion that they consume less sugar and other sugary confectionaries compared to the 27.5% who consume more and 30.6% who consume the same since coming to Ukraine. Increase in consumption of low fat milk products is reported by 20.7% of the students while 45.6% report consuming less and 33.7% consume the same amount. Lastly, 45.6% of the students report eating more processed/fast foods whereas 37.3% report eating less and the other 17.1% eat the same amount.

Results show the responses of the respondents when asked about their opinion on what is important in maintaining a healthy diet. A majority of the students agree that reduction of fatty and fried foods intake (63.7%), eating lots of fruits and vegetables (80.3%), eating fibre rich foods (69.9%), and increased intake of whole grain cereal (53.9%) are all important in maintaining a healthy diet. Furthermore, 41.5% of the students agree that a reduction in intake of refined foods is also important for maintaining a healthy diet.

Gender has a significant effect on overall knowledge of healthy diet ($p=0.004$). Female students have a better knowledge healthy diet than male students with a mean score of $7.14+2.08$ compared to $6.34+1.73$ for male students. Age and duration of stay in Ukraine don't have any significant effects on estimated knowledge of healthy diet.

Some results show the responses of the students on the

perceived barriers to maintaining healthy diet. A majority of the students consider lack of will power to make healthy choices (66.8%) and high prices of healthy foods (57.5%) as the major barriers to maintaining a healthy diet. The students' opinions on the lack of information on healthy foods and healthy foods being boring as barriers to maintaining a healthy diet are marginally balance. 35% of the students agree that a lack of information hinders them from maintaining a healthy diet whereas 38.9% disagree. 40% of the students also consider healthy being boring to eat to be one of the factors that hinders them while another 38.3% disagrees with this opinion. Age, gender and duration of stay in Ukraine have no significant effects on the perceived barriers.

DISCUSSION

The importance of diet in the promotion of health and general wellbeing is well established. Therefore, the evaluation of dietary habits, knowledge and attitudes towards diet as well as facilitators and barriers to adoption and adherence to healthy dietary habits is of utmost importance. This is even more so for subpopulations that are at risk of adopting unhealthy dietary habits such as international students.

The results of our study show that the rate of fruit and vegetable consumption amongst international students in Ukraine is high. Over 70% of students consume at least 2 portions of fruits and 3 portions of vegetables a day as per the 400g/day recommendation. A larger portion of the students also include more lean meat (poultry – 45.1%, white fish – 43.5% and oily fish – 58.5%) in their diet compared to red meat (beef – 20.2% and pork – 13.5%). Only a small portion of the students drink soft/fizzy drinks daily (28%). Consumption of alcoholic beverages is low amongst international students with daily consumption reported by only 7.3%.

The results of this study show that sweets and snack including cakes, puddings, sweet biscuits cream crackers, candies and toffees are consumed daily by 96.9% of students. We suspect that this high rate of consumption of convenience foods is in part as a result of the university schedule of the students which does not allow them time to prepare meals [14].

Results from a DEDIPAC study show the broad range of factors influencing dietary behaviour among ethnic minority groups living in Europe [15]. Our study shows that only 14% the students eat nuts and legumes up to once daily. More students who have been in Ukraine for 2 – 4 years believe they consume more soft/fizzy drinks since coming to Ukraine (46%) than those who have been in Ukraine for less than 2 years (22%). The findings of our study show that with longer stay, more students start to adopt some eating behaviours that are common in Ukraine. For example a larger proportion of students who have been in Ukraine for more than 4 years eat pork (25.6%), beef (29.5%) and processed meat (38.5%) daily compared to those students who have been in Ukraine for shorter periods.

The effects of gender on dietary patterns and food choices

have been reported [16] In line with this, our study found that female students have better knowledge and are more likely to make healthier food choices than their male counterparts. Female students are more likely to choose low-fat over whole milk and milk products as well as vegetable oils over butter and/or margarine. Female students (2.1%) are also less likely to consume alcoholic beverages than their male counterparts (12.2%).

Overall knowledge of a healthy diet as estimated by our overall knowledge score show that the students' mean score is 6.74+1.95. Female students appear to have a better knowledge of healthy dietary habits with a mean score of 7.14+2.08 than their male counterparts who have a mean score of 6.34+1.73.

A study of the changes in dietary habits of international students in Belgium revealed a perceived lack of information and price as the main factors that hinder adoption and adherence to a healthy diet.[17] The findings of our study agree with the findings of Perez-Cuerto et al., 2009 with 57.5% of students stating price as a barrier. However, results of our study show that only a small proportion of international students (23.8%) in Ukraine consider lack of information on healthy foods to be one of the barriers to healthy diet. On the contrary, 66.8% of the students perceive lack of willpower to make healthy food choices as a major factor that hinders them from adhering to a healthy diet.

Some of the limitations of this study include the relatively small sample used. A larger sample was not attained due to time and budget constraints. However, the results of this study give an insight into the diet of these students and serve as a starting point for further studies.

CONCLUSIONS

1. This study shows that the dietary behaviour of international students in Ukraine is characterized by: high consumption of fruits and vegetables, high intake of lean meats, high intake of fish, higher consumption of unsaturated fats and oils than saturated ones, and low consumption of soft/fizzy and alcoholic drinks.
2. The assessment of the effects socio-demographic factors on dietary habits shows that gender, age and duration of stay in Ukraine all have effects on the dietary behaviour of the students. Duration of stay: (a) students who have been in Ukraine longer consume more fruits, (b) more red meat (beef and pork), (c) more processed meat and meat products, d) less soft/fizzy drinks, and (e) more fish and seafood. Gender: Female students are (a) more likely to consume low-fat milk and (b) less likely to consume alcoholic beverages than their male counterparts. Age: older students are more likely to consume (a) more fruits, (b) more pork, (c) more processed meat products, and (d) more fish. More attention should be paid to the younger students and those students who have only been in Ukraine for up to 2 years. More education on the importance of low-fat milk consumption and decreased alcohol consumption should be provided especially to male students.
3. Assessment of perceived changes shows that almost all students have made changes to their dietary habits since coming to Ukraine. Perceived changes include: (a) increase in the consumption of refined and fast foods, (b) decrease in the consumption of soft/fizzy drinks (c) decreased consumption of fried foods, (d) decreased intake of low-fat milk and milk products, and (e) decreased consumption of sugar and confectionaries. Female students have better knowledge about healthy dietary habits than their male counterparts.
4. Assessment of the perceived barriers to maintaining a healthy diet by international students in Ukraine shows that the main barriers are: (a) high price of healthy food, and (b) lack of willpower. Therefore, all of these factors should be considered when organizing information and educational programs about healthy dietary habits for international students, especially those studying in Ukraine.

REFERENCES

1. Diet, nutrition and the prevention of chronic diseases. In World Health Organization technical report series. 2003;916: 1–149.
2. FAO, IFAD, UNICEF, WFP and WHO. The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets. Rome. FAO. 2020. <https://doi.org/10.4060/ca9692en>.
3. El Ansari W., Suominen S., Samara A. Eating Habits and Dietary Intake: Is Adherence to Dietary Guidelines Associated with Importance of Healthy Eating among Undergraduate University Students in Finland?. *Cent Eur J Public Health*. 2015;23(4):306–313. doi: 10.21101/cejph.a4195.
4. Yahia N., Wang D., Rapley M. et al. Assessment of weight status, dietary habits and beliefs, physical activity, and nutritional knowledge among university students. *Perspect Public Health*. 2016;136(4):231–244. doi: 10.1177/1757913915609945.
5. Sukalakamala S., Brittin H.C. Food practices, changes, preferences, and acculturation of Thais in the United States. *J Am Diet Assoc*. 2006;106(1):103–108. doi: 10.1016/j.jada.2005.09.050.
6. Satia-Abouta J., Patterson R.E., Neuhauser M.L. et al. Dietary acculturation: applications to nutrition research and dietetics. *J Am Diet Assoc*. 2002;102(8):1105–1118. doi: 10.1016/s0002-8223(02)90247-6.
7. Bárbara R., Ferreira-Pêgo C. Changes in Eating Habits among Displaced and Non-Displaced University Students. *Int J Environ Res Public Health*. 2020;17(15):5369. doi: 10.3390/ijerph17155369.
8. Fieldhouse P. Food and Nutrition: Customs and culture (Illustrate). London. Chapman & Hall. 1995.
9. Nelson M. C., Story M., Larson N. I. et al. Emerging adulthood and college-aged youth: an overlooked age for weight-related behavior change. *Obesity (Silver Spring)*. 2008;16(10):2205–2211. doi: 10.1038/oby.2008.365.
10. Sharma S., Cade J., Riste L., Cruickshank K. Nutrient intake trends among African-Caribbeans in Britain: a migrant population and its second generation. *J Hum Nutr Diet*. 2003;16(5):327–337. doi: 10.1046/j.1365-277x.2003.00461.x.
11. Creswell J.W. Research design: Qualitative, Quantitative and Mixed Methods Approaches (4th ed.). London. SAGE. 2014.
12. Perez-Cuerto F., Verbeke W., Lachat C. et al. Changes in dietary habits following temporal migration. The case of international students in Belgium. *Appetite*. 2009;52(1):83–88. doi: 10.1016/j.appet.2008.08.005.

13. Subar A. F., Midthune D., Kulldorff M. et al. Evaluation of alternative approaches to assign nutrient values to food groups in food frequency questionnaires. *Am J Epidemiol.* 2000;152(3):279–286. doi: 10.1093/aje/152.3.279.
14. Hilger J., Loerbroks A. Eating behaviour of university students in Germany: Dietary intake, barriers to healthy eating and changes in eating behaviour since the time of matriculation. *Appetite.* 2017;109:100–107. doi: 10.1016/j.appet.2016.11.016.
15. Osei-Kwasi H.A., Nicolaou M., Powell K. et al. Systematic mapping review of the factors influencing dietary behaviour in ethnic minority groups living in Europe: a DEDIPAC study. *J Behav Nutr Phys Act.* 2016 Jul 28;13:85. doi: 10.1186/s12966-016-0412-8.
16. Ngongalah L., Rankin J., Rapley T. et al. Dietary and Physical Activity Behaviours in African Migrant Women Living in High Income Countries: A Systematic Review and Framework Synthesis. *Nutrients.* 2018;10(8):1017. doi: 10.3390/nu10081017.
17. Perez-Cueto F., Verbeke W., Lachat C. et al. Changes in dietary habits following temporal migration. The case of international students in Belgium. *Appetite.* 2009;52(1):83–88. doi: 10.1016/j.appet.2008.08.005.

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SELF-ASSESSMENT OF THE CONTENT OF THE PUBLIC HEALTH MASTER'S EDUCATIONAL PROGRAM FOR COMPLIANCE WITH THE EUROPEAN PUBLIC HEALTH CORE COMPETENCES PROGRAMME

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ABSTRACT

The aim: Determining the compliance of the developed Public Health Educational Program with the principles and basic provisions of the WHO-ASPHER Competency Framework for Public Health Workforce in the European Region.

Materials and methods: The study used bibliographic and information-analytical methods and content analysis. A comparative analysis compliance of the content of the Public Health Master's Educational Program, developed in Bogomolets National Medical University, with the provisions of the WHO-ASPHER Competency Framework for Public Health Workforce in the European Region in terms of providing academic disciplines in the ECTS credits (European credit transfer and accumulation system), has been carried out.

Results: Comparative analysis of the components of the University Public Health Master's Educational Program and regulations of the WHO-ASPHER Competency Framework for Public Health Workforce in the European Region has identified a high level of their compliance in all areas of competence formation, including science and practice, health promotion, legislation, policy, ethics, common health and safety in health, leadership and operational mind-set, cooperation and partnership, communication, culture and advocacy, strategic and resource management, professional development, organizational training and adaptability.

The competence-based educational program provides future professionals with theoretical knowledge and practical skills for a clear understanding of public health problems, a reasonable choice of methods for solving them, taking into account modern practices; forming partnerships, effective communication and cooperation on a cross-sectoral basis, developing leadership skills, organizing and providing people-centred public health services.

Conclusions: Self-assessment of the content of Public Health Master's Educational Program for compliance with European educational standards for the formation of the necessary competencies is an important tool for its quality formation and improvement. A comparative analysis of the university's Public Health Master's Educational Program, with the European Competency Framework for Public Health Workforce, has identified a high level of compliance.

KEY WORDS: Public Health, workforce training, educational programs, academic disciplines, competencies, functions

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INTRODUCTION

Providing the proper level of health of the population, which requires the improvement of the main determinants of human health and quality of life, the general coverage of health services, is crucial for achieving the social goals set by the Sustainable Development Strategy. [1-2].

The implementation of tasks aimed at improving population health in modern conditions is complicated by a number of problems, including aging, the negative impact of socio-economic and environmental determinants, increasing health inequalities, epidemic of non-infectious and pandemic infectious diseases, uncontrolled migration, etc. [3-7].

Under current conditions, health systems are building their development strategies towards ensuring sustainability, the ability to respond to challenges, the provision of high-quality services focused on the modern needs of consumers, and the rational use of available resources. This requires improving the provision of services, expanding their range, introducing inclusive service models, applying

innovative approaches, technical innovations, establishing interagency interaction and the participation of all stakeholders. [8-9].

The current epidemiological landscape of population health causes a high need for public health services as a preventively oriented integrative basis for the prevention of health disorders, its preservation and promotion. Personnel matter have a special place among the priority ones for the successful development of the public health system. They cover various aspects, from determining the needs for human resources and requirements for their quality, including the processes of training, their distribution, use, professional development, etc. [10-12].

The development of human resources in the public health system should correspond to the general approaches to the generation of health resources and specific requirements for knowledge, skills and competencies in this area of activity. In this context, it is especially important to expand the scope of vocational education to lifelong learning and the transition from specialized training to the formation and

development of a wide range of necessary competencies.

This approach is consistent with the provisions of the Global Strategy on Human Resources for Health: Workforce 2030 and the Regional Committee for Europe Resolution “Towards a sustainable health workforce in the WHO European Region: framework for action”. Those documents emphasize the need to develop normative documents to regulate the improvement of public health workforce professional qualifications and to assist in obtaining the necessary skills in specific conditions at the national level. This requires the vocational education system restructuring and additional investment in workforce training [13-14].

In Ukraine, health care reform involves, among other things, prioritizing the development of the public health service and building its human resources. The approval of the new “Public Health” specialty is aimed at the implementation of the educational area. The professional environment has developed and approved educational standards for Public Health Bachelor's and Master's degrees at the state level, which defines the requirements for training specialists. Educational programs and public health workforce training have been developed at a number of universities. The National Classification of Occupations includes the new professions “environmental and health specialist” and “public health specialist”. The preparation of the integrated test exam STEP 2 for the “Public Health” specialty and the educational standard for the training of doctors of philosophy is underway [15-16].

Substantiation and development of the Public Health Educational Program by universities in Ukraine was carried out in accordance with state educational standards, requirements of national legislation and existing needs. The recommendations of international organizations have been taken into account, including WHO, Association of Schools of Public Health in the European Region (ASPHER), Agency for Public Health Education Accreditation (APHEA), and experience of many countries in Europe and the world [17-18].

Given the European vector of Ukraine's development and the need to integrate the approaches to solving common cross-border problems in public health sphere, the unity of requirements for the preparation of specialized labour resources, common understanding of ways to preserve and promote health based on existing knowledge, abilities and skills that form the competence basis of specialists.

Although European countries differ significantly in the available capacity and organization of public health services, models of service provision and features of human resources training, the WHO-ASPHER Competency Framework for Public Health Workforce in the European region was developed as a framework document. The proposed document provides ample opportunities for European countries to optimize curricula and programs in the field of public health, to assess existing capacity, to identify needs, to plan investments, to create accreditation systems, to stimulate cooperation, etc. [19].

In view of the above, self-assessment of university vocational educational programs in the field of “public health”

allows to compare their provisions with the requirements of the European community, serves as a tool for comparing and identifying deficiencies, shortcomings, and provides opportunities for improvement and modernization.

THE AIM

The aim was determining the compliance of the developed Public Health Educational Program with the principles and basic provisions of the WHO-ASPHER Competency Framework for Public Health Workforce in the European Region.

MATERIAL AND METHODS

The study used bibliographic and information-analytical methods and content analysis. The content and structure of the WHO-ASPHER Competency Framework for Public Health Workforce in the European Region, categories and levels of professional qualification have been analysed. The assessment of the main components of the Public Health Master's Educational Program, developed in Bogomolets National Medical University, on their compliance with the provisions of the WHO-ASPHER Competency Framework for Public Health Workforce in the European Region by the following groups: science and practice, health promotion, law, policy, ethics, personal health and health security, leadership and operational mind-set, cooperation and partnership, communication, culture and communication outreach, leadership and resource management, and professional development has been carried out.

RESULTS

Research of content and structure of the WHO-ASPHER Competency Framework for Public Health Workforce in the European Region allows forming a new approach to the assessment of Public Health Master's Educational Programs in terms of the formation of future professionals with a wide range of competencies required to perform professional duties in European countries. It is suggested to consider the competency-based public health workforce in three categories, namely: contents and context, attitudes and interactions, performance and achievements. These categories of competencies include 10 sections, which cover 84 individual competencies. The category “content and context” includes science, knowledge and theory related to public health practice; the category of “relationship and interaction” includes the competence of communication, cooperation, networking to achieve leadership goals and partnerships; the category “results of work and achievements” includes competences for decision-making and activities to gain health. Thus, professional qualifications of public health workforce provide three levels, namely: competency, specialist, expert.

The set of competencies in the section “science and practice” involves the availability of knowledge and skills in a wide range of sciences, including the epidemiology

of infectious and non-infectious diseases; demographics; biostatistics; qualitative and quantitative research methods; analysis and assessment; evidence-based medicine; health care organizations; population health and health inequalities.

Health competencies are based on knowledge and skills in education; literacy in population, group and individual health; knowledge of the rights and opportunities of citizens; health service needs assessments; application of screening and secondary prevention; evaluations of interventions and health promotion programs results.

The section of legislation, policy and ethics competencies covers knowledge and application of international and European legislation and regulations in the public health sphere; strategies and programs; development of policies and plans; their assessment; setting priorities; decision-making in compliance with ethical norms.

Under the heading of "Common Health Principle and Health Safety", the competence is based on knowledge of human health; health care; international health; global risks and threats; cross-border healthcare; environmental and climate change hygiene; occupational hygiene; food safety.

The category of "relationship and interaction" includes competencies that provide leadership qualities and operational mind-set, cooperation and partnership, communication, culture, advocacy work.

Competency basis in the category "results of work and achievements" is formed by knowledge and skills in strategic leadership and resource management, professional development and reflective practice in compliance with ethical standards, organizational issues and the ability to adapt.

Public Health Master's Educational Program, prepared by Bogomolets National Medical University, in the amount of 120 ECTS credits, includes 34 compulsory and 10 elective courses. Their study is aimed at ensuring the formation of the necessary competencies for prospective Public Health Masters' successful practical activities.

A comparative analysis of the university curriculum with the European Competency Framework for Public Health Workforce has been conducted in each of the 10 areas.

It was found that the educational content of the educational program in "Science and Practice" provides 13 disciplines, including Epidemiology of Infectious Diseases, Epidemiology of Non-infectious Diseases, Demography, Biostatistics, Research Methodology, Modern Methods of Data Analysis, Monitoring and Evaluation of Interventions, Obtaining, Visualization and Aggregation of Public Health Data, Global Burden of Disease, Public Health, Organization and Management in Health Care, Health Care Systems, and Health Inequalities. 20 ECTS credits have been allocated for their mastering. The components of the university curriculum in this area fully comply with the WHO-ASPHER Competency Framework for Public Health Workforce in the European Region.

To acquire competencies in the field of "Health Promotion" there are 6 academic disciplines in the university curriculum, namely: Healthy Lifestyle Promotion; Communication and Mass Media; Forms of Medical Attention, Public Health

Prevention, Monitoring and Evaluation of Interventions, Assessment and Forecasting of Health Care Needs. The volume of learning is 10 ECTS credits. These disciplines give you an opportunity to master the knowledge and skills provided by the WHO-ASPHER Competency Framework for Public Health Workforce in the European Region, in terms of training and support through public participation; health literacy issues at the community, organization and individual levels; screening and secondary prevention; assessments of interventions and health support programs; health care needs assessments.

There is educational content in "Legislation, Strategy, and Ethics" area in the following disciplines of the university curriculum: Law in the Health Care System; Public Health Policy; Ethics in Public Health. 8 ECTS credits are allocated for mastering the material and developing competencies in international, European and national legislation, developing strategies and using strategic approaches, developing programs, evaluation and implementation policies, applying ethical frameworks, implementing ethical practices and decision-making, planning and setting priorities.

Considerable attention in the university's Public Health Master's Educational Program is focused on "Common Health Principle and Health Safety". The list of academic disciplines allows covering all the issues provided by the WHO-ASPHER Competence Framework for Public Health Workforce in the European Region in this area, including human health; health protection; occupational health; international health; global risks and threats; pandemics; environmental health; safe food; climate change and health. To do this, the learning process involves the acquisition of 13 disciplines, such as Social and Environmental Determinants of Health, Public Health, Global Burden of Disease; Pedagogy of Health; Psychology of Health; Sociology of Health; Sexology; Physical Education and Health; Sanitary and Epidemiological Supervision; Infection Control; Occupational Safety and Health; Occupational Risk Methodology; International Health Problems, Health Care Emergencies; Environmental Protection. The volume of academic disciplines is 30 ECTS credits.

Inclusion in the educational program of educational components of competences in the group "Leadership qualities and operational mind-set" is achieved through the following disciplines: Public Health Policy (intersectoral strategies); Healthy Lifestyle Promotion; Public Health Management and Leadership; Public Health in Practice; Human Resources Management; Strategic Management in Health Care. The study of these subjects gives you an opportunity to form the competencies regulated by the WHO-ASPHER Competency Framework for Public Health Workforce in the European Region, namely: Visions, Missions and Strategies; Individual Work in the Target Group; Leadership in Change and Innovation; Understanding and using theories of Complex Systems in Practice; Organizational Training and Development; Human Development; Emotional Development. 10 ECTS credits have been allocated for this in the educational program.

In accordance with “Cooperation and Partnership” area of the compared WHO-ASPHER Competency Framework, the university curriculum provides for the formation of competencies for effective cooperation; building relationships and partnerships; building interdisciplinary and intersectoral networks, relationships with stakeholders and their management within the study of “Health Care Policy” discipline.

The formation of competencies in “Communication, Culture and Advocacy” area is due to the inclusion in the educational process of the following studying disciplines: Communication and Media; Health Care Media and Systems; Acquisition, Visualization and Compiling Data in Public Health. They allow you to acquire knowledge and skills in effective written and verbal communication, including communication with the media; presentations; communication outreach, etc.

The content of the educational program in “Strategic leadership and resource management” area is provided by 8 academic disciplines, including Human Resources Management; Quality Management in Health Care System; Managerial Accounting; Health Care System Funding; Financial Analysis and Assessment of the Financial Condition of the Medical Organization; Fundamentals of Logistics; Economics; Pharmacoconomics. 14 ECTS credits have been allocated for their mastering. The components of the university curriculum are fully compliant with the WHO-ASPHER Competency Framework for Public Health Workforce in the European Region on human resource management; quality assurance; administration and resource management; financial planning; technical expertise and logistics; economic evaluation and analysis.

According to “Professional development and reflective practice in compliance with ethics” area, the teaching of Human Resources and Public Health Ethics disciplines is provided for in the university curriculum, laying the foundations for continuous professional development, lifelong learning and ethical professional behaviour.

In order to acquire competencies in “Literacy in Organizational Matters and the Ability to Adapt” area 1 academic discipline, including Entering into Contracts and Financing of Medical Services; Fundamentals of Accounting; Medical Insurance; Acquisition, Visualization and Compiling Data in Public Health; Marketing of Medical Services; Capital Market; Modern Methods of Data Analysis; Health Information Tools and Systems; Telemedicine and E-health are allocated in the university curriculum. The volume of learning is 22 ECTS credits. These disciplines allow you to master the knowledge and skills provided by the WHO-ASPHER Competency Framework for Public Health Workforce in the European Region, on the use of technology; data management; entrepreneurship; creativity, analysis and synthesis; digital health and social media; understanding of services and operations in public health.

DISCUSSION

A comparative analysis of the university's Public Health Master's Educational Program with the European Compe-

tency Framework for Public Health Workforce have found a high level of compliance. Virtually all competencies in the 10 areas of core competencies provided by the WHO-ASPHER Competency Framework for Public Health Workforce in the European Region are provided by the educational context of the university curriculum while studying a wide range of disciplines. At the same time, attention is paid to the formation of competencies in such aspects of the future activities of Public Health Masters as a deep understanding of public health matters and theories on which the practice is based; establishing the necessary connections, effective cooperation and implementation of leadership qualities; substantiation, development and decision making for gaining in health with a focus on people's needs.

It goes without saying that health inequalities in the structure and organization of public health services in different countries will determine the features of public health workforce training. However, the strategic directions of educational training should ensure the formation of a basic, mandatory list of competencies, without which successful activities in public health are impossible. This is the approach offered by WHO-ASPHER in the WHO-ASPHER Competency Framework for Public Health Workforce in the European Region. It presents a clear normative interpretation of the needs in the competence-based of the public health workforce for the implementation of the tasks assigned to them.

In view of the above, the periodic assessment of Public Health Master's Educational Programs for their compliance with the general requirements for acquiring the necessary competencies should become a routine practice of improving the formation of public health human resources.

CONCLUSIONS

Self-assessment of Public Health Workforce Educational Programs for their compliance with WHO-ASPHER Competency Framework for Public Health Workforce in the European Region is an important tool for their quality formation and promotion. The use of this tool will allow assessing the overall educational program, identifying its strengths and possible shortcomings, deficiencies with the necessary competencies of prospective Public Health Bachelors or Masters.

A comparative analysis of the Public Health Workforce Educational Program developed by Bogomolets National Medical University, with the European Competency Framework for Public Health Workforce has found a high level of compliance. The list of academic disciplines available in the educational program creates preconditions for the formation of almost all the necessary competencies in 10 main areas. Competence-based educational program will give an opportunity to acquire theoretical knowledge and master practical skills providing the prospective professionals with clear understanding of public health problems, reasonably choosing methods to solve them with respect to current practices; creating partnerships, commu-

nicating and collaborating effectively on a cross-sectoral basis, demonstrating leadership skills, and organizing and delivering people-centred public health services.

REFERENCES

1. Transforming our world: the 2030 Agenda for Sustainable Development. United Nations. 2015. <https://sustainabledevelopment.un.org/post2015/transformingourworld/publication#>.
2. Tracking universal health coverage: First global monitoring report. Geneva: World Health Organization. 2015.
3. European health report 2018 «More than numbers – evidence for all». Copenhagen: WHO EURO; 2018.
4. Evidence and resources to act on health inequities, social determinants and meet the SDGs. Copenhagen: WHO EURO; 2019.
5. Health inequity and the effects of COVID-19. Copenhagen: WHO EURO; 2020.
6. Protecting health in Europe from climate change: 2017 update. Copenhagen: WHO EURO; 2017.
7. Gruzieva T.S., Diachuk M.D., Inshakova H.V. et al. Modern demographic trends in Ukraine as a realization of preventional strategies. *Wiadomości Lekarskie*. 2019;72:2033–2039.
8. European Action Plan for Strengthening Public Health Capacities and Services. Copenhagen: WHO Regional Office for Europe; 2015.
9. Implementing a Health 2020 vision: governance for health in the 21st century. Making it happen. Copenhagen: WHO Regional Office for Europe; 2013.
10. Strengthening public health services across the European Region – a summary of background documents for the European Action Plan. Copenhagen: WHO Regional Office for Europe; 2012.
11. Second expert meeting of The Coalition of Partners to Strengthen Public Health Capacities and Services in the European Region: how do we collaborate powerfully and accelerate targeted action? Copenhagen: WHO Regional Office for Europe; 2017.
12. Rechel B., McKee M. Facets of Public Health in Europe. Copenhagen: WHO Regional Office for Europe; 2014.
13. Global strategy on human resources for health: Workforce 2030. DRAFT 1.0 submitted to the Executive Board (138th Session). Geneva: World Health Organization; 2016.
14. Towards a sustainable health workforce in the WHO European Region: framework for action. Copenhagen: WHO Regional Office for Europe. 2017. https://www.euro.who.int/__data/assets/pdf_file/0011/343946/67wd10e_HRH_Framework_170677.pdf?ua=1.
15. Gruzieva T.S., Pelo I., Smiyanov V.A. et al. Conceptual assumptions to create a system for preparation of healthcare human resources in Ukraine. *Wiadomości Lekarskie*. 2016;69:719–725.
16. Gruzieva T., Kurylo T. Educational Requirements and Practice of Public Health Professionals Training in the Republic of Poland as a Basis for Formation of Educational Programs in Ukraine. In: Health problems in Ukraine and Poland. Lviv: Editorial House of the Lviv Regional Charity Fund “Medicine and Law”; 2017. p. 46–52.
17. ASPHER's European List of Core Competences for the Public Health Professional. *Scandinavian Journal of Public Health*. 2018;46(23):1–52. doi:10.1177/1403494818797072.
18. Curriculum validation. Handbook & application. Version 3.6.-2020. Agency for Public Health Education Accreditation; 2020.
19. WHO-ASPHER Competency Framework for the Public Health Workforce in the European Region. Copenhagen: WHO Regional Office for Europe; 2020.

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ORIGINAL ARTICLE

ANALYSIS OF MEDICINAL PROVISION OF PATIENTS WITH ARTERIAL HYPERTENSION IN HOSPITAL CONDITIONS

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ABSTRACT

The aim: The aim of the study was to study drug consumption in pharmacotherapy of arterial hypertension in a hospital setting.**Materials and methods:** In the course of work medical cards of patients of the Kyiv regional Cardiac Dispensary in the conditions of inpatient treatment were used. Methods such as: questionnaire, pharmaco-economic, expert assessments were used.**Results:** One of the main issues of drug supply for the population, in particular for patients with arterial hypertension, is the study of the demand and consumption of drugs. The drugs used to treat hypertension belong to different pharmacotherapeutic groups and are used in the treatment of a number of other diseases. Recent years of development of the domestic pharmaceutical market are characterized by an increase in the number of these drugs.**Conclusions:** One of the main issues of drug supply for the population, in particular for patients with arterial hypertension, is the study of the demand and consumption of drugs. As a result of the study, an analysis of the range of drugs for the treatment of hypertension, a comparative study of the market of offers and prices for the treatment of hypertension was carried out.**KEY WORDS:** arterial hypertension, cardiovascular diseases, marketing research, pharmacotherapy

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INTRODUCTION

An analysis of the range of drugs for the treatment of hypertension, a comparative study of the market offers and prices for the treatment of hypertension [1].

In technologies for the treatment of hypertension, medicines are used today that belong to fourteen pharmacological groups (first-level drugs – diuretics, beta-adrenergic receptor blockers, ACE inhibitors, blockers of alpha-adrenergic receptors, angiotensin II receptors and calcium channels; the second level – agonists of alpha-receptors of the central actions, central and peripheral sympatholytics, vasodilators, potassium channel activators, ganglion blockers, drugs with myotropic action; drugs of a new generation – agonists of imidazoline receptors, calcium ion antagonists and blockers of alpha-1-adrenergic receptors simultaneously), as well as combined drugs. Pharmacological groups of drugs of the first level are recommended for the treatment of arterial hypertension by the World Health Organization [2, 3].

THE AIM

The aim of the study was to study drug consumption in pharmacotherapy of arterial hypertension in a hospital setting.

MATERIALS AND METHODS

The base of the experimental study was the Cardiological Dispensary of the Kyiv Health Department. Subjects of

research – medical records, which were selected by the method of free sampling. A total of 1038 case histories were analyzed for 2019.

RESULTS

Each case history was analyzed according to the following criteria: the name, sex and age of the patient, the stage of arterial hypertension, the length of stay of the patient in the hospital, concomitant diseases, the appointment of a cardiologist, the cost of pharmacotherapy [4, 5]. Microsoft Excel spreadsheets were used for mathematical data processing.

As can be seen from Table I, 12,5 % of case histories belonged to the first stage of arterial hypertension, 71,2 % to the second, 20,1 % to the third. More than half of all patients were women. The average age of the patients was 42,6, 50,2 and 52,1 years in accordance with the stages of the disease. A similar trend is observed for the average length of hospital stay. At the same time, the deadlines (4 and 30 days) are typical for patients with the first and second stages of arterial hypertension, respectively. For half of the patients, hypertension was characterized by a crisis course. On average, during the treatment period, one patient of the first stage of arterial hypertension was prescribed 9,4 drugs, the second – 12,3 and the third – 10,7. The studied nomenclature of drugs prescribed by cardiologists amounted to 107 drugs in the form of 118 trade names, the total index of occurrences of which in the

Table I. Quantitative characteristics of case histories

№	Indicators	Stage of arterial hypertension			Total
		First	Second	Third	
1.	The number of case histories	125	712	201	1038
	- incl. in %	12,5	71,2	20,1	100,0
2.	Patient gender, in %:				
	- female	62,1	55,8	52,2	56,7
	- male	37,9	44,2	47,8	43,3
3.	Patient's age, in years:				
	- minimum	21	37	49	36
	- maximum	71	74	75	73
	- middle	42,6	50,2	52,1	48,3
4.	Number of days of hospital stay	1625	10228	2427	14280
5.	Length of stay of one patient in the hospital, days:				
	- minimum	8	11	16	12
	- maximum	21	25	23	23
	- middle	10,8	13,6	15,8	13,4
6.	The incidence index of concomitant diseases, units	425	3475	1278	5178
7.	The number of concomitant diseases per patient, units:				
	- minimum	1	2	3	2
	- maximum	8	14	11	11
	- middle	4,0	4,5	5,8	4,8
8.	The total number of medical appointments, units	1247	8201	1170	10618
9.	The number of prescribed drugs for one patient, units:				
	- minimum	4	5	6	5
	- maximum	17	21	20	19
	- middle	9,4	12,3	10,7	10,8
10.	The total cost of pharmacotherapy for a certain sample of patients, UAH	12047,50	62247,20	20142,30	94437,0
11.	The total cost of pharmacotherapy for a certain sample of patients, UAH:				
	- minimum	31,20	55,40	29,45	38,68
	- maximum	185,40	248,20	294,50	242,70
	- middle	82,50	98,40	90,55	90,48
12.	Correlation coefficient between the length of stay and the cost of pharmacotherapy per patient	0,57	0,69	0,50	0,59

case histories was 10618. Antihypertensive drugs account for 34,8 % of all medical prescriptions. In general, in the structure of antihypertensive drugs prescribed to patients, diuretics accounted for 32,5 %, calcium channel blockers – 16,4 %, ACE inhibitors – 15,7 %, drugs with myotropic action – 12,7 %, combined drugs – 8,1 %, beta-blockers – 6,3 %, central alpha-adrenergic receptors – 4,9 %, ganglion blockers – 3,4 %.

In total, the doctors of the cardiological dispensary prescribed 20 antihypertensive drugs (by international names) in the form of 29 trade names. The dominant group (75 % of medical prescriptions) among medicines (by international names) consisted of eight drugs (that is, 31,6 % of their total number), namely: furosemide (diuretic),

diltiazem (calcium channel blocker), enalapril (inhibitor ACE), bendazole (myotropic effect), triamterene + hydrochlorothiazide (combined diuretic), atenolol (beta-blocker), hydrochlorothiazide (diuretic), clonidine (central alpha-adrenergic receptor). The most popular antihypertensive drugs by trade names are: dibazol (myotropic action), triampur compositum (combined diuretic), diltiazem (calcium channel blocker), lasix and furosemide (diuretics), atenolol (beta-blocker), cortiazem retard (calcium channel blocker), enalapril and enap (ACE inhibitors), hypothiazide (diuretic) and clonidine (central alpha-adrenergic receptor). The drugs listed above (19,4 % of the total number of trade names) constitute the dominant group of trade marks that are used in antihypertensive therapy.

In the process of determining the cost indicators, the number of units of the drug (tablets, drops, etc.), which were prescribed to the patient during his stay in the hospital, was first established, and then its cost was established. Calculations have shown (table 1) that the cost of pharmacotherapy for one patient with arterial hypertension (stage 1) is on average UAH 82,50 with a range of variation from 31,20 to 185,40 UAH. For the second stage, the average cost was 25,3 % higher and amounted to UAH 98,40 with a range of variation from UAH 55,40 to 248,20. The final stage of the study was a comparative analysis of the list of drugs prescribed by inpatient cardiologists and the restrictive List of drugs allowed for purchase by State Medical Institutions. The results of the analysis showed that of the 118 assigned funds, 38,2 % were not included in the restrictive List. They were prescribed to patients in 29,6 % of cases and on average accounted for 32,2 % of the cost of pharmacotherapy per patient.

DISCUSSION

The experience of European countries shows that the solution to the issue of providing the population with quality and affordable drugs is in the sphere of influence of the formulary system of medicines as a component of industry standards in the field of health care. Works are devoted to the methodological principles of creating a formulary system at the state level, its organizational features V.I. Maltsev, A.M. Morozov, V.D. Parii et al.; A.B. Zimenkovskiy et al. Given the rather dynamic development of pharmacy in recent years, changes in society in all countries, we believe that the future of pharmacy, its development as part of the pharmaceutical supply system, as well as its interdisciplinary and intersectoral nature, are closely linked to changes in socio-economic, political, cultural and educational life of Ukraine. According to a modern model of hypertension management, the patient and not his/her disease has a central role and is directly involved in his/her health care management in collaboration with the physician, family, and community, each other interacting in different ways to influence and support health decision [6]. This approach also emphasizes that patients with the same disease are nonetheless different from one another, due to differences in genetic predisposition as well as underlying mechanisms for high BP. Thus, different subjects may respond differently to the same antihypertensive treatment and a traditional population-based approach may not be effective. Rather an individualized or personalized approach is required, according to a modern medical model often referred to as «precision medicine» [7]. This article has summarised the current evidence related to hypertension screening and management in community pharmacies. The strongest evidence in support of pharmacist involvement relates to their role in managing hypertension, where meta-analyses have suggested that BP can be significantly reduced by up to 7 mmHg over usual GP care. Despite this, there are a lack of economic analyses and «hard outcomes» (e.g. CV events) that would likely aid the translation of

the existing evidence from trial settings into real-world practice. Our results showed that the number of types of antihypertensive drugs was larger in hospitals equipped with ≥ 200 beds than in smaller facilities, and the proportion of patients who were prescribed > 2 antihypertensive drugs was the same. The difference showed statistical significance, indicating the association between facility size and the intensity of hypertension therapy. This result might indicate that the patients with difficult-to-control hypertension, to some extent, visit larger, experienced facilities, but the difference was not so large. First, the database used in this study only contained administrative data, and no blood pressure or chemical examination data were available. Therefore, we could not extract adequate outcomes or comorbidities from the viewpoint of pathophysiology, but could only estimate them from prescription and diagnosis data. Financial incentives for reimbursement and governmental punishment for overcharge may make the prescription data accurate, but the association between prescription claim and patient conditions has not yet been proven. Regarding diagnosis information related to kidney disease, as also mentioned in the discussion section, its sensitivity was reported to be low. Therefore, information related to these strata is limited. Second, we could not distinguish physicians' intention of prescription other than lowering blood pressure. For instance, we could not omit beta-blocker prescription for heart failure or diuretics for hypervolemia. Owing to this limitation, the mean number of antihypertensive agents increased, and the proportion of refractory hypertension also increased. Finally, the data obtained were those accumulated in only one month, October. We could not take seasonal effects into account, and we might have missed patients whose hypertension was managed but did not visit a healthcare facility during this month. In addition, the consultation interval can be different between large hospitals and clinics due to the difference in background comorbidities, which were not adjusted for in the aforementioned stratification. Therefore, this variation in consultation interval may have also affected our results. Ideally, our investigation would be more accurate when utilizing the whole claims data from the ministry. However, restricting laws and regulations are far stronger if we intend to use the whole data compared to the sampled data that we analyzed in the present study. To effectively examine the current healthcare situation, our method has certain rationality even though some limitations exist [8].

CONCLUSIONS

Thus, on average, more than half of the cost of pharmacotherapy for one patient with arterial hypertension, including more than three quarters of the cost of antihypertensive drugs, was provided not at the expense of state guarantees of free medical care, but in other ways. This is the purchase of the necessary medicine by the patient himself or his family.

REFERENCES

1. Gorgui J., Gorshkov M. et al. Hypertension as a risk factor for ischemic stroke in women. *The Canadian journal of cardiology*. 2014;30(7):774-782.
2. Drummond M.F., O'Brien B., Stoddart K. Methods for the economic evaluation of health care programmers. 2012;78(2):92-116.
3. Apazov A.D. Legislative and economic foundations for the formation of a civilized pharmaceutical market. *New pharmacy*. 2011;12:9-12.
4. Gromovik B.P. Characteristics of the main methods of determining the competitiveness of medicines. *Pharmaceutical Journal*. 2012;3:7-11.
5. Sakhanda I.V. Analysis of assortment of phytopreparations in Ukraine. *Harkiv*: 2017;46-49.
6. Carter B.L., Bosworth H.B., Green B.B. The hypertension team: the role of the pharmacist, nurse, and teamwork in hypertension therapy. *J Clin Hypertens*. 2012;14:51-65.
7. Melville S., Byrd J.B. Personalized medicine and the treatment of hypertension. *Curr Hypertens Rep*. 2019;21:13.
8. Sakamoto H.R.M., Nomura S., Okamoto E. et al. 5.3.1 Primary care. In: *Japan Health System Review*. Vol 8. New Delhi: World Health Organization, Regional Office for South-East Asia; 2018.

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ORIGINAL ARTICLE

IMPROVING DENTAL HEALTH – IS IMPROVING QUALITY OF LIFE

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The aim: To assess the impact of dental status on the quality of life of the adult population in the presence of periodontal disease in combination with musculoskeletal dysfunction in patients with dental anomalies and deformities.

Materials and methods: To study this goal, we examined 283 patients who complained of an aesthetic defect of the dentition, combined with the presence of joint pain and periodontal disease of varying severity.

Results: received a complete analysis of factors that significantly affected the quality of life of patients with a lot of diseases of the oral cavity.

Conclusions: Oral health deficiencies reduce the quality of life of our patients, and the treatment significantly changes its quality depending on age, sex and method. But the best results in achieving positive changes in the quality of life of the patient dentists can expect only by conducting a comprehensive treatment.

KEY WORDS: quality of life, dental health correction

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INTRODUCTION

Quality of life of the population is one of the generally accepted and important indicators that define the real opportunities of people that they need for a comfortable life. The characteristics of quality of life include all living conditions, factors and problems.

The search for and development of methods for determining the quality of life is an urgent problem of foreign and domestic medicine and the state of dental health is given a very important role [2].

Dental or oral health includes a condition that allows a person to eat, improve communication, restore the aesthetic function of the mouth and face, and increase self-esteem [3].

In the 1980s, Reisine S.T. drew attention to the impact of pathological conditions in the oral cavity on human social and psychological well-being, which was the impetus for the development and implementation of tools for measuring the quality of life associated with the state of dental health [4].

In studying the state of the problem from the point of view of dental health, 4 types of factors were identified that are directly related to the quality of life of patients:

1. Pathology of the dental-maxillary system, which quantitatively and qualitatively affect on quality of human nutrition;
2. The state of the dental-maxillary system that affects on communicative function of man;
3. Influence of the condition of the dental-maxillary

apparatus, which affects on aesthetics of the face and smile;

4. The condition of the dental-maxillary apparatus, which affects on them function.

An important role is played by the maxillofacial area in the matter of human communication. Therefore, the most important areas and defects that are associated with the communication process – defects in the frontal area, smile, pronunciation changes, splashing saliva during conversation – all these signs accompany a number of abnormal processes, namely abnormalities in the location of individual teeth and occlusion can lead to joint trauma (acute, subacute: Nespryadko V.P., Tereshchuk O.G., Skrypnyk I.L.), which due to the pain symptom adds difficulties with prolonged chewing – especially in public places.

Therefore, it is clear that all these situations rapidly reduce the quality of life of people with similar problems and due to mass dental diseases: periodontal disease, dysfunction of the temporomandibular joint, occlusal pathology, can be considered as one of the important influencing the quality of life and gives the opportunity to search for us to improve it.

THE AIM

Therefore, the aim of our study was: to assess the impact of dental status on the quality of life of the adult population in the presence of periodontal disease in combination with musculoskeletal dysfunction in patients with dental anomalies and deformities.

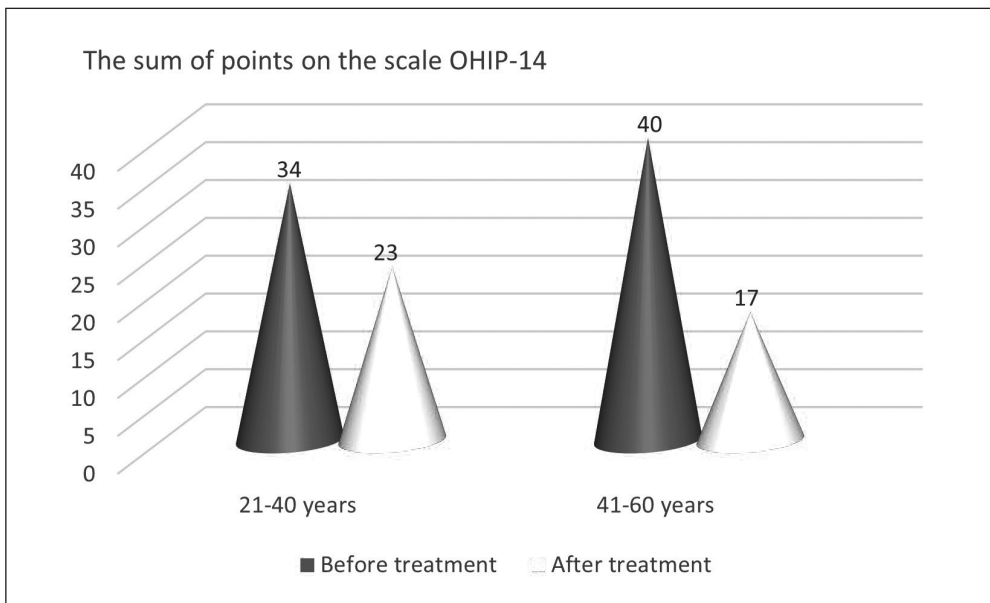


Fig. 1. Dependence of quality of life change from age, after correction of dental health.

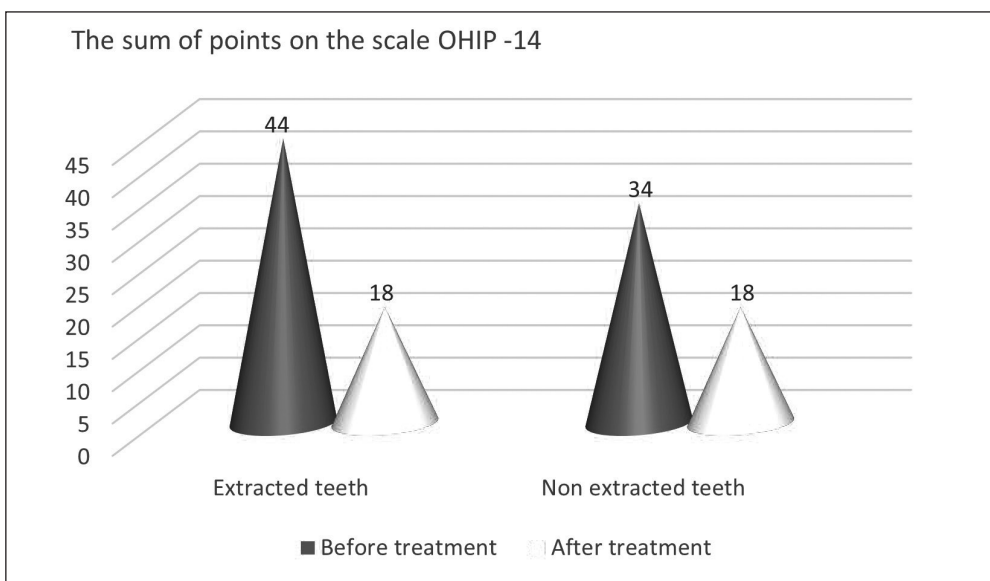


Fig. 2. Changes in quality of life after correction of the TMJ (Temporomandibular joint).

MATERIALS AND METHODS

To study this goal, we examined 283 patients who complained of an aesthetic defect of the dentition, combined with the presence of joint pain and periodontal disease of varying severity.

All patients were called for a repeat visit after 6 months, but only 173 people showed up. The age of the subjects varied from 21 to 60 years, among them 83 men. All patients lived in Kyiv and Kyiv region.

Quality of life was examined by a special questionnaire with the degree of measurement on the scale OHIP-14 (The Oral Health Impact Profile) [1].

RESULTS AND DISCUSSION

After the treatment, which consisted of restoration of occlusion by gnathological preparation, prosthetic restoration of the destroyed areas in combination with orthodontic correction of anomalies and periodontal support?

During the analysis the results of a study on the quality of life related to food intake, concerns were expressed at the first visit, but it turned out that it was more psychological in nature. What really affected, first of all, the quality of life was the age of the patients.

In patients aged 21-41 years, the quality of life after dental treatment increased 1.5 times, while in older patients – 2.3 times (Fig. 1).

I will note that before the start of treatment the quality of life of patients in the older group was the worst – after treatment – it became better.

The second social factor that significantly affects the quality of life after the aesthetic restoration of occlusion was gender. At the beginning of the examination, the difference in this feature was not detected, but 6 months after completion of treatment, the quality of life for men improved 1.6 times, and for women – 1.9 – this is as in the previous case due to improved process food intake.

After the treatment, the quality improved to the highest extent, 2.5 times in those who underwent gnathological

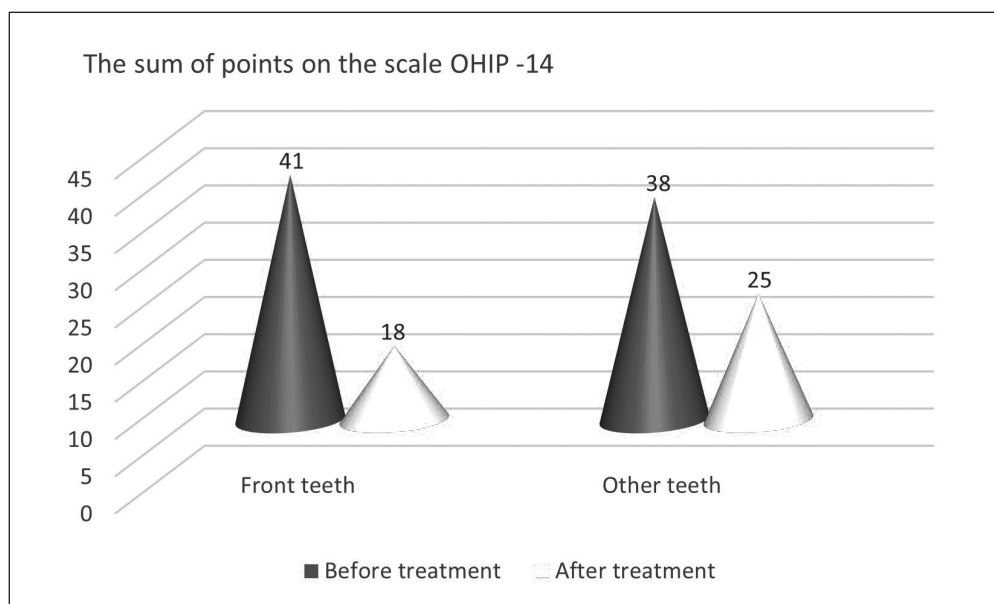


Fig. 3. Changes in quality of life depending on the location of the defect and occlusion anomaly.

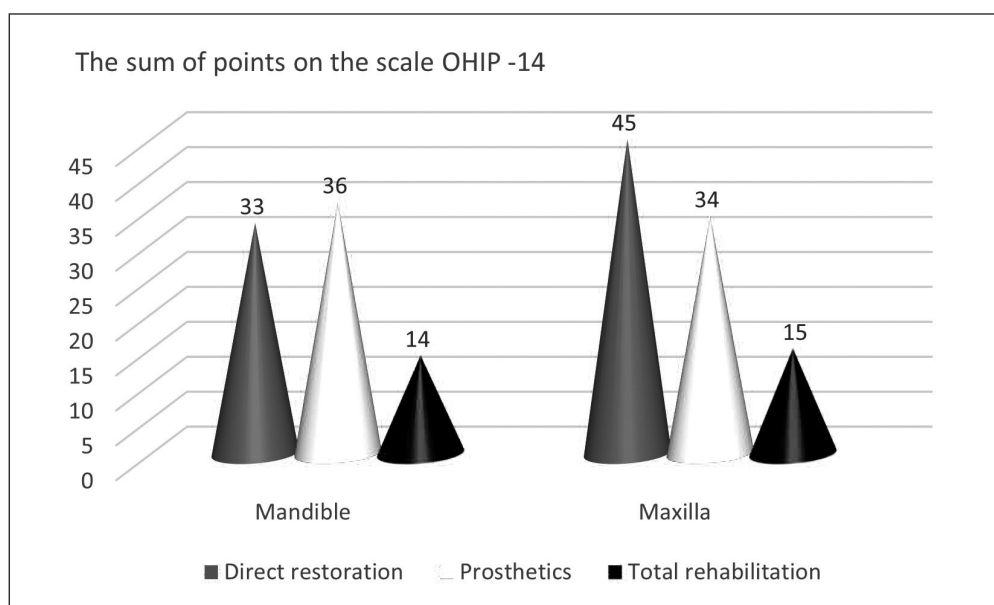


Fig. 4. Changes in quality of life depending from the type of correction provided.

stage with the help of splint therapy before the prosthetic stage, than those who underwent prosthetics and underwent orthodontic treatment without this stage – 1.9 times – and was not important it was only a relaxing or repositioning splint. At the initial examination, joint pain showed the worst quality of life (Fig. 2).

Another clinical factor influencing the quality of life was the localization of occlusion anomalies and abnormal location of individual teeth. When changing the appearance of the frontal area, the quality of life improved 2.3 times, while the latent (for the patient) manifestations of occlusion pathology in the presence of a problem in the lateral – improved 1.5 times as in other studies, the subjective feelings of patients (Fig. 3).

The next clinical factor influencing the quality of life was the type of treatment – namely, the best quality of life was found in the comprehensive rehabilitation of oral health, by periodontal and gnathological preparation before

prosthetic restoration, with orthodontic correction. In addition to the medical advantage, he had the highest level of improvement in the quality of life of patients 2.5 times on the lower jaw and 2.7 times – on the upper jaw (Fig. 4).

CONCLUSIONS

Accordingly, it can be concluded that the deficiencies associated with oral health reduce the quality of life of our patients, and the treatment significantly changes its quality depending on age, gender and method. But the best results in achieving positive changes in the patient's quality of life dentists can expect only by conducting a comprehensive, pathogenetically justified – in this case consisting of periodontal treatment, orthodontic occlusion correction, gnathological preparation with subsequent prosthetic restoration of occlusal contacts, which also has long-term functional aesthetic result of treatment.

REFERENCES

1. Vedeneeva E.N., Gurevich K.G., Vagner V.D. et al. Sochialnaya harakteristika i kachestvo zhizni patsientov, obrashchayushchihysya v kliniku estetieskoy stomatologii. [Social description and quality of life of patients circulating in the clinic of aesthetic stomatology] Kremlevskaya med. 2009; 2: 149-151. (In Russian).
2. Beskaravaynaya A.V., Ovodova G.F., Kuzmina L.N. Opredelenie faktorov, imeyushchih otnoshenie k kachestvu zhizni vrachey stomatologov. [Determination of factors, relating to quality of life of doctors of stomatologies]. Bul. Sev. gos. med. un-ta. 2008; 1: 138-139. (In Russian).
2. Opravin A.S., Ovodova G.F., Kuzmina L.N. et al. Professionalnaya deyatel'nost vrachey stomatologov v aspekte osnovnykh pokazateley kachestvu zhizni [Professional activity of doctors of stomatologies is in the aspect of basic indexes of quality of life]. Ekologiya cheloveka. 2008; 4: 16-18. (In Russian).
3. Greenstein G., Cavallaro J., Tarnow D. When to save or extract a tooth in the esthetic zone: a commentary. Compend Contin Educ Dent. 2008; 29: 3: 136 – 145.

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ORIGINAL ARTICLE

COMPARATIVE HYGIENIC ASSESSMENT OF WORKING CONDITIONS AND OCCUPATIONAL RISK IN THE APPLICATION OF PESTICIDES (ON THE EXAMPLE OF FUNGICIDE AMISTAR EXTRA 280, SC) USING DIFFERENT TYPES OF SPRAYERS

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ABSTRACT

The aim: Was a comparative hygienic assessment of working conditions and occupational risk in the application of fungicide Amistar Extra 280, SC using slotted and injector sprayers.

Materials and methods: Sprayers Super Poly 110-04 (variant №1) and Guardian Air GA110-04 (variant № 2), and certified equipment were used. The occupational risk was assessed in accordance with the methodological recommendations proposed by the L.I. Medvedia Scientific Center for Preventive Toxicology, Food and Chemical Safety specialists.

Results: When using the slotted sprayer Super Poly 110-04 in the air of the working zone of the tractor driver the content of azoxystrobin was 0.0015 ± 0.0001 mg/m³, cyproconazole – 0.085 ± 0.002 mg/m³, at a distance of 10 m from the edge of the field on the leeward side – 0.003 ± 0.001 and 0.11 ± 0.02 mg/m³, respectively. Visual analysis of water-sensitive cards after using slotted sprayers showed the presence of single drops of pesticide working solution in the wear zone.

When applying the pesticide using a Guardian Air GA110-04 injector sprayer in the air of the working zone of the tractor driver, areas of possible wear (10 and 100 m), the concentration of the active substances of Amistar Extra 280, SC formulation was below the limit of quantification of the method.

When assessing the complex risk for tractor drivers, a statistically significant difference was found for azoxystrobin ($p = 0.002$) and cyproconazole ($p = 0.001$) when using a slotted sprayer Super Poly 110-04 and injector Guardian Air GA110-04.

Conclusions: Values of the combined complex risk of application of the Amistar Extra 280, SC formulation for tractor drivers of variant №2 application were significantly lower than those for tractor drivers of variant №1.

KEY WORDS: injector nozzle, type of spraying, complex, combined occupational risk

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INTRODUCTION

According to the International Labor Organization [1], agriculture is among the most dangerous to life and health of workers in both industrialized and developing countries. Agriculture employs almost half of the world's workforce (1.3 billion people), killing up to 170,000 agricultural workers each year as a result of accidents, injuries related to agricultural machinery, poisoning by pesticides and other chemicals [2].

Improving chemical plant protection products (ChPPPs), applied technologies and the integration of chemical, physical and biological knowledge will truly optimize the use of pesticides without compromising the quality and efficiency of agriculture or consumer and environmental protection [3].

The Directive [4], which regulates the actions of citizens to ensure the sustainable and safe pesticides application, amended the safety requirements for pesticide application machines. Particular attention is paid to assessing the risk of using pesticide application machines, ensuring maximum deposition of pesticides on target sites and

minimizing losses in non-target areas, which will ensure a high level of protection of human health and safety and the environment.

The sprayer (nozzle) is a key element of the sprayer and the efficiency of processing, economic, operational, hygienic and ecological indicators depend on it. Properly selected nozzles and conditions for pesticide application ensure efficient distribution of the working solution on the target surfaces [5], which reduces the risk of impact on the ecosystem and workers involved in the treatments.

Currently, hydraulic injectors are increasingly used, which, according to manufacturers [6, 7] and literature sources [3, 8] have a number of significant advantages in the effectiveness of ChPPPs application, economic and hygienic aspects.

THE AIM

Therefore, the aim of our work was a comparative hygienic assessment of working conditions and occupational risk when applying the fungicide Amistar Extra 280 SC using slotted and injector sprays.

MATERIALS AND METHODS

Field studies were conducted in 2020 on the basis of Bila Tserkva research station LLC "Syngenta" in the Kiev region using the Amistar Extra 280, SC (80 g/l of cyproconazole and 200 g/l of azoxystrobin) in the maximum application rate of the formulation (0.75 l/ha), working solution – 250 l/ha on soybean crops. When applying the formulation certified equipment was used (trailed boom sprayer AMAZON 1201 UF (1200 l), which was combined with a tractor MTZ 82.1 Belarus). Super Poly 110-04 (variant №1) and Guardian Air GA110-04 (variant № 2) sprays were selected for comparative studies. The first of them is a universal slotted sprayer of a wide range, which performs disintegration of the working solution; the second is an air-injector spray, which due to its structure performs air ejection, mixing with liquid and spraying drops with air inclusions.

The refueler carried out preparation of the formulations' working solution, the duration of the operation was 7-10 minutes. The soybean crops were processed by a tractor driver for 20 minutes. The refueler and the tractor driver were dressed in special protective clothing during the production operations: overalls made of synthetic fabric and boots. Rubber gloves and respirators were used as personal protective equipment.

Air sampling was performed using a portable aspirator "Typhoon". Air samples were taken on a paper filter "blue tape" and silica gel. When performing each production operation at three parallel points, 3 samples were taken sequentially. Cards, made of water-sensitive paper TeeJet 20301-1N (76 mm×26 mm), were installed at a height of 0.5 m on an artificial support for visual assessment of the presence and density of working solution drops in a possible wear zone (10 m on the leeward side of the field). Evaluation of the result was performed by counting through a magnifying glass the number of drops on the cards that were used during the slotted and injection application of the pesticide. In each variant of the field study, 10 water-sensitive cards with their obligatory numbering were used.

Studies of the pesticides content on the skin surface of the workers were performed after the operation with degreased and soaked in ethyl alcohol diluted in water in a ratio of 1: 1, gauze napkins and stripes (3-layer stripes: outer layer – cotton fabric, middle layer – medical gauze, internal – the filter "blue tape") on overalls.

Sampling and quantification of the active substances content in the air of the working area, atmospheric air, in washes from exposed skin and gloves, stripes on overalls were performed by high performance liquid and gas-liquid chromatography. Methods, limits of quantitative determination and hygienic standards of the investigated active substances are given in Table I.

Occupational risk assessment was performed in accordance with the guidelines [9]. Because Amistar Extra 280, SC is a combined pesticide, the simultaneous action of two active substances is possible. Therefore, to assess, we calculated the magnitude of occupational risk in the combined exposure of both active substances in one formulation. The combined risk (CR) was determined by simply summing the risk values of several active substances in a complex intake:

$$CR = \sum \left(\frac{D_{ing.}}{PD_{ing.}} \right)_{1,2...n} + \sum \left(\frac{D_{derm.}}{PD_{derm.}} \right)_{1,2...n}$$

where CR – combined risk;

1,2, ... n – studied active substances;

$D_{ing.}$ – a dose of pesticide that enters the worker's body by inhalation;

$D_{derm.}$ – the dose of pesticide that enters the worker's body through the skin;

$PD_{ing.}$ – permissible inhalation dose for professional contingents;

$PD_{derm.}$ – permissible percutaneous dose for professional contingents.

Statistical processing of the results was performed using the licensed statistical software package IBM SPSS Statistics Base v.22.

RESULTS

As a result of field studies of working conditions during pesticide application operations, it was found that the concentration of azoxystrobin and cyproconazole in the air of the refueler's working zone and the zone of possible wear in all variants of experiments was below the limit of quantitative determination of the method (Table I).

When using the slotted sprayer Super Poly 110-04 (variant №1) in the air of the tractor driver's working area the content of azoxystrobin was 0.0015 ± 0.0001 mg/m³, cyproconazole – 0.085 ± 0.002 mg/m³. We also analyzed the

Table I. Hygienic standards and limits of quantitative determination (LQD) of the studied active ingredients in the air of the working zone, atmospheric air, washes from the skin surface and stripes from the overalls of personnel

Sample type	Current norms, LQD	Azoxystrobin	Cyproconazole
The air of the working zone, mg/m ³	TSEL	1.0	0.1
	LQD	0.001 (HPLC)	0.05 (GC)
Atmospheric air, mg/m ³	TSEL	0.01	0.01
	LQD	0.001 (HPLC)	0.008 (GC)
Washes, stripes, mg	LQD	0.002 (HPLC)	0.002 (GC)

Notes: TSEL – tentatively safe level of exposure; LQD – limit of quantitative determination; HPLC – high performance liquid chromatography; GC – gas-liquid chromatography.

Table II. The content of active ingredients of the Amistar Extra 280, SC formulation in air samples using different spraying technologies, mg/m³

Type of nozzle	Active ingredient	Air in the respiratory zone		Air in the treatment zone after				Air in zone of		
		refueler	tractor driver	10 m from the edge of the field		possible wear * after		1 hour	3 days	7 days
				1 hour	3 days	7 days	treatment time			
Super Poly 110-04 (slotted sprayer)	azoxystrobin	<0.001**	0.0015	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001
	cyproconazole	<0.05	0.085	<0.008	<0.008	<0.008	0.11	<0.008	<0.008	<0.008
Guardian Air GA110-04 (injector sprayer)	azoxystrobin	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	cyproconazole	<0.05	<0.05	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008

Notes: 1. * - the study was conducted at a distance of 100 m from the edge of the site; 2. ** - below the limit of quantitative determination of the method in the air of the working zone and atmospheric air.

Table III. The magnitude of the potential risk of hazardous exposure to the drug Amistar Extra 280 SC, hp for refuelers and tractor drivers when using different spraying technologies

Type of nozzle	Active ingredient	Risk values						Proportion of inhalation risk, %		Proportion of dermal risk, %		Combined risk	
		inhalation, ×10 ⁻²		dermal, ×10 ⁻²		complex, ×10 ⁻²		R	TD	R	TD	R	TD
		R	TD	R	TD	R	TD						
Super Poly 110-04 (slotted sprayer)	Azoxystrobin	0.01	0.12*	0.04	0.03	0.05	0.16*	22.6	79.3	77.4	20.7	0.04	0.46*
	Cyproconazole	3.4	46.2*	0.53	0.48	3.93 ²	46.72*	86.6	98.9	13.4	1.1		
Guardian Air GA110-04 (injector sprayer)	Azoxystrobin	0.01	0.04*	0.04	0.03	0.05	0.07*	22.6	56.0	77.4	44.0	0.04	0.02*
	Cyproconazole	3.4	13.6*	0.53	0.48	3.93	14.1*	86.6	96.6	13.4	3.4		

Notes: 1. R – refueler; 2. TD – tractor driver; 3. * – the values of the risk when using a slit sprayer are significantly higher according to the Student's criterion at p < 0,05.

content of active substances of the Amistar Extra 280, SC formulation at a distance of 10 m from the edge of the field on the leeward side. The concentration of azoxystrobin in the wear zone when applying the formulation using Super Poly 110-04 was 0.003±0.001 mg/m³, cyproconazole – 0.11±0.02 mg/m³. In the air of the treatment zone (above the field) after 1 hour, 3 days, 7 days and the zone of possible wear at a distance of 100 m from the edge of the site after 1 hour, 3 days, 7 days the concentrations of active substances was below the limit of quantification in atmospheric air.

When applying the pesticide using the injector spray Guardian Air GA110-04 (variant №2) in the air of the tractor driver working area the concentration of studied active substances was below the limit of quantification of the method (Table II). In the air of the treatment zone, zones of possible wear (10 and 100 m) in different time intervals the concentration of active substances was below the limit of quantitative determination of the method (Table II).

Visual analysis of water-sensitive cards installed in a possible wear zone (10 m on the leeward side of the field) using slotted sprayer, showed the presence of single drops of pesticide working solution on cards № 1-5, 8, 9. On cards № 6, 7, 10 visually, using a magnifying glass, the drops were not detected. No color change was observed on any water-sensitive card when the pesticide was applied by injection technology.

An analysis of the content of active substances in washes from exposed areas of skin and stripes on staff overalls was performed. It was found that the level of contamination of open (face, neck) and closed areas of the skin of the refueler and tractor driver was below the limit of quantification of the relevant methods. In strips on workers' overalls, the concentrations of active substances were also below the limit of determination of the method.

The obtained factual data on the assessment of working conditions using the injector sprayer Guardian Air GA110-04 and slotted one Super Poly 110-04 allowed us to calculate the occupational risk of complex intake through the skin and respiratory tract, as well as the combined intake of several active substances in one formulation. (Table III).

Analysis of the data of occupational risk calculations for complex and combined exposure to pesticides showed that the difference in the risks for refuelers of the sprayer tanks in variants №1 and №2 of field studies is not significant according to Student's criterion (p > 0.05). This is completely comparable to the expected result, as the technologies for preparing the working solution and filling the sprayer tank were identical. The proportion of percutaneous and inhalation risks in azoxystrobin refuelers was 77.4 and 22.6 %, respectively. For cyproconazole, the percutaneous and inhalation risks were 13.4 and 86.6 %, respectively, and the combined risk was 0.04.

When assessing the complex risk for tractor drivers, a statistically significant difference was found for azoxystrobin ($p = 0.002$) and cyproconazole ($p = 0.001$) when using a slotted sprayer Super Poly 110-04 and injector Guardian Air GA110-04. The proportion of percutaneous risk in variants № 1 and № 2 was lower for all active substances than the proportion of inhalation risk. The values of the combined risk when using a slotted sprayer (0.46 ± 0.04) significantly exceeded the data obtained when using an injector one (0.02 ± 0.006).

DISCUSSION

The results of the analysis of the working area air of persons involved in the preparation of the working solution, filling the sprayer tank and application of Amistar Extra 280, SC indicate compliance with the concentration of active substances. But it should be noted that the concentration of active substances in the working area of the tractor driver when slotted application is higher. In the air of the wear zone at a distance of 10 m from the edge of the field on the leeward side, the concentration of azoxystrobin and cyproconazole was also higher in variant №1. It should be noted that even such a minimal difference may be decisive in the implementation of the risk of negative impact not only for professional contingents, but, for example, for the ecosystem (honey insects in the neighboring field) or workers in the neighboring field (who doing non-pesticide field work, of course, without personal protection means).

The results of visual analysis of water-sensitive paper cards in the variant №1 of field studies confirmed the presence of wear of microdroplets, which can cause loss of effectiveness of the formulation, impact on non-target objects and create a burden on the environment as a whole. This problem becomes especially relevant when applying pesticides in private farms or in areas where compliance with the protection zone is difficult.

The obtained results correlate with the data given in [3, 8, 10, 11], i.e. we can say about the advantage of injector sprays not only as “anti-drift”, but also as means of providing lower concentrations of active substances under the same conditions of application of formulations based on them.

The values of occupational risks in the complex and combined effects of azoxystrobin and cyproconazole in the studied application technologies indicate a statistically significant difference for tractor drivers of slotted and injector application. According to [1, 5, 12] the proportion of inhalation risk is higher for tractor drivers due to work during the disintegration of pesticides working solutions; and for refuelers the proportion of percutaneous risk prevails, as components of professional activity are unpacking, dosing pesticide and filling the sprayer tank. The obtained results are comparable with the literature data, but it should be noted that in studies with slotted sprayers complex and combined risks for tractor drivers are significantly higher than for tractor drivers with injector spraying and this difference is due to the high inhalation risk. From the point of view of working conditions safety, the use of injectors is

more justified, especially in private farms, where the use of personal protective equipment is not controlled by the employer and is often ignored by workers.

CONCLUSIONS

1. It is established that in real conditions of carrying out treatment of soy by the Amistar Extra 280, SC formulation with the use of Guardian Air GA110-04 injectors and slotted Super Poly 110-04 in compliance with the recommended agronomic and hygienic regulations for safe application, there is no excess of hygienic standards in the air of the working and wear zone and it is proved that occupational risk does not exceed acceptable (< 1).
2. Statistical analysis of the obtained results showed that the values of inhalation risk are significantly higher for tractor drivers when using slotted sprayers than in tractor drivers involved in the application of pesticides by injector sprayers (at $p < 0.05$). Values of the combined complex risk of application of the Amistar Extra 280, SC formulation for tractor drivers of variant №2 application were significantly lower than those for tractor drivers of variant №1.
3. Absence of even insignificant wear of active substances of the investigated formulation outside of the processed field at use of injector sprayers is shown. This, on the one hand, will provide greater biological and economic efficiency of the formulation application by this method; on the other hand, it further reduces the risk of negative impact not only on the pesticide treatment workers, but also on other people and the ecosystem as a whole.

REFERENCES

1. International Labor Organization. ILO warns on farm safety Agriculture mortality rates remain high Pesticides pose major health risks to global workforce. https://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_008027/lang--en/index.htm.
2. Berezhnyak Y.V., Rakytskyj V.N., My'xeeva E.N. et al. Ry'sk zdorov'yu operatorov pry' pry'meneny'y' pesty'cy'dov v sel'skom zoxyajstve. [The risk to health of operators under application of pesticides in agriculture] *Zdravooxraneny'e Rossy'jskoj Federacy'y'*. 2017; 61(4): 185—190. (In Russian). DOI: <http://dx.doi.org/10.18821/0044-197X-2017-61-4-185-190>.
3. Borysenko A. A., Antonenko A. M., Shpak B. I. et al. Gigiyenichna ocinka zastosuvannya pesty'cy'div shlyaxom vy'kory'stannya inzhektorny'x rozpy'lyuvachiv (oglyad literatury'). [Hygienic evaluation of pesticide application in using injection sprayers (literature review)]. *Ukrayins'ky' zhurnal z problem medy'cy'ny' praci*. 2020; 4(65): 302–310. (In Ukrainian).
4. Directive 2009/127/EC of the European Parliament and of the Council of 21 October 2009 Amending Directive 2006/42/EC with Regard to Machinery for Pesticide Application. <http://data.europa.eu/eli/dir/2009/127/oj>.
5. Novoxacz'ka O.O. Gigiyenichna ocinka osobly'vostej zastosuvannya rizny'x grup pesty'cy'div na posadkax kartopli v agropromy'slovomu kompleksi Ukrayiny'. [Hygienic assessment of the peculiarities of the use of different groups of pesticides on potato plantings in the agro-industrial complex of Ukraine] *Ekologichni ta gigiyenichni problemy' sfery' zhy'ttyediyal'nosti lyudy'ny'*. 2020: 127-128. (In Ukrainian).

6. TeeJet Technologies. A Spraying Systems Company. 2007; 192.
7. Agricultural Spray Nozzles and Accessories. Catalogue Lechler. 2012; 65.
8. Li Y., Li Y., Pan X. et al. Comparison of a new air-assisted sprayer and two conventional sprayers in terms of deposition, loss to the soil and residue of azoxystrobin and tebuconazole applied to sunlit greenhouse tomato and field cucumber. *Pest Manag Sci.* 2018; 74(2): 448-455. DOI 10.1002/ps.4728.
9. Metodichni rekomendatsiyi «Vyvchennya, otsinka i zmeshennya ryzyku inhalyatsynoho i perkutannoho vplyvu pestytsydiv na osib, yaki pratsuyut' z nymy, abo mozhut' zaznavaty vplyvu pestytsydiv pid chas i pislya khimichnoho zakhystu roslyn ta inshykh ob'yektiv». [Guidelines "Study, assessment and reduction of the risk of inhalation and percutaneous exposure to pesticides on persons who work with them or may be affected during and after chemical protection of plants and other objects"], *Zatv. MOZ Ukrainy* № 324 vid 13.05.2009, Kyiv. 2009: 29 p. (In Ukrainian).
10. Lammoglia S.-K., Kennedy M. C., Barriuso E. et al. Assessing human health risks from pesticide use in conventional and innovative cropping systems with the BROWSE model. *Environment International.* 2017; 105: 66–78. <https://doi.org/10.1016/j.envint.2017.04.012>.
11. Revjakin E. L., Krahoveckij N. N. Neproizvoditel'nyye poteri pestitsidov pri opryskivanii. Kak ikh izbezhat': nauch. analit. Obzor [Unproductive losses of pesticides during spraying. How to avoid them. Overview], *Rosinformmagroteh.* 2010. 124. (In Russian).
12. Omelchuk S.T., Vavrinevych O.P., Antonenko A.M. et al. Gigiyenichna ocinka profesijnogo ry'zy'ku dlya pracivny'kiv pry' zastosuvanni pesty'cy'div na posadkax kartopli. [Hygienic assessment of professional risk for employees when applying pesticides for protection of potatoes]. *Medy'chna nauka Ukrainy.* 2018; 14: 95-102. (In Ukrainian).

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ORIGINAL ARTICLE

ARTIFICIAL TERMINATION OF PREGNANCY IN UKRAINE: BIOETHICAL, PHILOSOPHICAL AND RELIGIOUS ASPECTS

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ABSTRACT

The aim: Is to study the levels of influence of the Christian spiritual tradition on the attitude of medical students to abortion, which necessitated a comparative analysis of Christian ethics and the main approaches of secular bioethics regarding artificial termination of pregnancy; analysis of the results of sociological research taking into account the peculiarities of religious self-identification of medical students.

Materials and methods: The complex nature of the studied issue necessitated the application of interdisciplinary approaches, philosophical, general scientific and special sociological methods of collecting, processing and analyzing information. Certain differences between Christian moral guidelines and attitudes towards artificial termination of pregnancy were found in a questionnaire study conducted by a sociological group of the Bogomolets National Medical University (hereinafter – NMU) in 2020. The object of the study were first and sixth year students and postgraduate students of NMU (N = 375).

Results: Based on a comparative analysis of the evaluative judgments of three groups of respondents (1 group – those who identified themselves as Christians; 2 group – those who are uncertain with their attitude towards religion; 3 group – those who consider themselves non-believers) regarding artificial termination of pregnancy, it was found that the attitude of medical students-believers towards this problem differs from the more liberal approaches of the respondents of the second and third groups, and, at the same time, has significant differences with Christian moral guidelines on this issue.

Conclusions: A comparative analysis of the main approaches of secular bioethics and Christian ethics to the issue of artificial termination of pregnancy allows us to conclude that the Christian position is distinguished by the recognition of sacredness, inviolability of human life, inalienable dignity and value of human being from conception to the natural end of life. This determines the special importance of the Christian spiritual tradition in overcoming the manifestations of abortive mentality in contemporary Ukrainian society.

KEY WORDS: abortion, bioethics, medical students, Christian ethics, secular bioethics

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INTRODUCTION

The issue of abortion is one of the most acute ethical and legal problems of the contemporary post-secular world, as it is a violation of a fundamental, basic human right – the right to life. According to the WHO, about 40-50 million abortions are performed annually in the world: approximately 125 thousand abortions per day. The positive dynamics of artificial abortions of pregnancy can be traced in recent years in Ukraine. The number of abortions, according to the Ministry of Health of Ukraine in 2019, amounted to 74 thousand 606, of which 727 were done under the age of full [1].

Overcoming this negative tendency in Ukraine is a particularly difficult process, as Ukrainians (except in the western regions) belong to those peoples to whom abortive “culture” was imposed during the 70-year stay in the USSR. It is a shame, but its consequences have not been overcome to this day. Bishops of the Roman Catholic Church in their message to the 100th anniversary of abortion genocide mention: “Unfortunately, after the collapse of the Soviet Union, Ukraine did not break with this communist legacy and to this day has not created a law that would protect its

citizens from conception to natural death. More than 30 million surgical abortions have been performed in Ukraine since independence. During these hundred years since the beginning of the legalization of abortion, the abortion mentality has been formed in society. In the minds of many people, abortion is a common medical procedure, but nevertheless devalues human life, the dignity of women and sows a “civilization of death” in society”. [2] Therefore, it is important in solving the issue of abortion not only to provide comprehensive approaches to its solution at the state level, including the regulation of a number of legal norms in accordance with fundamental criteria of morality, but also moral and value transformation, revival of Ukrainian society. Particularly urgent is the formation of the worldview of modern Ukrainian youth, including students of medical institutions of higher education, based on humanistic, universal values, Christian spiritual tradition, which is historically rooted in the history and culture of the Ukrainian people. After all, the moral and ethical principles and strategies of Ukraine's health care system development will largely depend on the position of this group of young people in the coming decades.

THE AIM

The aim of this article is to study the levels of influence of Christian spiritual tradition and secular culture on the attitude of medical students towards the issues of abortion. Hence, the tasks are following: to carry out a comparative analysis of the positions of Christian ethics and the main approaches of secular bioethics towards abortion; to analyze the results of sociological research taking into account the peculiarities of religious self-determination of medical students.

MATERIALS AND METHODS

The complex nature of the studied issue necessitated the application of interdisciplinary approaches, philosophical, general scientific and special sociological methods of collecting, processing and analyzing information. Certain differences between Christian moral guidelines and attitudes towards artificial termination of pregnancy were found in a questionnaire study conducted by a sociological group of the Bogomolets National Medical University (hereinafter – NMU) in 2020. The object of the study were first and sixth year students and postgraduate students of NMU (N = 375).

RESULTS

An essential feature of bioethics as an integrative direction of modern knowledge and social practice is openness to religious worldview, coexistence of different types of secular version of bioethics and its religious versions: Orthodox, Catholic, Protestant, Jewish, Islamic and other bioethics. [3, p. 39, 40].

One of the essential features of Ukraine is a fairly high level of religiousness of population, despite 70 years of experience of forced quasi-atheism. According to a survey conducted by the Razumkov Centre among the Ukrainian citizens as of the end of 2019, the number of people that identify themselves as believers is 66%. Among them, 64.9% identify themselves with Orthodoxy, 1.6% – with Roman Catholicism, 9.5% – with Greek Catholicism, 1.8% – with Protestantism and 8% identify themselves as “just a Christian”. [4, p.14].

Considering the religious and confessional features of Ukrainian society, the significant influence of Christian spiritual tradition on the development of bioethics and biomedical ethics in Europe, we emphasize the common Christian position regarding artificial termination of pregnancy, its differences from approaches in secular bioethics. As it is known, bioethical assessments of artificial termination of pregnancy are based on two fundamental issues: about the status of the human embryo; the relationship between the mother's right to autonomy, reproductive choice, and the right of the unborn child to life. Although, in our opinion, the current formulation of the issue of the status of the embryo, in the broad sense of this term, does not quite accurately reflect the essence of this problem in bioethics. After all, the

emphasis on the embryo (a human being from 2 to 8 weeks of intrauterine development) leaves in the shadow the primary, pre-embryonic stage of development, the moral and ethical assessment, which distinguishes the Christian tradition not only from the moderate (graded) approach in secular bioethics but also from other religious versions [5].

In bioethics, the question of the status of a human embryo is usually related to the answers to question: from what period of fetal development can an embryo be considered human being; does it apply to him and to what extent universal rights, especially the right to life? However, a deeper philosophical question of understanding the essence of man is at the heart of this bioethical issue.

Representatives of the liberal approach understand man as a purely social being, so an embryo is only part of mother's body even in the later stages of fetal development. Therefore, the issue of abortion is considered only in the context of maternal autonomy. Perhaps it is the sociologizing approach to man, and not only the protection of “basic democratic rights of citizens” (Lenin) became the ideological basis for the adoption of the Resolution “On Health” by Bolshevik government on November 18, 1920, which first legalized abortion at a request of a woman. Today, liberal approaches are most actively supported by feminist movements, emphasizing the “basic right of women – the right to their own bodies”.

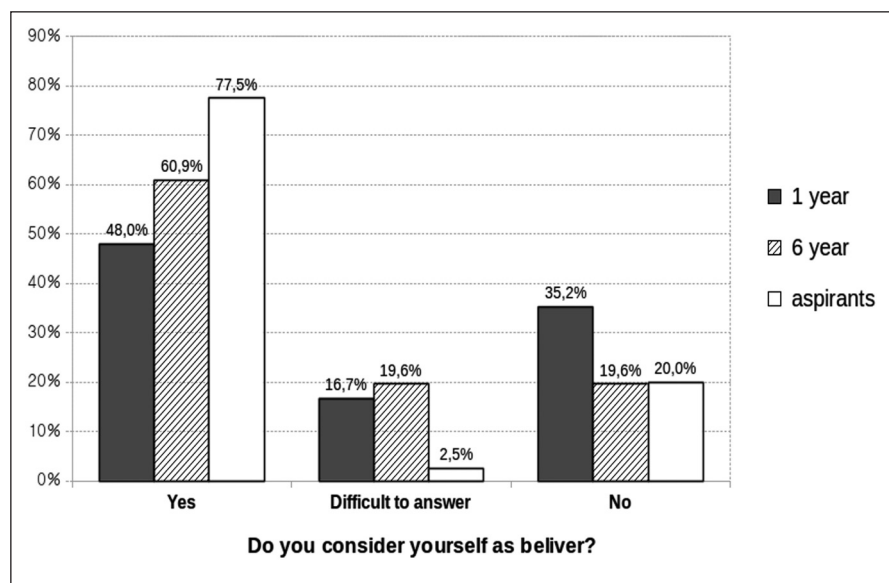
Proponents of a moderate (graduated, centrist) approach assess the status of a human embryo in the dynamics, taking into account the stages of development of a potential human. In the process of its development, the embryo seems to accumulate its right to life, and accordingly reduces the mother's right to autonomous decision-making on abortion. Aristotle was one of the representatives of this approach believing that abortion can be performed as long as a fetus does not become sensitive and mobile.

The position of Christian ethics on abortion and other issues related to the beginning of human life are based on the biblical doctrine of man as the only one in the world created by God in His image and in His likeness (Gen. 1:26), the uniqueness of the divine likeness of human dignity. The principle of human dignity in Christian moral theology is more fundamental and universal than the principle of individual autonomy, because freedom is only one manifestation of the specific nature of man as God's gift. According to the Catholic theologian and bioethicist Ignacio Carrasco de Paula, the deepest basis of human dignity is not that it is individual (unique and inimitable) and not that it is free, but above all that it is transcendent: as the scholastics insisted, *capax Dei* (capable for God). The idea of the fundamentality of human dignity is inherent in all Christian denominations. [6].

Christian anthropology is characterized by an approach to man in its integrity as a spiritual soul-corporeal creature. The human body is not separated from its “I”. Pope John Paul II spoke of a “spiritual body” and a “embodied spirit” [7]. Prominent Orthodox archpastors of the 20th century, the physician and archbishop Luka (Voyno-Yasenetsky)

Table I. The attitudes of medical students towards the acceptability of induced abortion

«What is your attitude towards an artificial termination of pregnancy»	% of those who identify themselves as believers	% of those who are undecided	% of those who do not identify themselves as believers
Every woman can decide for herself whether to keep or terminate a pregnancy	45,6%	75,0%	71,0%
Abortion is acceptable at the request of a woman only up to 12 weeks	11,7%	12,5%	15,0%
Abortion is acceptable only in cases related to medical or exceptional social indicators	35,6%	12,5%	11,2%
Abortion is acceptable only if a woman's life is threatened	3,9%	0,0%	2,8%
Induced abortion is unacceptable under any circumstances	3,3%	0,0%	0,0%

**Fig. 1.** The attitudes towards religion of medical students of various years of study. Case of Bogomolets National Medical University.

and Metropolitan Anthony of Sourozh also developed this approach. Professor of Medicine Voyno-Yasenetsky substantiating the inseparable relationship between the spirit, soul and human body noted that "...spirit forms a body in the embryonic state. All cells of the body inherent spiritual energy and life from the Spirit". [8].

The Christian Eucharistic ethos is characterized by an attitude to life as a priceless gift of God. The contemporary Orthodox theologian Metropolitan John Zizioulas emphasizes the primary understanding and implementation of the Eucharist as an expression of gratitude for the gift of being. [9]. Since life is a fundamental good for man, the morally justified attitude to it is accepting life as a gift that must be cherished, nurtured and loved. [10].

Therefore, today, the common Christian position is the recognition of the inherent dignity and value of the human being from the moment of conception and including all subsequent stages of its intrauterine development. It should be noted that the formation of this approach in Christianity was largely facilitated by the development of science, in particular embryology, genetics. It is no coincidence that Pope Francis qualifies the problem of abortion primarily as a scientific problem.

"It is unethical to hinder the further development of a creature that is already endowed with a full-fledged human genetic code... To have an abortion means to kill a defenseless one" [11]

Certain differences between Christian moral guidelines and attitudes towards artificial termination of pregnancy were found in a questionnaire study conducted by a sociological group of the Bogomolets National Medical University (hereinafter – NMU) in 2020. The object of the study were first and sixth year students and postgraduate students of NMU (N = 375).

Among the respondents, 52.9% respondents consider themselves believers, 31.6% consider themselves non-believers and 15.5% are hesitant to answer the question "Do you consider yourself a believer?" The vast majority of respondents who considered themselves believers identified themselves as Christians (95.2%), 3.2% – as Muslims and 1.6% identified themselves as representatives of other religions.

A statistically significant connection was found between identifying oneself as a Christian and attitude towards abortion ($p < 0.005$). Respondents who identified themselves as believers were more likely to take a moderate

Table II. The attitudes of medical students towards the acceptability of induced abortion in relation to years of study. Case of Bogomolets National Medical University.

«What is your attitude towards an artificial termination of pregnancy»	% of respondents of first year of study	% of respondents of sixth year of study and aspirants
Every woman can decide for herself whether to keep or terminate a pregnancy	58,0%	57,6%
Abortion is acceptable at the request of a woman only up to 12 weeks	12,5%	16,5%
Abortion is acceptable only in cases related to medical or exceptional social indicators	21,4%	23,5%
Abortion is acceptable only if a woman's life is threatened	3,9%	0%
Induced abortion is unacceptable under any circumstances	1,6%	2,4%

approach to the acceptability of induced abortion. Instead, among those who do not consider themselves a believer, the most common is liberal attitude towards acceptability of abortion: 71.0% respondents believe that every woman can decide for herself whether to keep or to abort pregnancy, because she has the right to control her body (see Table 1).

There is a statistically significant relationship between the year of study and the believer's identification ($p = 0.000$): 48.0% of first-year respondents, 60.9% of 6-year respondents and 77.5% of postgraduate students identified themselves as believers (See Figure 1), which confirms the results of previous studies. In November–December 2013, a survey of students of NMU of 1–6 years of studying ($N=8259$) was conducted, the results of which show that contrary to stereotypes that religiosity is associated with low educational and cultural level of the population, the level the religiosity of the respondents does not decrease with the increase in the educational level of medical students.

It is worth noting that the lowest percentage (2.5%) of those who are hesitant to answer the question “Do you consider yourself a believer?” is among the postgraduate respondents. That suggests that the worldview self-identification of future doctors becomes more definite with increasing year of study.

Despite this tendency, there was no statistically significant relationship between attitudes towards abortion and year of study ($p = 0.36$) (see Table 2). The majority of respondents in both the first year of study (58.0%) and respondents of the 6th year and postgraduate students (57.6%) follow a liberal approach to the issue of abortion.

DISCUSSION

The study of the influence of Christian spiritual tradition and secular culture on the attitude of medical students towards the issue of artificial termination of pregnancy indicates the need for further differentiation of groups of respondents. The distinguishing of only three groups on the basis of religious self-identification (those who identified themselves as believers; those who consider themselves non-believers; and those who are undecided) proved insufficient. Medical students who have identified themselves as believers are more inclined to take a moderate approach in assessing the acceptability of induced abortion,

as opposed to the liberal approach that prevails in other groups of respondents. Nevertheless, the attitude towards abortion of some medical students who have identified themselves as believers (95.2% of whom are Christians) does not correspond with Christian morality, which is based on the inviolability of human life from conception at all subsequent stages of fetal development.

Therefore, the group of respondents who identify themselves as believers should be distinguished into at least two subgroups: believers that are characterized by internal religiousness and are focused on Christian spiritual tradition, and believers who are characterized by a fairly high level of focus on secular values of contemporary culture.

CONCLUSIONS

A comparative analysis of the main approaches of secular bioethics and Christian ethics to the issue of artificial termination of pregnancy allows us to conclude that the Christian position is distinguished by the recognition of sacredness, inviolability of human life, inalienable dignity and value of human being from conception to the natural end of life. This determines the special importance of the Christian spiritual tradition in overcoming the manifestations of abortive mentality in contemporary Ukrainian society. At the same time, the study shows that the values of secular culture, which is largely due to the peculiarities of the modern globalized world, have a significant influence on the formation of evaluative judgments of medical students who have identified themselves as Christians. This highlights the importance of a comprehensive approach to the issue, in particular not only the formation of contraceptive culture among modern youth (which is emphasized in modern society), but also moral education on the basis of universal humanistic values.

REFERENCES

1. Torik ukrainky zrobyly ponad 74 tys. abortiv, – ofitsiini dani MOZ [Last year, Ukrainian women performed more than 74,000 abortions, according to official data from the Ministry of Health]. (In Ukrainian).
2. Dibrivna E. Sohodni 100 rokiv abortyvnomu henotsydu u sviti. Istoriia ta statystyka 18.11.2020 [Today is the 100th anniversary of abortive genocide in the world. History and statistics]. 2020. (In Ukrainian).
3. Zaporozhan V., Ariaiev M. Bioetyka ta biobezpeka: Pidruchnyk [Bioethics and biosafety: Textbook]. 2013:456. (In Ukrainian).

4. Derzhava i tserkva v Ukraini – 2019: Pidsumky roku i perspektyvy rozvytku vidnosyn (informatsiini materialy). [State and the Church in Ukraine – 2019: Results of the year and prospects for the development of relations (information materials)]. 2019:70. (In Ukrainian).
5. Vasylieva I., Mozgova N., Bilozor D. et al. The development of bioethics in the context of the christian spiritual tradition. AD ALTA: Journal of Interdisciplinary Research., 2021; 11: 166.
6. Melina L., Herr T., Carrasco de Paula I. et al. Nravstvennoe deistvie khrystyany. [The moral action of a Christian]. 2007:159. (In Russian).
7. Giovanni Paolo I.I. Lettera Enciclica Evangelium Vitae [Text] (Citta del Vaticano (25 marzo) . 1995:19.
8. Luka S. (Voyno-Yasenetskyi) "Dukh, dusha y telo» [Luka (Voyno-Yasenetsky). Spirit, Soul and Body]. Avicenna; 2010:199-200. (In Russian).
9. Yoann Z. Obshchenie i inakovost. Novie ocherky o lichnosti y tserkvi [Zizioulas John. Communion & Otherness: Further Studies in Personhood and the Church (Translated from English)]. 2012:114. (In Russian).
10. Melina L., Herr T., Carrasco de Paula I. et al. Nravstvennoe deistvie khrystyany. [The moral action of a Christian]. 2007:148. (In Russian).
11. Berhalio Kh., Skorka A.. Na nebi i na zemli [In heaven and on earth]. 2017:108-109. (In Russian).

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ORIGINAL ARTICLE

HYGIENIC ASPECTS OF LIFESTYLE OF KHARKIV NATIONAL MEDICAL UNIVERSITY JUNIOR STUDENTS IN THE CONDITIONS OF QUARANTINE

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ABSTRACT

The aim: To assess the impact of adverse factors on the lifestyle and health status of students in conditions of prolonged isolation.

Materials and methods: Data collection was carried out by anonymous survey using the survio.com online survey service. The study involved 273 students of Kharkiv National Medical University: 47 men (17,2%) and 226 women (82,8%) aged 17 to 20. Age of 85% of respondents is 18-20 years old. 38 (13,9%) students are from 21 to 25 years old and 3 students (1,1%) – over 25 years old.

Results: A comparative analysis revealed the characteristic changes in the students' lifestyle. If under normal conditions the majority of students (63.7%) use their free time for walks outdoors, and 46.5% spend it at the computer, then during quarantine most respondents spend leisure time in front of a computer monitor (64.8%) or watching TV (71.4%). These indices were the result of a direct restriction on the interaction of students with the environment and the prohibition of their stay outside the zone of residence.

Conclusions: The most common negative changes of the students' health were sleep disturbances and headaches.

The second most common symptoms are changes in the musculoskeletal system, associated mainly with physical inactivity.

The third ones are deterioration of vision and psycho-emotional state of students.

KEY WORDS: COVID-19, students, lifestyle, distance learning, Kharkiv National Medical University

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INTRODUCTION

The COVID-19 virus pandemic has made adjustments to the lives of people around the world and put them in certain conditions of existence. Mankind is faced with a situation where it is necessary to clearly follow certain rules to curb the spread of the virus. Ukraine, as well as other countries around the world, has introduced a quarantine regime.

The concept of "quarantine" provides for restrictions on movement, as well as identification of people who are prone to contagious disease, to further clarify whether they have contracted it. Thus, the risk of spreading the virus is reduced. Quarantine, from a medical point of view, is very effective in protecting the population from the spread of the disease [1]. The restriction of movement, the introduction of an observational regime after travel, the prohibition of visits to parks, squares, recreation areas in the future will lead to positive consequences for overall health [2].

Studies of different years, by interviewing, described subjects who were in quarantine and, in general, the indices of health disorders coincided. According to the results of some studies, there were mental health disorders. Mihashi M. mentions such symptoms as general emotional distress in quarantined people [3]. The state of depression and stress was evaluated by Austrian researchers, the frequency of depression cases increased four times [4]. Long-term mood decline, insomnia, and

increased irritability were described by Lee S. in his studies 73% of respondents showed a decrease in mood, 57% of respondents noted irritability [5].

Assessing the results by Weiss and Marmar impact of event scale, Reynolds D. L., Garay J. R. identified symptoms of post-traumatic stress [6].

Most of the negative consequences were due to restrictions on freedom of movement and communication. Thus, it has been established that the general state of health is always reflected in all spheres of life [7].

The intensity of various processes directly depends on the level of health, qualitatively characterizes a person's lifestyle: levels of economic, labor, social activity. Health is one of the most important conditions for the quality of human performance [8].

Attention to the lifestyle of students during the quarantine period is associated with high public concern about the health of specialists graduating from higher educational institutions [9].

One of the determining factors of a healthy lifestyle is optimal physical activity, which directly depends on the routine of the working day, domestic needs and the rational distribution of free time. However, since the beginning of 2020, there have been numerous adverse factors, including isolation conditions, which contributed to an increase in psycho-emotional stress with reduced physical activity.

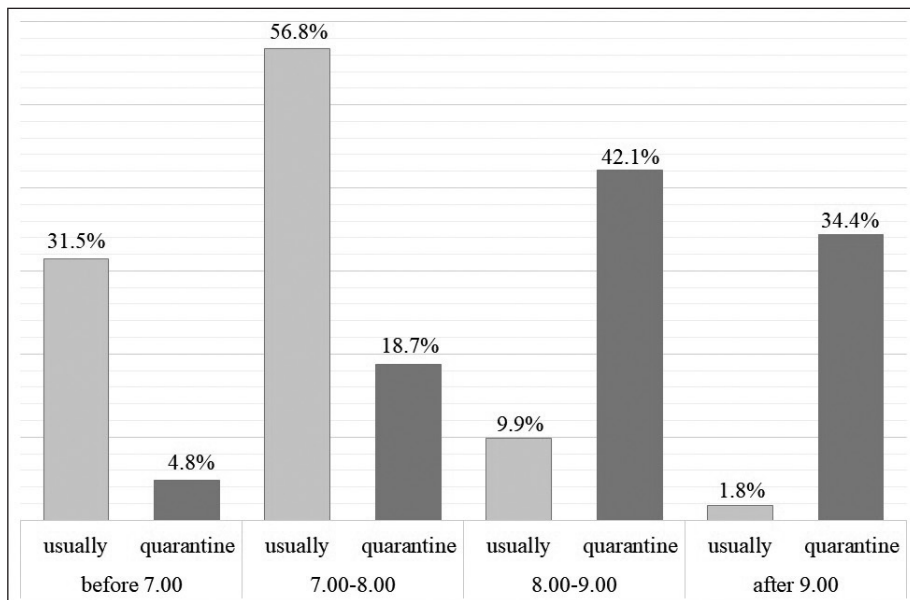


Fig. 1. Indices of changes in the time of morning awakening of students

Teachers of Kharkiv National Medical University are also concerned about the health status of future doctors, substantiating the need for a study. The study revealed various negative trends in students' lifestyle changes.

THE AIM

The aim was to assess the impact of adverse factors on the lifestyle and health status of students in conditions of prolonged isolation.

MATERIALS AND METHODS

Data collection was carried out by anonymous survey [12] using the survio.com online survey service. The study involved 273 students of Kharkiv National Medical University aged 17 to 20. The questionnaire contained questions that characterize the students' lifestyle (leisure activities, playing sports, spending time outdoors), day regimen (distribution of work and rest hours, sleep and wakefulness regimen, and nutritional regimen), the features of organizing distance learning in quarantine (organization of workspace and type of digital device that is primarily used for online learning, the time spent on homework), changes in the physical and psycho-emotional state (subjective characteristics of students' health status, the presence of symptoms such as fatigue, blurred vision, headaches, sleep disturbance, distraction, anxiety, depression).

RESULTS

A comparative analysis of the data revealed the characteristic changes in the daily routine and lifestyle of students before and during quarantine. Thus, if under normal conditions the majority of students (63.7%) use their free time for walks outdoors, and 46.5% spend it at the computer (communication on social networks, computer games, etc.), then during quarantine most respondents spend leisure time in front of a computer monitor (64.8%) or watching television

programs and films (71.4%). These indices were the result of a direct restriction on the interaction of students with the environment and the prohibition of their stay outside the zone of residence. A long stay in a confined space with a limited area of movement leads to physical inactivity and hypokinesia, which in turn can lead to a number of disorders of many functions and systems of the body. Most negatively this affects students with a low level of self-organization who do not pay due attention to their physical development and do not play sports. According to the results of the survey, 34.4% of students do not go in for sports and do not exercise at home. 32.9% went in for sports and visited a gym until isolation, but their number was almost halved, and they completely stopped any sports during quarantine (15.0%).

Most students (57.9%) note changes in the nature of nutrition, in the direction of increasing the frequency of food intake and its volume. The increase in body weight observed by 39.2% of respondents in combination with physical inactivity / hypokinesia can lead to functional disorders of the musculoskeletal, vestibular and sensorimotor apparatus. At the same time, there is a direct relationship of motor activity and the nature of nutrition with metabolic processes, which can lead to disruption of processes in the endocrine system.

An important factor in this case is also the correct organization of the workspace, taking into account the basic principles of ergonomics. 85.3% of respondents indicated that they have a separate specially equipped workplace. However, distance learning can imply the employment of fundamentally different electronic devices (desktop computer, tablet, smartphone and others). Working on a personal computer is mainly carried out at a specially equipped workplace, while working on a smartphone and other small devices does not require any special conditions. According to the survey, 48% of students use a computer for learning. The remaining 52% work with smartphones and tablets, while ergonomic and hygiene requirements are most often not respected.

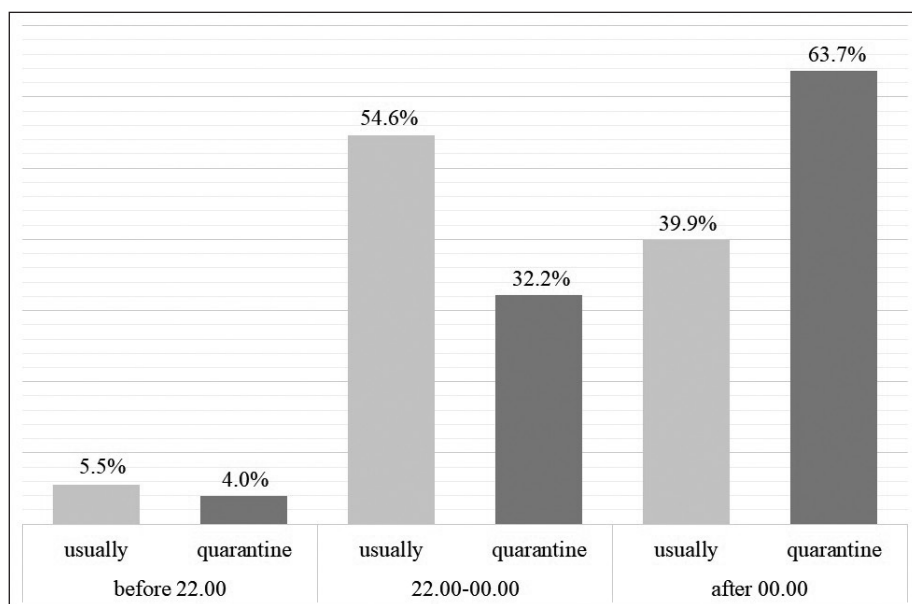


Fig. 2. Indices of changes in the evening bedtime of students

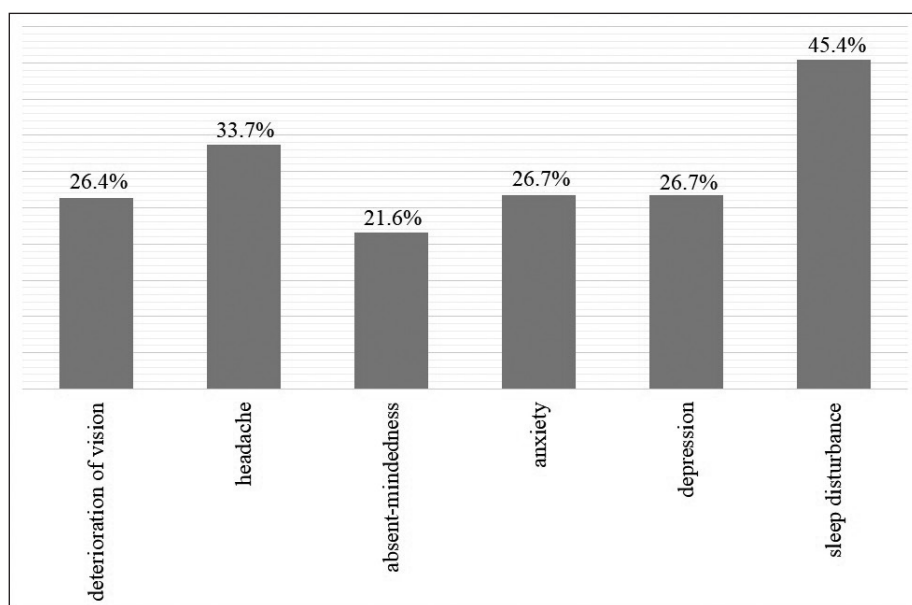


Fig. 3. Indices of changes in the physiological and psychological state of students

Typical symptoms in a decrease in motor activity and a long stay in an uncomfortable position are pain and tension in the back, which was noted by 29.7% of respondents. 27.5% of students indicated a decrease in muscle strength, 43.6% noted increased fatigue.

Assessment of daily regimen and working capacity showed insignificant fluctuations of biorhythms with a tendency to increase the number of students with evening type of working capacity. Daily routine of respondents markedly shifted towards a later awakening in the morning and late going to bed (Fig. 1).

As can be seen from the chart, the percentage of respondents who wake up earlier than 7 am and from 7.00 to 8.00 decreased from 31.5% to 4.8% and from 56.8% to 18.7%, respectively. The number of students who sleep in the morning until 8.00 – 9.00 and longer during quarantine significantly increased. Their percentage increased from 11.7% to 76.5%. The percentage of respondents who go to

bed late also increased (Fig. 2).

54.6% went to bed in the interval from 22.00 to 24.00 before quarantine, and 46.9% during quarantine. The number of students awake until midnight and later increased from 39.9% to 63.7%. The change in the student's day regimen can be explained by a change in biorhythms aimed at maintaining homeostasis under the influence of adverse external factors. To a greater extent, these changes occurred due to restrictions on movement.

Changes in day regime and lifestyle with prolonged and forced exposure to a number of adverse factors under quarantine lead to changes in both the physiological and psychological state of students. The results of the survey revealed that during the isolation period, students developed the following symptoms: sleep disturbance in 45.4% of respondents, headaches in 33.7%, deterioration of vision in 26.4%. Depression and anxiety developed in 26.7% of respondents, absent-mindedness in 21.6% (Fig. 3)

The above symptoms are determined by stress associated with space limitations and inactivity / hypokinesia during the isolation period, an abundance of numerous negative information about the pandemic from the media and the Internet, a forced restructuring of the daily regimen, changes in the nature and frequency of nutrition, and a sharp restructuring from the full-time education system to distance learning system and as a result, an increased amount of time for working with various information resources.

DISCUSSION

As the results of the study showed, the lifestyle of Kharkiv National Medical University students has undergone certain changes because of the COVID-19 pandemic. These changes are primarily related to forced isolation. Scientists from different countries found out that the most frequent companions of social isolation are psycho-neurological disorders: a deterioration in a person's mood, a feeling of loneliness, vulnerability, the appearance of anxiety and fears, including fear of infection, many people develop severe symptoms of depression. These changes lead to a decrease of cognitive abilities, memory, concentration of attention. The most common neurological symptoms are sleep disturbances and headaches. [3, 4, 6, 7, 13, 14]. Moreover, in young people, these symptoms are more pronounced. Similar disturbances were revealed during a survey of students of Kharkiv National Medical University: sleep disturbance noticed 45.4% of respondents, headaches – 33.7%, depression and anxiety developed in 26.7% of respondents, absent-mindedness in 21.6% ($p>0,05$).

Distance learning is the second equally important factor that influencing the lifestyle of students during the quarantine period. Most often changes of daily routine and habits are: a decrease in physical activity, changes in sleep and wake regimen [7, 13, 15] and changes of diet. It has been proven that increased release of cortisol in humans organism as a result of prolonged stress increases appetite [16]. These changes may lead to disorders of the musculoskeletal, cardiovascular and nervous systems, overweight. Within 60 days of quarantine 27.5% of students indicated a decrease in muscle strength, 43.6% noted increased fatigue ($p>0,05$), the increase in body weight observed by 39.2% of respondents. The changes become more pronounced in case of prolonged quarantine restriction.

CONCLUSIONS

Assessment of the students' survey findings showed that despite the indisputable advantages of training using information technologies in recent years, this system also has a number of drawbacks that became most obvious under quarantine and the forced transition of educational institutions to full-time distance learning.

The most common manifestations of the negative impact on the health of students of this educational system are

sleep disturbances and headaches. This might be associated with a change in the day regime, physical inactivity, irrational organization of the workplace and time, information overload.

The second most common symptoms are changes in the musculoskeletal system, associated mainly with physical inactivity.

The third ones are deterioration of vision and psycho-emotional state of students.

The main role in the prevention of identified health disorders belongs to the student himself, who must properly organize his workplace, strictly observe the regime of work and rest, regularly perform a set of exercises for both the musculoskeletal system and the eyes. It also depends a lot on the social conditions and material capabilities of the student (the higher the quality of electronic devices used for work, the less their adverse effect on health).

Negative changes in the student's psycho-emotional state can be minimized by the employment in the learning process of dynamic, easy-to-perceive techniques, involving the change of different types of activities, collective solution of certain problems with the participants communicating in real time, the use of educational games and simulations, etc.

REFERENCES

1. Manuell M-E., Cukor J. Mother Nature versus human nature: public compliance with evacuation and quarantine. *Disasters*. 2011;35:417-442.
2. Li X., Zhao X., Sun Y. The lockdown of Hubei Province causing different transmission dynamics of the novel coronavirus (2019-nCoV) in Wuhan and Beijing medRxiv.2020. doi: <https://doi.org/10.1101/2020.02.09.20021477>.
3. Mihashi M., Otsubo Y., Yinjuan X. Predictive factors of psychological disorder development during recovery following SARS outbreak. *Health Psychol*. 2009;28:91-100.
4. Samozhnev A. Uchenye opredelili naibolee postradavshih ot karantina. 2020. <https://rg.ru/2020/05/06/uchenye-opredelili-naibolee-postradavshih-ot-karantina.html>
5. Lee S., Chan L.Y., Chau A.M., Kwok K.P. The experience of SARS-related stigma at Amoy Gardens. *Soc Sci Med*. 2005;61:2038-2046 .
6. Reynolds D.L., Garay J.R., Deamond S.L., Moran M.K. Understanding, compliance and psychological impact of the SARS quarantine experience. *Epidemiol Infect*. 2008;136:997-1007.
7. Blinova E.G. Prichinno-naslidkovi vzjazki v sisteme vtraty zdorovja studentiv. *Materials Vseros. Nauchno-practicheskoy konferencii s mezhdunarodnim uchastiem « Gigiena detey I podrostkov istorija I sovremennost (problemy I puti reshenija)»*. Nauchniy centrd zdorovja detey i podrostko.v RAMN. 2009:57-59.
8. Pro problemy globalnoy strategii WHO po dosjagnennij zdorovja dlja vsih v XXI veke. //Pitannja ekonomiki I upravlinnja dlja precivniciv ohorony zdorovja. 2002; 4:2-37.
9. Gorbach N.A., Zharov A.V., Lisnjak M.A. Perspektivy vikoristannja metodu ocinki jakosty zhittja u formuvanni zdorovja ctudentiv vishiv. *Ochorona zdorovja Rossijskoi federacii*. 2007;2:43-46.
10. COVID-19 i prava cheloveca. 2020. <https://www.hrw.org/ru/news/2020/04/01/340211>.
11. Hawryluck L., Gold W.L., Robinson S. SARS control and psychological effects of quarantine, Toronto, Canada. *Emerg Infect Dis*. 2004;10:1206-1212.

12. Oprosnick dlja ocenki izmeneniy zhiznedejatelnosti studentov v uslovijah isoljacji. http://www.knmu.kharkov.ua/index.php?option=com_content&view=article&id=148%3A-1.
13. Khasuev A.E. Social insulation and human self-insulation: social-philosophical analysis. *Economical and humanitaral researches of the regions*. 2020;2:122-128.
14. Mohammad S., Oakeshott R.P., Kankam H. et al. Mitigating the psychological effects of social isolation during the covid-19 pandemic. *BMJ*. 2020; 369. doi: <https://doi.org/10.1136/bmj.m1904>.
15. Oliinyk Y., Nesterenko V. Vplyv dystanciinogo navchannia na styl zhyttia inozemnyh studentiv. *Materialy konferencii MCND*. 2020: 73-74. <https://doi.org/10.36074/22.05.2020.v2.08>
16. Ahmed M. Abbas Mark Mohsen Kamel Dietary habits in adults during quarantine in the context of COVID-19 pandemic. *Obesity Medicine*. 2020;19:100254. doi: 10.1016/j.obmed.2020.100254.

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APPROACHES TO DEVELOPING AND IMPLEMENTING CLINICAL AND ORGANIZATIONAL REGULATIONS ENSURING INFECTIOUS SAFETY AND EPIDEMIOLOGICAL RESPONSE IN THE WORK PROCESS (THE CASE OF COVID-19)

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ABSTRACT

The aim: Of the work was to develop clinical and organizational regulations ensuring infectious safety and epidemiological response in the work process (the case of COVID-19) based on the current legislative acts of Ukraine to combat the spread of coronavirus disease (COVID-19), as well as on the data from international practices.

Materials and methods: The research objective was carried out in accordance with the Methodology for the development of medical and technological documents for the standardization of medical care.

Results: The Protocol includes organizational elements to prevent the spread of coronavirus disease, such as "The development of general provisions on infectious safety and antiepidemic measures during the COVID-19 pandemic in the company's workplaces, taking into account the legislative acts of Ukraine and international practices", which include: the development of "Health Questionnaire" (epidemiological data questionnaire) for daily monitoring of the company employee health; the development of "Checklist for self-assessment of the workplace", "Checklist for self-assessment of the public space"; the development of "Analytical report on compliance with the infectious safety rules in the workplace and in the public space on the basis of self-assessment", thirteen Appendices.

Conclusions: "The Protocol for infectious safety and antiepidemic measures in the work process" is a detailed instruction that provides a balance of compliance with medical standards and reasonable needs of employees and employers through the implementation of scientific evidence base in antiepidemic and infectious safety measures in the workplace.

KEY WORDS: Protocol, infectious safety, antiepidemic measures, work process, COVID-19

Wiad Lek. 2021;74(3 p.II):741-745

INTRODUCTION

One of the key principles of health care is the provision of medical aid in accordance with the standards of evidence-based medicine. In the present context of the development of our state, standardization plays a leading role in the system of management tools for quality control in public health care [1, 2]. The state has identified the development of standardization as one of the priority areas of health care reform in Ukraine and annually provides supplements and updates to the legal and regulatory framework for standardization administration [1, 3-5].

The outbreak of a new coronavirus disease (COVID-19) is accompanied by uncertainty about the main epidemiological, clinical, virological characteristics of the new pathogen and especially its ability to spread among the population and its virulence (disease severity). Currently, data on the epidemiology, clinical features, prevention and treatment of this disease are updated almost every day [6-10]. The urgency of counteracting the spread of coronavirus disease issues challenges to healthcare professionals related to rapid diagnosis and timely provision of medical aid to patients, as well as to ensuring sufficient level of infectious safety in the workplace.

The COVID-19 pandemic has become the defining challenge not only for the Ukrainian health system, but also for employers who are concerned about personnel infectious safety in the workplace. Enterprises and organizations that resume work have to implement measures on minimizing the spread of infectious diseases during the epidemic.

THE AIM

The aim of the work was to develop organizational tool for ensuring infectious safety and antiepidemic measures in the work process (the case of COVID-19) and to establish its effectiveness in early detection of coronavirus disease (COVID-19) in the working environment.

MATERIALS AND METHODS

The study was designed and performed at the State Scientific Institution "Scientific and Practical Center for Preventive and Clinical Medicine" of the State Administration (hereinafter referred to as SSI "SPC PCM" SA).

The research objective was carried out in accordance with the Methodology for the development of medical

and technological documents for the standardization of medical care [4, 11, 12]. The Protocol form as a regional statutory document aimed at ensuring the provision of infectious safety services and medical care in certain infectious diseases was used [1, 2, 5].

The content of the Protocol provisions was developed in accordance with the current legislative acts of Ukraine [3-10, 11, 13-15] and data from modern scientific literature on relevant issues of COVID-19 prevention. The international guidelines on the features of organizing a safe working process, countering the spread of coronavirus disease (COVID-19) in the working environment were analyzed using analytical and systematic approach methods [16-20]. The provisional results of our study on the development of local health care protocols (clinical pathways) were used in modeling [21,22].

RESULTS

The main tasks in the development of the *Protocol* involved the control of infectious diseases during production, assignment of authority between the employer, employees and medical personnel who provide primary, emergency and specialized (tertiary) medical care.

The Protocol is presented on 53 pages and has the following structure: title page, writing group, table of contents, organizational, production and final stages and description of the activities of each stage, appendices, instructions and registers to the Protocol.

The Protocol includes organizational elements to prevent the spread of coronavirus disease, such as “The development of general provisions on infectious safety and antiepidemic measures during the COVID-19 pandemic in the company's workplaces, taking into account the legislative acts of Ukraine and international practices”, which include: the development of “Health Questionnaire” (epidemiological data questionnaire) for daily monitoring of the company employee health; the development of “Checklist for self-assessment of the workplace”, “Checklist for self-assessment of the public space”; the development of “Analytical report on compliance with the infectious safety rules in the workplace and in the public space on the basis of self-assessment”; the development of instructions on compliance with the infectious safety rules by the company staff, taking into account the possible risks of spreading coronavirus infection SARS-CoV-2.

It should be noted that at each stage of the Protocol, preventive measures for the disease spread are taken into account, namely ensuring the safety of workers and medical staff: compliance with the rules of personal protection and rational use of personal protective equipment (PPE) (according to Appendix 6 “Rational use of personal protective equipment in case of COVID-19” and Appendix 7 “Infection prevention and control measures during the provision of medical care to a patient whose case is defined as COVID-19” of the Standards of medical care “Coronavirus disease (COVID-19)” approved by the Order of the Ministry of Health Of Ukraine No.722 of 28.03.2020) [6].

The organizational stage also includes “Coordination of provisions on hygiene and infection control, collection and disposal of PPE, public catering rules” by the employer, namely: conducting a marketing search and concluding an agreement for the purchase of personal protective equipment for the company's employees, creating a permanent irreducible minimum level of supply of PPE; calculation of the need for personal protective equipment for the company's employees in accordance with the specification approved by the Order of the Ministry of Health of Ukraine No.2122 of 17.09.20 “On amendments to the Standards of medical care “Coronavirus disease (COVID-19)””; conducting a marketing search and concluding an agreement on the disposal of used PPE; development of requirements for the collection and disposal of used PPE; conducting a marketing search and concluding an agreement with a cleaning company to ensure hygiene and infection control at the company's workplaces during the COVID-19 pandemic; development of requirements for hygiene and infection control at the company's workplaces during the COVID-19 pandemic; development of requirements for the provision of public catering services during the COVID-19 pandemic.

The preparatory stage also envisages creating personnel's awareness of the safety rules and adaptive quarantine, namely instructing the personnel responsible for the internal control on the implementation of general provisions, instructions on infectious safety; placement in the workplace of information posters on the symptoms of coronavirus disease (COVID-19), mandatory use of PPE, compliance with quarantine rules.

The maintenance stage of the production process provides for common antiepidemic measures with a multiplicity that meets the requirements of the Resolution of the Cabinet of Ministers of Ukraine No.641 of 22.07.2020 “On the establishment of quarantine and the introduction of enhanced antiepidemic measures in the area with a significant spread of acute respiratory disease COVID-19 caused by coronavirus SARS-CoV-2” [15].

Common antiepidemic measures provided by the Protocol are as follows: before-doctor examination of the employees before the start of the working day (thermometry) and identification of individuals for additional examination; conducting employee surveys and submitting employee questionnaires to the supervising physician on a daily basis; analyzing employee questionnaires and identifying individuals for additional examination; internal control of compliance with instructions on infectious safety by employees in the workplace.

The Protocol includes a number of measures on internal control of the required level of hygiene and infection control and rules of public catering, collection of PPE on the territory of the company, which is carried out by the authorized personnel of the company: internal control of compliance with the disinfection cycle and the cleaning schedule at workplaces and in the public space; internal control of compliance with the infectious safety rules in public catering; internal control of the collection and

disposal of used PPE; weekly analysis of the results of internal control.

The Protocol provides for screening and ongoing examinations of the company's employees for infection (e.g. COVID-19). The set of necessary medical services is provided by a medical institution within the framework of a contractual relationship and may include: conducting a preventive examination of employees by a GP or a family medical doctor for early detection of ARVI; before-doctor examination of the employees (questionnaires, thermometry); collecting samples from the nasopharynx for SARS-Cov-2 virus detection by PCR; blood sampling for the detection of Ig M, Ig G antibodies by ELISA; laboratory testing; assessment of the examination/survey findings and registration of admission to the workplaces for the company's employees.

When a confirmed case of COVID-19 disease is detected, the Protocol provides for all necessary medical services recommended in a particular case and approved by the Resolution of the Cabinet of Ministers "Coronavirus disease (COVID-19)" taking into account the severity of the course. The Protocol also includes antiepidemic measures in case of contact.

If the company carries out a certain amount of work in time, then at the final stage of the Protocol implementation, the final act of the health status of the company's employees is issued and the responsible person of the company provides an analytical report on compliance with the infection safety rules at workplaces; hygiene and infection control; collection and disposal of used PPE; public catering rules for the period of implementation of work.

Thirteen **Appendices** have been prepared to the Protocol based on the current statutory documents [1, 2, 15] and international practices [16-20]:

Appendix 1. Common antiepidemic measures and provisions for infectious safety.

Appendix 2. Covid-19 epidemiological questionnaire for employees (in Ukrainian and English).

Appendix 3. Checklist for self-assessment of compliance with the infectious safety rules in the workplace.

Appendix 4. Checklist for self-assessment of compliance with the infectious safety rules in the public space.

Appendix 5. Analytical report on compliance with the infectious safety rules in the workplace and in the public space on the basis of self-assessment.

Appendix 6. Instructions for personnel at each workplace on compliance with the infectious safety rules.

Appendix 7. Requirements plan for personal protective equipment.

Appendix 8. Instructions for the collection and disposal of personal protective equipment.

Appendix 9. Cleaning/processing instruction.

Appendix 10. Cleaning and disinfection schedule.

Appendix 11. Instructions for personnel on compliance with the infectious safety rules in public catering.

Appendix 12. Report of personnel screening examination (routine, opportunistic).

Appendix 13. Report on the results of examination.

DISCUSSION

Thus, "The Protocol for infectious safety and antiepidemic measures in the work process" is a detailed instruction that provides a balance of compliance with medical standards and reasonable needs of employees and employers through the implementation of scientific evidence base in antiepidemic and infectious safety measures in the workplace.

"The Protocol for infectious safety and antiepidemic measures in the work process" was approved in the working environment during the preparatory and shooting periods of film production from 20.07.20 to 06.10.20. Medical workers of the SSI "SPC PCM" SA examined 358 individuals of the organized contingents on work days of the enterprise in accordance with the provisions of the Protocol, namely: daily monitoring of the employees' clinical state, collecting samples from the nasopharynx for SARS-Cov-2 virus detection by polymerase chain reaction, studying the level of Ig M, Ig G antibodies to SARS-CoV-2 by enzyme-linked immunosorbent assay.

The high effectiveness of the organizational tool is shown by the detection of 19 cases of coronavirus disease (COVID-19), which amounted to 5.3% of the total number of employees, including asymptomatic disease in 6 people (1.7%) and early manifestations of coronavirus disease (COVID-19) in 13 people (3.6%). It should also be noted that the implementation of antiepidemic measures helped timely localize the sites of the disease and prevent its spread among the employed persons, as evidenced by the absence of patients among the contact personnel.

CONCLUSIONS

It is the first time the organizational tool "The Protocol for infectious safety and antiepidemic measures in the work process" has been developed and its effectiveness has been evaluated, which allows recommending its implementation for employers and health care institutions in the absence of the relevant approved medical and technological document of the state standard.

The developed Protocol is a new clinical and organizational document, which is a tool for social and clinical administration with the ability to manage updates in accordance with modern scientific evidence, and is the basis of an integrated approach in health care.

The continuous update of the regulatory framework of medical care to patients with suspected COVID-19 requires constant updating of the provisions and measures of the Protocol with further assessment of the quality of antiepidemic measures.

REFERENCES

1. Seniuta I. Ya. Novi pidkhody do standartiv yakosti nadannia medychnoi dopomohy ta yikh mozhlyvi yurydychno-pravovi naslidky [New approaches to the quality standards of medical care and their possible legal consequences]. *Ukrainskyi medychnyi chasopys*. 2017. <http://www.umj.com.ua/article/108196/novi-pidhodi-do-standativ-yakosti-nadannya-medichnoyi-dopomogi-ta-yih-mozhlivi-yuridichno-pravovi-naslidki>. (In Ukrainian).

2. Yarosh N. P. Normatyvno-pravove rehuliuвання розвитку standartyzatsii u sferi okhorony zdorovia naselennia Ukrainy [Normative-legal regulation of standardization development in the sphere of public health protection of Ukraine]. *Ekonomika i pravo okhorony zdorovia*. 2016; 2: 76 – 80. (In Ukrainian).
3. Kulhynskiy E. Kontseptsyia hosudarstvennoho upravleniya kachestvom medytsynskoi pomoshchy v sfere zdravookhranennia Ukrainy [The concept of state management of the quality of medical care in the field of health care in Ukraine]. *Administrarea Publică*. 2016; 3: 94-103. (In Russian).
4. Nakaz MOZ Ukrainy vid 28 veresnia 2012 roku №751 «Pro stvorennia ta vprovadzhenia medyko-tehnolohichnykh dokumentiv zi standartyzatsii medychnoi dopomohy v systemi Ministerstva okhorony zdorovia Ukrainy» (redaktsiia vid 02.11.2018r.) [Order of the Ministry of Health of Ukraine dated September 28, 2012 №751 «On the creation and implementation of medical and technological documents for the standardization of medical care in the system of the Ministry of Health of Ukraine»]. (In Ukrainian).
5. Nakaz MOZ Ukrainy 29 hrudnia 2016 roku № 1422 «Pro vnesennia zmin do nakazu Ministerstva okhorony zdorovia Ukrainy vid 28 veresnia 2012 roku №751» [5. Order of the Ministry of Health of Ukraine of December 29, 2016 № 1422 «On Amendments to the Order of the Ministry of Health of Ukraine of September 28, 2012 №751»]. (In Ukrainian).
6. Nakaz MOZ Ukrainy vid 28 bereznia 2020 r. №722 «Orhanizatsiia nadannia medychnoi dopomohy khvorym na koronavirusnu khvorobu (COVID 19)» [Order of the Ministry of Health of Ukraine of March 28, 2020 №722 «Organization of medical care for patients with coronavirus disease (COVID 19)»]. (In Ukrainian).
7. Nakaz MOZ Ukrainy vid 02 kvitnia 2020 r. №762 «Pro zatverdzhennia protokolu «Nadannia medychnoi dopomohy dlia likuvannia koronavirusnoi khvoroby (COVID-19)» [Order of the Ministry of Health of Ukraine of April 2, 2020 №762 «On approval of the protocol "Provision of medical care for the treatment of coronavirus disease (COVID-19)"»]. (In Ukrainian).
8. Nakaz MOZ Ukrainy vid 09 kvitnia 2020 r. №827 «Pro vnesennia zmin do nakazu Ministerstva Ustinov O. V. Standartyzatsiia nadannia medychnoi dopomohy v Ukraini: suchasnyi stan problem [Standardization of medical care in Ukraine: the current state of the problem]. *Ukrainskyi medychnyi chasopys*. 2014; 2(100). (In Ukrainian).
9. Nakaz MOZ Ukrainy vid 10 kvitnia 2020 r. №852 «Pro vnesennia zmin do protokolu «Nadannia medychnoi dopomohy dlia likuvannia koronavirusnoi khvoroby (COVID 19)» [Order of the Ministry of Health of Ukraine of April 10, 2020 №852 «On Amendments to the Protocol "Provision of medical care for the treatment of coronavirus disease (COVID 19)"»]. (In Ukrainian).
10. Nakaz MOZ Ukrainy vid 23 kvitnia 2020 r. №953 «Pro vnesennia zmin do nakazu Ministerstva okhorony zdorovia Ukrainy vid 28 bereznia 2020 roku №722» [Order of the Ministry of Health of Ukraine of April 23, 2020 №953 «On Amendments to the Order of the Ministry of Health of Ukraine of March 28, 2020 №722»]. (In Ukrainian).
11. Iermolova Yu. V. Lokalni protokoly — osnova systemy standartyzatsii medychnoi dopomohy [Local protocols – the basis of the system of standardization of medical care]. *Ukrainskyi medychnyi chasopys*. 2012. <https://www.umj.com.ua/article/24170/lokalni-protokoli-osnova-systemi-standartizatsii-medichnoi-dopomogi>. (In Ukrainian).
12. Ustinov O. V. Standartyzatsiia nadannia medychnoi dopomohy v Ukraini: suchasnyi stan problem [Standardization of medical care in Ukraine: the current state of the problem]. *Ukrainskyi medychnyi chasopys*. 2014; 2(100). <https://www.umj.com.ua/article/72108/standartizaciya-nadannia-medichnoi-dopomogi-v-ukraini-suchasnij-stan-problemi>. (In Ukrainian).
13. Ihnatieva H. F. Standartyzatsiia medychnoi dopomohy yak faktor sotsializatsii derzhavnykh upravlinskykh posluh [Standardization of medical care as a factor in the socialization of public administration services]. <http://academy.gov.ua/ej/ej6/txts/07igfsas.htm>. (In Ukrainian).
14. Postanova Kabinetu Ministriv Ukrainy vid 11 bereznia 2020 r. №211 «Pro zapobihannia poshyrenniu na terytorii Ukrainy koronavirusu COVID-19» [Resolution of the Cabinet of Ministers of Ukraine of March 11, 2020 №211 «On prevention of the spread of coronavirus COVID-19 in Ukraine»] <https://chernigiv-rada.gov.ua/news/id-42234/>. (In Ukrainian).
15. Postanova Kabinetu Ministriv Ukrainy vid 22 lypnia 2020r. №641 «Pro vstanovlennia karantynu ta zaprovadzhenia posylenykh protyepidemichnykh zakhodiv na terytorii iz znachnym poshyrenniam hostroi respiratornoi khvoroby COVID-19, sprychynenoi koronavirusom SARS-CoV-2» [Resolution of the Cabinet of Ministers of Ukraine of July 22, 2020 №641 «On the establishment of quarantine and the introduction of enhanced anti-epidemic measures in the area with a significant spread of acute respiratory disease COVID-19 caused by coronavirus SARS-CoV-2»]. (In Ukrainian).
16. Clinical management of severe acute respiratory infection when novel coronavirus (2019-nCoV) infection is suspected Interim guidance 28 January 2020. 2020. [https://www.who.int/publicationsdetail/clinical-management-of-severe-acute-respiratory-infection-when-novelcoronavirus-\(ncov\)-infection-is-suspected](https://www.who.int/publicationsdetail/clinical-management-of-severe-acute-respiratory-infection-when-novelcoronavirus-(ncov)-infection-is-suspected).
17. «Coronavirus Disease 2019 (COVID-19) Treatment Guidelines». 2020. <https://www.covid19treatmentguidelines.nih.gov/>.
18. Novel Coronavirus (2019-nCoV) technical guidance: Early investigations. 2020. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technicalguidance>.
19. Novel Coronavirus (2019-nCoV) v2 Operational Support & Logistics. 2020. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200203-sitrep-14-ncov.pdf?sfvrsn=f7347413_4.
20. WHO. 2019-nCoV. Surveillance Guidance. 2020. 3 Global Surveillance for human infection with novel coronavirus (2019-nCoV) Interim guidance v3 31 January 2020. 2020. [https://www.who.int/publications-detail/global-surveillance-for-human-infection-with-novel-coronavirus-\(2019-ncov\)](https://www.who.int/publications-detail/global-surveillance-for-human-infection-with-novel-coronavirus-(2019-ncov)).
21. Oshyvalova O.O. Klinichniy marshrut patsiienta z peredonkolohichnoiu patolohiieiu shkiry [Clinical route of a patient with pre-oncological skin pathology]. *Ukrainskyi zhurnal dermatolohii ta venerolohii*. 2016; 3(62): 64-68. (In Ukrainian).
22. Oshyvalova O.O. Rozrobka ta vprovadzhenia lokalnykh protokoliv nadannia medychnoi dopomohy khvorym na peredonkolohichnu patolohiiu shkiry. Materialy naukovo-praktychnoi konferentsii z mizhnarodnoiu uchastiu «Suchasni pidkhody do formuvannia klinichnykh nastanov z diahnozyky i likuvannia shkirnykh zakhvoriuvan ta infektsii, shcho peredaiutsia statevym shliakhom: yevropeyskyi dosvid ta ukraïnski realii» [Development and implementation of local protocols for providing medical care to patients with pre-oncological skin pathology. Proceedings of the scientific-practical conference with international participation «Modern approaches to the formation of clinical guidelines for the diagnosis and treatment of sexually transmitted diseases and infections: European experience and Ukrainian realities»], 19-20 zhovtnia, 2016r. Ternopil, 2016; 1:100. (In Ukrainian).

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ORIGINAL ARTICLE

STUDENTS' HEALTH STATUS AND THEIR ABILITY TO ADAPT TO A MULTINATIONAL UNIVERSITY ENVIRONMENT

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ABSTRACT

The aim: Development of practical recommendations to further improve students' adaptation to a multicultural university environment as a factor in ensuring their health.

Materials and methods: The publication is based on the results of a comprehensive multi-purpose randomized epidemiological study using a standardized questionnaire. Questionnaire results (n = 355) were tested for paired correlations of all considered factors.

Results: 93,8% of respondents positively assessed their overall health with a mode of 3 (satisfactory health). In general, students' health was not particularly sensitive to the effects of temporal and natural factors. Recommendations have been developed to improve students' adaptation to the university's multinational environment, including by preventing stressful situations. It is important that students are sufficiently informed, financially secure, and mentally prepared for student life.

Conclusions: The key to safeguarding students' health is developing their skills in adapting to a multinational university environment.

KEY WORDS: student health, adaptability, multinational environment, university, interconnectivity

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INTRODUCTION

In today's society, the importance of up-to-date knowledge and skills is increasing, considering that they play an important role in obtaining high incomes and moral satisfaction from life. In the pursuit of a happy future, young people face the need to leave their parents' homes and adapt to new living conditions in another city, and sometimes in another country. This problem is particularly acute when freshmen students enter the multinational environment of leading universities [1]. Not all are prepared for the new challenges, and this often has negative health effects. The foregoing informed the relevance of this research after all.

THE AIM

Development of practical recommendations to further improve students' adaptation to a multicultural university environment as a factor in ensuring their health.

MATERIALS AND METHODS

The initial basis of the publication was the result of a comprehensive randomized epidemiological study, conducted using a standardized questionnaire (certificate of copyright registration for the work № 93548 dated 29.10.2019), where considerable attention was paid to the impact of social, economic, temporal, and natural factors on the health of

students, as well as their ability to adapt to the multinational environment of the university.

The results of the extensive questionnaire were tested for pair-wise correlations of all considered factors. For this study, a threshold of absolute 0,5 was established, i.e., values greater or equal to 0,5 and lower or equal to -0,5 were selected for further analysis. Spearman's rank correlation test was chosen to be the basis for this evaluation. This is because the vast majority of the questions were based on a Likert scale which produced nominal data with varying intervals. Therefore, measuring rank changes was deemed to be a more representative approach for the non-Gaussian data in hand as opposed to focusing on absolute changes with Pearson's correlation test. The statistical significance of the correlations was tested by the means of Fisher's exact test for pairs with binary and continuous data as well as Spearman's rank correlation test for pairs where both variables were continuous. The primary focus was on the obtained p-values which were tested for being less than or equal to 0,05.

Preliminary analysis of the obtained intermediate results allowed to: differentiate all data according to the defined criterion; disregard those that did not have a significant relationship; conduct a more detailed analysis of those that are sufficiently interconnected.

The final analysis of the survey results allowed to: identify a relatively low impact of the studied factors on the health

of students; identify the most common forms of manifestation and causes of deterioration of students' health; identify factors that had the most significant effect on the adaptation of students; develop practical recommendations aimed at further improving students' adaptation to the university's multinational environment.

The studies were approved by the Commission on Ethics and Bioethics of the Kharkiv National Medical University and were carried out in accordance with the requirements prescribed in the Helsinki Declaration of the International Medical Association «Ethical Principles of Medical Research with the Participation of People as the Object of Study», the Law of Ukraine on Personal Data Protection. All participants gave written informed consent.

RESULTS

The respondents were 355 adults (aged 18 to 27) who study at Kharkov universities; 31,3 % – men, 68,7 % – women; 36,3 % live in their parents' house, 39,2 % – in a dormitory, 24,5 % – in rented housing; 8,5 % had previous experience of living outside the family in another country, 46,5 % – in another city, 7,0 % – with another family, 38,0 % – had no such experience at all.

The generalized results of the survey revealed the following:

1) 93,8 % of respondents positively assessed their overall health with a mode of 3 (satisfactory health). Additional optimism arose from having only a single “critical” assessment. At the same time, respondents with generally good health (which is quite natural for young people) did not use negative assessments of its individual components, and as their health self-evaluation decreased, they increasingly complained of certain health issues.

2) Respondents especially frequently visited a neurologist (33,0 %) and complained about anxiety (53,5 %), irritability (51,0 %), depression (52,4 %), memory impairment (29,6 %), and tremor (27,3 %) due to grief for parents (57,7 %), as well as due to significant psychological stress in the first days of university (associated primarily with uncertainty about residence, organization of life, education, etc.) and as they approached their examination period (an unsatisfactory grade would be a reason for re-taking the exam and could even be a threat to the continuation of studies; in contrast, a high grade would bring them moral satisfaction and improve the prospects for successful employment, etc.).

3) Students' health was mostly insensitive to the effects of temporal factors (season, day of the week, time of day) ($r = 0,54$) and natural phenomena (solar activity, atmospheric pressure, air temperature) ($r = 0,51$). At the same time, 26,2 % of respondents had ENT diseases and complained of fever (23,1 %), cough (22,5 %), and sore throat (20,3 %).

4) High and partly un-optimized (over time) study load led to fatigue (85,3 %), palpitations (32,1 %), and weight loss (29,1 %); at the same time, sedentary lifestyle and a significant amount of time spent at the computer – led to

back pain (45,9 %), sore legs (30,7 %), as well as vision loss (31,0 %).

5) Despite the lack of a close relationship ($r = 0,30$) between the level of health of students and their ability to adapt to a multinational environment, there were still isolated cases where individuals (mostly freshmen) found themselves in situations (mostly not directly related to student life) which negatively affected their health, namely:

Injuries and damage of varying severity as a result of fights with other people (in particular, due to the inability to avoid conflicts arising from material, moral, or other grounds), getting involved in a car accident or other emergency.

Alcohol and drug abuse are form of addictions that have a detrimental effect on health and can even be fatal.

6) Adaptation of students to the multinational environment of the university depends on their ability to respond to the following factors:

Better adaptation to living conditions at the university was facilitated by the presence of previous experience of self-sufficiency (financial, household) ($r = 0,54$), living in a metropolis ($r = 0,53$), ability to find new friends ($r = 0,50$), and support university administration ($r = 0,50$).

As financial independence grew, students were increasingly making decisions on their own ($r = 0,55$) which made it easier to adapt to external factors ($r = 0,58$).

The presence of previous experience of living in another family (most often, disorderly sexual life) increased the frequency of sexually transmitted diseases ($r = 0,62$), negative consequences of abortion, etc.

7) If we disregard the congenital malformations acquired before entering the university, diseases, and consequences of emergencies, the main threat to the health of students is stress. It can arise due to many reasons: study, work, lifestyle, household, nutrition, personal life, emotions, etc. Even though it is virtually impossible to avoid stress completely, one can attempt to avoid stressful situations as much as possible or otherwise, at least try to minimise its negative impact.

DISCUSSION

As of now, many theoretical concepts and practical recommendations have been accumulated to address pressing issues in this area. For instance, L. Katrushova, S. Yalanska, L. Rudenko, O. Katrushov used the Hall's test (EQ test) to evaluate the dynamics of the development of emotional intelligence in the process of psychological adaptation and socialization of foreign students” [2]. L. Cao, T. Zhang developed a structured interview to identify the impact of social networking adaptation on the learning process, which is a forum where students and teachers can communicate informally on both educational and personal issues [3]. Z. Latipov, A. Ziyatdinov, L. Demidova, V. Gerasimov, M. Zaostrovtsseva – interviewed foreign students about their psychological, social, and ethnic adaptation to learning and communication [4]. R. Birzina, D. Cedere, L. Petersone – designed an e-questionnaire to identify

institutional and personal factors in adapting freshmen to university (in particular, the level of knowledge in “basic” disciplines, as well as the ability to learn independently [5]. However, their use should be considered and taken into account as regards the specifics of the contingencies of a particular university.

The generalisation of the achievements of leading scientists and the results of their own research on this issue allowed to develop practical recommendations aimed at further improving the adaptation of students to the multinational environment of the university:

1. *For prospective students:* To be motivated to learn and be able to master new knowledge; to acquire skills of self-control and independent decision-making, and to be ready to be responsible for the consequences; to take care of oneself and one's loved ones; to be able to establish contacts, communicate and avoid conflict situations, and navigate the environment of a metropolis; to be able to organise their own lives (cook, clean the room, wash and iron things, etc.); to be financially literate (rationally allocate a limited budget; choose the necessary goods / services at the best prices; respect parents' money); to be able to choose comfortable clothes / shoes depending on the weather, season, and dress code; to develop (if possible, to achieve success) in the non-academic field (sports, art, etc.); to acquire proficiency in foreign languages (primarily English); to establish the dream image of the future, choose a university and a degree, and with that – the scale and energy of the city (country); to assess the likely cost in terms of time, effort, and finances to obtain the desired qualification.

2. *For students:* To avoid the illusion of “permissiveness” and realise that from now on they carry most of the responsibility for their actions or inaction; to not panic, but be ready for the worst and hope for the best; to choose and furnish the apartment taking into account financial capabilities, comfort, and logistics; to optimise the household routine (cooking, cleaning, washing and ironing, etc.); to establish good relationships with neighbours and classmates; to find a circle of like-minded people (with similar background, interests, and financial capabilities) some of who are likely to become friends; not to succumb to pressure of others who encourage reckless actions (to be able to say “no”); to find a compromise in cases where there is a misunderstanding due to noise, mess, bullying, etc.; to enlist the support of classmates, curators, and others who are able and willing to help; to organise their expenses, alcohol consumption, sexual relationships; to find a balance between studying (top priority) and leisure; to realise the importance of learning for oneself and not just for grades; to choose their own format (for example, single- or group-based) and place (dormitory, library, etc.) of preparation for classes / exams; to realise that in school academic success mostly depends on the professionalism of teachers and parental support, while in university it depends on the persistence and self-discipline of the student; to systematically study the material of academic disciplines taking into account its content and the requirements by teachers, and not to “postpone” it until right before the exam period; to

segment disciplines by relevance (as they understand their professional careers); to master a foreign language for professional purposes; in case of disappointment, to be ready to change the degree course (or university); to consider work as a source not just of income but even more so of professional and life experience; to realise that part-time work can distract / hinder the main objective – getting a future profession; while factors like taboos and ambitions, lack of mastery of the language of the host country (for foreigners), overlap of study and work schedules, lack of knowledge and skills (especially freshmen) make it impossible for them to hold positions with adequate pay and attractive functional responsibilities; to optimise your own working day/week taking into account the workload (study, self-training, work, leisure), well-being, biorhythms, accumulated fatigue; to develop and use their own knowledge and skills (including non-academic) in order to gain competitive advantage and self-realisation; take care of yourself (follow the rules of hygiene, respond in a timely and appropriate manner to the deterioration of health).

3. *For parents of prospective / current students:* To be ready for changes in their own lives and the lives of their children; to encourage them to learn and be independent; to be a mentor and motivator; to support morally and materially; to promote physical, intellectual, and cultural development; to trust and accustom to the need to be responsible for one's actions or inaction, as well as to adequately respond to changes in children's lives; to help to choose a university and a degree, and also to form an image of the dreamed future; to learn to appreciate family, national, religious, and other traditions; to teach to take care of oneself and take care of one's loved ones; to promote the formation of skills in the organisation of a household, communication, finding compromises, financial literacy, etc.

4. *For the university administration:* To appoint curators from among teachers or students from higher semesters, whose mental and informational support is extremely important at the first stage of adaptation to the multinational environment of the university; at the beginning of the school year to organise meetings with freshmen (primarily to find answers to the most pressing questions, provide general information, establish communication between classmates through interactive activities, etc.); to use different platforms (university website, Instagram, Facebook, WhatsApp, Viber, etc.) to place information about the university, city, organisation of the educational process, possible options for accommodation, and leisure; to organise the educational process in such a way that students in an accessible and convenient form receive the necessary knowledge and skills (to optimise the schedule based on the complexity of academic disciplines, time and locations; to help choose elective disciplines, etc.); to organise access to the students' personal offices, constantly monitor the implementation of the curriculum; to involve student self-governance and fellow countrymen in the organisation of students' extracurricular life (to hold cultural events, sport competitions, support in solving everyday problems, promote employment and self-realization).

The results of discussions with the stakeholders allow us to assert the practical relevance of the proposed recommendations. However, the positive effect of their use can be multiplied by organising proper interaction in the chain “applicants/students – their parents – university administration”. At the same time, many of the “prosaic” activities listed above should not be taken lightly, as their simplicity often proves to be the “key to success” in students' adaptation to the multinational environment of the university.

CONCLUSIONS

The key to maintaining the health of students is the development of their skills to adapt to the multinational environment of the university, including by preventing stressful situations. It is important that students are sufficiently informed, financially secure, and mentally prepared for student life. They should be assisted in this process by practical recommendations aimed at further improving their adaptation to the university's multinational environment. Further research should be devoted to the development of theoretical concepts and practical recommendations aimed at improving the health of students and, ultimately, their quality of life.

REFERENCES

1. Birzina R., Cedere D., Petersone L. Factors influencing the first year students' adaptation to natural science studies in higher education. *Journal of Baltic Science Education*. 2019;349–361. doi: 10.33225/jbse/19.18.349.
2. Katrushova L., Yalanska S., Rudenko L., Katrushov O. Peculiarities of the process of psychological adaptation of foreign students of Ukrainian higher education institutions of medical profile, role of emotional intelligence in the socialization process. *Wiadomosci Lekarskie*. 2019;72(10):1930–1934.
3. Ling C., Tingting Zh. Social Networking Sites and Educational Adaptation in Higher Education: A Case Study of Chinese International Students in New Zealand. *Scientific World Journal*. 2012. doi: 10.1100/2012/289356.
4. Latipov Z., Ziyatdinov A., Demidova L. et al. The problem of adaptation of foreign students studying in Russian universities. *Espacios Revista*. 2017;38:56.
5. Melnychenko O.A., Melnychenko V.A., Ho J. Adaptatsiya inozemnykh studentiv do navchannykh u multynatsionalnomu seredytstsi: problem ta napryamy yikh vyrishennya [Adaptation of foreign students to study in a multinational environment: problems and directions of their solution]. *Public health in Ukraine: problems and ways to solve them: materials of scientific practice. conf. with international participation, Kharkiv: KhNMU; 2018, p. 121–124. (In Ukrainian).*

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REVIEW ARTICLE

COMPARATIVE ANALYSIS OF THE MAIN SOCIAL HEALTH DETERMINANTS OF LIFE EXPECTANCY AND INFANT MORTALITY IN UKRAINE AND POLAND

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ABSTRACT

The aim: To analyze the data of social health determinants – life expectancy of population and infant mortality in neighboring countries: Ukraine and Poland in cut-away of territory habitation.

Materials and methods: The statistical materials of the Ukrainian and Polish information sources were used in this work: SI “The center of medical statistics of the Ministry of Health of Ukraine”, The state statistics service of Ukraine, The central statistical management of Poland (Główny Urząd Statystyczny). Methods of system approach, bibliosemantic, statistical, analytical were used for analysis.

Results: In both countries, Poland and Ukraine, the general dynamics as to the growth of an average life expectancy (ALE) among men and women was observed during 28 years of surveillance, and in both countries it was revealed that the ALE indices in women were much higher than in men. Within the last five years, there is a considerable tendency of decrease in the infant death rate in Ukraine, while in Poland this index is particularly invariable. This may be due to the fact that the level of infant mortality in Poland is half the level in Ukraine; moreover, this correlation is approximate within the last five years of observation. A significant place in the structure of all the causes of infant mortality in 2019 is occupied by the XVI chapter in accordance with ICD-10 “Certain conditions originating in the perinatal period” – 54.39 % in Ukraine and 53.05 % in Poland, the last – “Diseases of the Urogenital system” (chapter XIV) – 0 % and 0.7 %, correspondingly.

Conclusions: With a view of an incessant improvement of a high-quality information which is registered when the statistical data are formed, it is necessary to promote a broad intersector cooperation inside the countries and international collaboration between the countries.

KEY WORDS: health indices, regional peculiarities, children's mortality, causes of infant mortality

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INTRODUCTION

The level of well-being of society is determined by the health status of the population, therefore, the information as to the health status of the population is the necessary base for taking the administrative decisions the health care organization and with the aim to control the morbidity rate.

According to the WHO data (strategy “Health 2020: the European policy for health and well-being” [1]) the main social health determinants are the infant mortality, the life expectancy, provision of primary education to children and the level of unemployment. The life expectancy and the infant mortality (under 1 year old) are the only ones among all the determinants that pertain to the health care organization, so let us dwell upon their analysis in detail.

The life expectancy in the European region increases, while the gap between the indices of men and women in the majority of countries, and exactly between the countries decreases. The average life expectancy at birth in the European region increases in men from 75.60 years in 2010 to 77.34 years in 2018 (average annual increase +0.22 years); in women: from 81.96 years to 83.04 years (average annual increase +0.13 years) respectively [2, 3].

Simultaneously, in the European region the significant decrease of the children's mortality level is observed. In 2015, the infant mortality level was equal to 6.8 cases of death in 1000 live-born babies, while in 2020, this index has decreased almost twice – 3.7 deaths per 1000 live-born babies [2, 3].

Ukraine and Poland are countries – neighbors (more than 500 km of common borders) with similar natural-climatic conditions and practically the same number of population: 41.732 mln. people (32nd place in the world) and 38.383 mln. people (35th place in the world) correspondingly. Both countries are highly urbanized. In Ukraine, the level of urbanization is equal to 70.1 % of population, in Poland – 60.5 % of population. But there are differences in this process. In Ukraine, the share of urban population increases per year: the growth rates – 0.35 % (trend evaluation for 2015-2020). Whereas in Poland, the number of the urban population decreases, from year to year, and accordingly, the rural population increases: the share of urban depopulation rate is equal to 0.1 %.

Starting from the 1 of January, 2020 in Ukraine, among all 29719 population centers there are 461 towns (1.55 %),

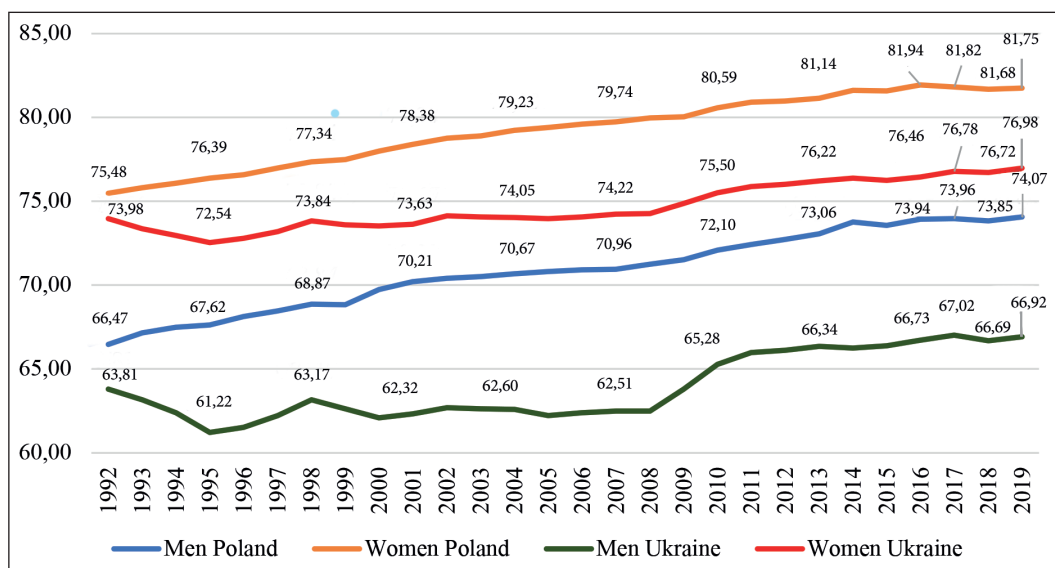


Fig. 1. Average life expectancy at birth (years) by gender in Ukraine and Poland in 1992-2019.

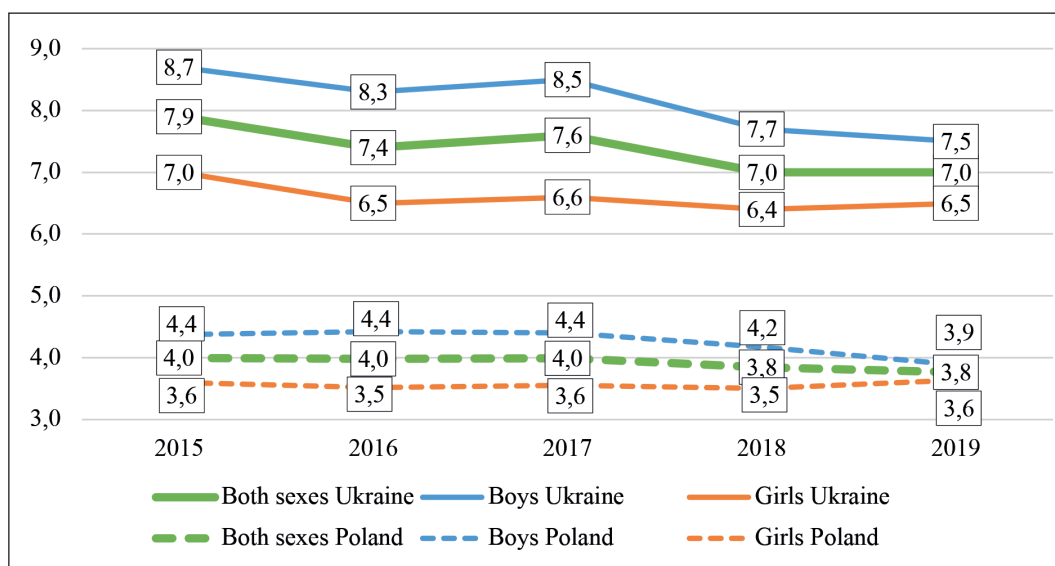


Fig. 2. Death rate of infants under 1 year old by gender in 2015-2019 in Ukraine and Poland (per 1000 live-born babies).

882 urban-type villages (2.97 %) and 28376 rural population centers (95.48 %). In Poland, there are only 44022 population centers, comprising: 930 towns (2.11 %), 13022 urban-type villages (gminy miejsko-wiejskie – 29.58 %) and 30070 villages (gminy wiejskie – 68.31 %). Thereby, according to the absolute numbers, there is an approximate equal number of rural settlements in both countries, but as to the percentage ratio with other types of population centers, their number is much higher in Ukraine than in Poland.

THE AIM

To analyze the data of social health determinants – life expectancy of population and infant mortality in neighboring countries: Ukraine and Poland in cut-away of territory habitation.

MATERIALS AND METHODS

The statistical materials of the Ukrainian and Polish information sources were used in this work: The state statistics

service of Ukraine [3], SI “The center of medical statistics of the Ministry of Health of Ukraine” [4], “The central statistical management of Poland” (Główny Urząd Statystyczny) [5]. Methods of system approach, bibliosemantic, statistical, analytical were used for analysis [6].

REVIEW AND DISCUSSION

The comparison of dynamics of the average life expectancy at birth (ALE) on the investigated territories within the period of 1992-2019 has shown the general dynamics of ALE growth in men and women in Poland and Ukraine during 28 years of observation. In Poland, identically as in Ukraine, the ALE indices are much higher in women than in men: from 75.48 years in 1992 to 81.75 years in 2019. While the highest ALE level in the Polish men that was in 2019 (74.07 years) failed to reach the lowest ALE level in the Polish women in 1992 – 75.48 years (fig. 1).

The comparison of data between the countries under study has shown that ALE indices in the Ukrainian women were higher than those in the Polish men, but lower than

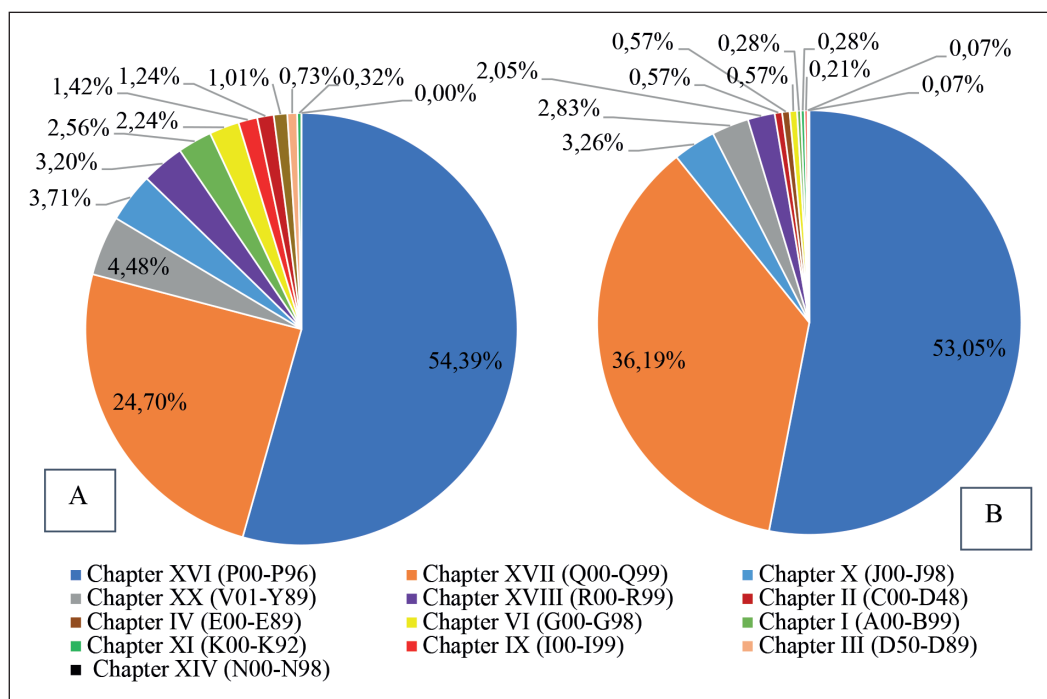


Fig. 3. Structure of causes of infant mortality (%) in Ukraine (A) and Poland (B) in 2019

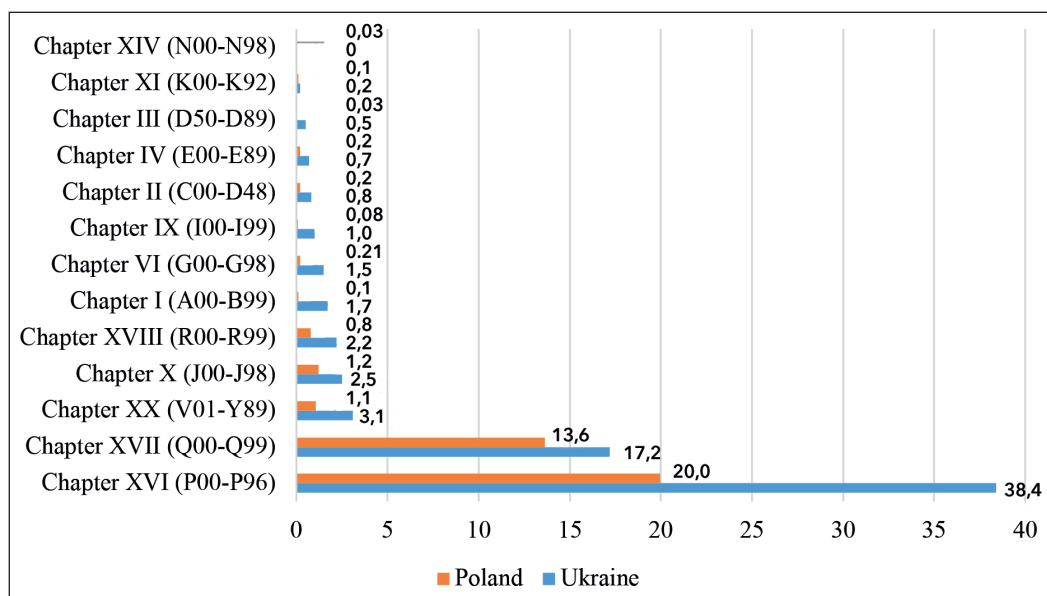


Fig. 4. Infant mortality levels (per 10 thousand of live-born babies) in Ukraine and Poland in 2019

the ALE indices in the Polish women. The least gap in years was in 1992 – merely 1.5 years, but over time this gap began to increase and in 2019 it was equal already to 4.77 years.

The level of the average life expectancy at birth in men from Ukraine was the lowest one with the minimal index in 1995 (61.22 years) and the maximal in 2017 (67.02 years).

The ALE analysis in men and women from 22 regions of Ukraine (the data from Donetsk and Lugansk regions, and the Autonomous Republic of Crimea are unavailable) has shown that the highest levels of this index is mainly in the Western regions of Ukraine: Ivano-Frankivsk, Chernivtsi, Ternopil, Lviv (table 1).

While the lowest ALE index was in the Northern and Central regions of Ukraine (Dnipropetrovsk region, Chernihiv region, Kirovohrad region, Zhytomyr region,

Kyiv region). Practically in all regions of Ukraine, the ALE level was higher in urban settlements (except Transcarpathian region). The largest difference in these indices among men was in Khmelnytskyi region (4.67 years) and Rivne region (3.93 years) and among women – in Odessa region (3.02 years) and Zhytomyr region (2.35 years). The lowest difference between the ALE indices in urban settlements and rural areas in men was in Kharkiv region (1.17 years) and Kirovohrad region (1.26 years); in women – in Kherson region (0.11 years) and Ivano-Frankivsk region (0.53 years).

On estimating the ALE level in 16 voivodeship of Poland, it was established that the lowest indices were in inhabitants of the center and west (Kuyavian-Pomeranian voivodeship, Lubusz voivodeship, Lodz voivodeship); while

Table 1. Average life expectancy at birth (years) by gender and type of settlement in regions of Ukraine in 2019

	Regions	Urban settlements (C)		Rural settlements (V)		difference between C and V in men	difference between C and V in women
		m	f	m	f		
	Ukraine	67.66	77.3	65.56	76.2	2.1	1.1
1	Vinnitsia	68.96	78.36	66.13	76.7	2.83	1.66
2	Volyn	68.05	77.79	64.96	76.75	3.09	1.04
3	Dnipropetrovsk	66.11	76.25	64.68	74.44	1.43	1.81
4	Zhytomyr	66.18	76.73	62.86	74.38	3.32	2.35
5	Transcarpathian	66.52	75.06	67.17	75.25	-0.65	-0.19
6	Zaporizhia	66.54	77.03	64.52	74.69	2.02	2.34
7	Ivano-Frankivsk	70.71	79.00	66.96	78.47	3.75	0.53
8	Kyiv	65.93	76.40	63.47	75.18	2.46	1.22
9	Kirovohradsk	66.64	76.36	65.38	75.30	1.26	1.06
10	Lviv	69.43	79.01	66.94	77.89	2.49	1.12
11	Mykolaiv	67.49	76.85	63.77	74.67	3.72	2.18
12	Odesa	67.78	77.17	64.15	74.15	3.63	3.02
13	Poltava	67.6	76.94	65.98	75.86	1.62	1.08
14	Rivne	68.74	78.11	64.81	76.96	3.93	1.15
15	Sumy	67.91	77.62	65.83	76.55	2.08	1.07
16	Ternopil	69.93	79.41	67.53	78.07	2.4	1.34
17	Kharkiv	67.05	76.78	65.88	75.61	1.17	1.17
18	Kherson	65.37	76.03	65.87	75.92	-0.5	0.11
19	Khmelnytsk	69.58	78.13	64.91	76.80	4.67	1.33
20	Cherkasy	67.78	77.82	65.76	76.48	2.02	1.34
21	Chernivtsi	70.25	78.76	68.96	78.10	1.29	0.66
22	Chernihiv	66.05	76.97	62.26	75.02	3.79	1.95

high indices were in inhabitants of south-eastern Poland: Podkarpackie voivodeship, Podlaskie voivodeship, Lesser Poland voivodeship, Lublin voivodeship, it being known that in all provinces, the difference in ALE indices in urban and rural population centres wasn't significant (from 0 to 2,7 years) (table 2).

From the above-mentioned voivodeships with high ALE indices, two of them (Podkarpackie and Lublin voivodeships) have borders with Ukraine, namely, Lviv and Volyn regions. Nevertheless, the ALE in these Ukrainian regions is considerably lower. In particular, Podkarpackie voivodeship is located practically on the border with the Lviv region, but the ALE level in urban settlements is 76.5 years in men and 83.0 years in women of Poland unlike 69.47 years in men and 78.86 years in women in Ukraine (distinction 7.03 years and 4.14 years); in rural area – 74.9 years in men and 83.1 years in women unlike 67.19 years and 77.78 years, correspondingly, (distinction 7.71 years and 5.32 years). In despite of close neighborhood of regions, the average life expectancy in Poland is considerably higher than in Ukraine.

The analysis of the second determinant of social health: infant mortality has shown that during the last five years there is a significant tendency to lowering of this index in

Ukraine (for 11.4 %: from 7.9 in 2015 up to 7.0 fatal cases per 1000 live-born babies in 2019), while in Poland, this index is left unchangeable (4.0 in 2015 and 3.8 fatal cases per 1000 of live-born babies in 2019) (fig. 2).

It may be connected with the fact that in Poland the infant mortality level is twice as low as in Ukraine and, for all this, the ratio is approximate within the last five years of observation.

The major distinction in infant mortality indices by gender is observed. In both countries the level of this index is much higher in boys than in girls, although the essential reduction of this distinction happens within the last 2019. So, if in 2015 in Ukraine the infant mortality level was 24.29 % higher in boys, whereas in 2019 – it was only on 15.38 %; in Poland – on 22.22 % and 8.33 %, correspondingly.

The next step, as a reasonable one, was considered to compare the causes of infant mortality in both countries. Due to the result of analysis it was established that in both countries in 2019 the due place in the structure of all causes of infant mortality belonged to chapter XVI in accordance to ICD-10 “Certain conditions originating in the perinatal period” – 54.39 % in Ukraine and 53.05 % in Poland (fig. 3).

Table 2. Average life expectancy at birth (years) by gender and type of settlement in voivodeships of Poland in 2019

Voivodeships	Urban settlements (C)		Rural settlements (V)		difference between C and V in men	difference between C and V in women
	m	f	m	f		
Poland	74.5	81.7	73.4	81.8	1.1	-0.1
1 Lower Silesia (Dolnośląskie)	73.7	81.4	72.7	81.0	1.0	0.4
2 Kuyavian-Pomeranian (Kujawsko-Pomorskie)	74.0	80.9	73.3	81.1	0.7	-0.2
3 Lublin (Lubelskie)	75.1	82.6	72.9	82.3	2.2	0.3
4 Lubusz (Lubuskie)	73.6	81.3	71.6	80.3	2.0	1.0
5 Lodz (Łódzkie)	73.0	80.7	71.8	81.7	1.2	-1.0
6 Lesser Poland (Małopolskie)	75.9	82.7	74.8	82.7	1.1	0.0
7 Mazovian (Mazowieckie)	75.3	82.3	72.6	81.7	2.7	0.6
8 Opolskie (Opolskie)	75.2	81.9	73.8	82.2	1.4	-0.3
9 Podkarpackie (Podkarpackie)	76.3	83.5	74.7	82.9	1.6	0.6
10 Podlaskie (Podlaskie)	75.3	83.3	72.9	83.0	2.4	0.3
11 Pomorskie (Pomorskie)	75.5	82.1	73.5	80.9	2.0	1.2
12 Silesian (Śląskie)	73.6	80.6	74.3	81.6	-0.7	-1.0
13 Swietokrzyskie (Świętokrzyskie)	74.7	82.3	73.0	82.2	1.7	0.1
14 Varmiansko-Mazurskie (Warmińsko-Mazurskie)	73.7	81.6	72.0	80.5	1.7	1.1
15 Greater Poland (Wielkopolskie)	74.7	81.8	73.8	81.2	0.9	0.6
16 West Pomeranian (Zachodniopomorskie)	73.9	81.5	72.9	80.2	1.0	1.3

The fourth part (24.70 %) of all deaths under 1 year old in Ukraine and one third (36.19 %) in Poland is due to “Congenital defects of development, deformation and chromosomal anomalies” (chapter XVII). Other diseases and conditions that lead to infant death, in sum, include only 20.91 % in Ukraine and 10.76 % in Poland. The most widespread ones are chapter XX “External causes of death” – 3rd place in Ukraine (4.48 %) and 4th place in Poland (2.83 %) among all the causes of death under 1 year old, and chapter X “The Respiratory diseases” (4th place in Ukraine (3.71 %) and 3rd place in Poland (3.26 %)). The rarer cause of children’s death under 1 year old in Ukraine were “Diseases of the Digestive system” (Chapter XI) – 0.32 %, in Poland – “Diseases of Blood and hemopoietic organs” (Chapter III) and “Diseases of the Urogenital system” (Chapter XIV) – 0.07 % each. At the same time, “Diseases of the Urogenital system” is the only chapter of diseases in Ukraine, that during the last years does not figure as the cause of children’s death under 1 year old.

The comparison of infant mortality levels, in both countries, depending on the cause of death has shown that indices of practically all chapters of diseases and conditions in Ukraine are much higher than in Poland (fig. 4).

The level of index of the main causes of children’s death under 1 year old that belong to chapter XVI “Certain conditions originating in the perinatal period” was in 1.9 times higher in Ukraine (38.4 cases of death per 10 thousand of live-born babies), than in Poland (20.0 cases of death per 10 thousand of live-born babies). In both countries, “The

Intrauterine hypoxia and asphyxia during labors”, “The Respiratory impairment in a newborn (distress)” belonged to this chapter.

“Congenital defects of development, deformation and chromosomal anomalies” (Chapter XVII) – the second cause of death taking into account its frequency; it does not differ by the index of widespread occurrence in both countries: 17.2 cases of death per 10 thousand of live-born babies, in Poland – 13.6 cases of death per 10 thousand of live-born babies. “Congenital development defects of the heart” and “Chromosomal anomalies” were the most widespread ones in this group.

The most clearly marked distinction between the infant mortality indices in 2019 in reference to Ukraine was in group “Diseases of Blood and hemopoietic organs” (Chapter III) 18.7 times (0.5 cases of death in 10 000 live-borns in Ukraine as compared to 0.03 cases of death per 10 thousand of live-borns in Poland). The essential distinction between indices was also in the following chapters of diseases: “Some Infectious and Parasitic diseases” (Chapter I) – in 15.9 times (1.7 as compared to 0.1 cases of death per 10 000 live-borns, correspondingly); “Diseases of Blood circulation” (Chapter IX) – in 12.5 times (1.0 as compared to 0.08 cases of death per 10 thousand of live-borns, correspondingly); “Diseases of the Nervous system” (Chapter VI) – in 7.0 times (1.5 as compared to 0.2 cases of death in 10 thousand of live-borns, correspondingly). Certain peculiarities among the rates of mortality caused by the diseases of the nervous system were revealed: if in

Ukraine, "Meningitis" was the main disease that caused death, then in Poland in addition to "Meningitis" there were "Other Degenerative diseases of the nervous system" and "Cerebral palsies and other paralytic syndromes".

In Ukraine, the single chapter of diseases which wasn't in the statistics of diseases, but led to the death of children under 1 year old – "Diseases of the Urogenital system" (Chapter XIV), in Poland it was worked out in greater detail in such subdivisions as "Diseases of the glomeruli, interstitial-canal renal diseases and other kidney ureter diseases" (N00-N19, N25-N28).

Thus, in spite of the similar climatic and geographical area, close neighborhood, Poland if we compare with Ukraine possesses many qualitative health indices which are presented by social determinants, such as average life expectancy at birth, which is much higher in Poland, and infant mortality with the indices which are half lower than those in neighboring Ukraine regardless the territorial data and gender differences. This testifies to a higher level of well-being in this country, in general, and the absence of differences in living standards between urban and rural inhabitants.

The prospect of further research is in the investigation and comparison of indices of other social determinants of health in countries-neighbors Ukraine and Poland.

CONCLUSIONS

For the purpose to ensure the persistent improvement of the quality of information which is registered when the statistical data are formed, it is necessary to promote a broad intersector teamwork inside the countries and international cooperation between the countries.

REFERENCES

1. Health 2020: the European policy for health and well-being. WHO strategy. <http://www.euro.who.int/en/health-topics/health-policy/health-2020-the-european-policy-for-health-and-well-being>.
2. European Health Report 2018. http://www.euro.who.int/__data/assets/pdf_file/0008/379862/who-ehr-2018-eng.pdf.
3. Statistical data of the State Statistics Service Of Ukraine. <http://www.ukrstat.gov.ua/>
4. Statistical data of the Center for Medical Statistics of the Ministry of Health of Ukraine. <http://medstat.gov.ua/ukr/news.html?id=242>.
5. Główny Urząd Statystyczny. <http://demografia.stat.gov.pl/bazademografia/TrwanieZycia.aspx>.
6. Maksymets T., Karpysyn N., Gutor T. et al. Influence of risk factors on insulin resistance in patients with overweight and obesity. *Wiadomosci lekarskie*. 2018; 71 (3 pt 1) : 558-560.

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REVIEW ARTICLE

INTERACTION LINKS OF HEALTHCARE INSTITUTIONS WITHIN ONE HOSPITAL DISTRICT

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ABSTRACT

The aim: Theoretical substantiation and determination of the main characteristics of the interaction links of medical institutions within one hospital district in the conditions of aggravation of the epidemiological situation in Ukraine on the analysis basis of the legislative base and elaboration of literary sources.

Materials and methods: In the work is used a range of methods: content analysis, bibliosemantic, systematic approach, analysis of products of activity.

Conclusions: The authors propose a doctrinal definition of the term "hospital district". The key problems of the domestic healthcare sector in the context of a pandemic have also been identified. The author points out that in order to successfully reform the health care system and the effective interaction of hospitals in one hospital district, it is necessary to pay attention to funding sources and proper legal regulation, as without the latter any initiatives will have no legal force and will be ignored. health care may be ineffective.

KEY WORDS: hospital district, health care, health care facilities, medical reform, interaction mechanism

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INTRODUCTION

Analyzing the events in Ukraine on the reform of all spheres of society and the state in connection with bringing strategically important state systems in line with international and European standards, we can state that in this aspect of the greatest resonance, the health care system has had a devastating impact.

The pandemic caused by COVID-19 in 2020 posed a very serious challenge to the international health care system as a whole, but the greatest stress and burden came from national health care structures and the Ukrainian one, unfortunately, was no exception and demonstrated obsolescence, incompetence and lack of equipment. appropriate tools and the complete impossibility of fighting the pandemic and providing medical services to the citizens of Ukraine.

However, all the above rather negative events have once again proved that the development of medicine is one of the main indicators of sustainable development of the country, because other areas of life can't exist if the health care system is low. So, as we have seen, without effective control of epidemics and without good protection against disease, people will not be particularly interested in secondary needs if the need to maintain health comes first.

Given the above, today we can talk about a long, complete leveling of the real problems of the health care system. Today in Ukraine there is a rather extensive and inefficient health care system. Participants in the medical field (hospitals, laboratory centers of the Ministry of Health, health centers, medical statistics centers, monitoring and evaluation departments) act inconsistently, duplicate their functions, need additional resources (financial, property) and change their management system.

THE AIM

The aim of the article is theoretically substantiate and determine the main characteristics of the interaction of medical institutions within one hospital district in the context of exacerbation of the epidemiological situation in Ukraine based on the analysis of the legal framework and the study of literature sources.

MATERIALS AND METHODS

In the work is used a range of methods: content analysis, bibliosemantic, systematic approach, analysis of products of activity.

REVIEW

The issue of research of links and interaction of health care institutions in the context of universal values of the welfare state is extremely relevant today and arouses increased scientific interest among medical scientists and researchers of public administration and legal processes. Leiberyuk O.M Babinets L.S, Bogaichuk V.G, Borovik I.O, Tkach O.O, Matyuk L.M, Bulakh I.V, Zakhidna O.O are devoted to the problems of formation of hospital districts. R., Midlyk Yu. I., Kachur O. Yu., Mamchin M.M, Pariy V.D, Roshchin G.G, Mazurenko O.V, Dorosh V.M, Pagava O.Z, Ivanov V.I Babinets L.S, Bogaychuk V.G, Borovik I.O, Tkach O.O, Matyuk LM identified the main challenges to the health care system in terms of decentralization, the priority of primary care and the formation of hospital districts, considering the experience of Ternopil region.

However, as we can see, most of the mentioned researchers pay special attention to the issues of creation and

functioning of hospital districts in the health care system. However, in our opinion, it is the links of interaction of health care institutions within one hospital district that need a thorough scientific research, because the development and functioning of this interdependence has a direct impact on the regulation of the most important area of public administration – human life and health.

The Constitution of Ukraine enshrines that Ukraine is a sovereign and independent, democratic, social, legal state. Man, his life and health, honor and dignity, inviolability and security are recognized in Ukraine as the highest social value [1].

According to Article 12 of the International Covenant on Economic, Social and Cultural Rights, everyone has the right to medical care and medical care in the event of illness. The key article of Ukrainian legislation, which regulates the fundamental principles of human rights in the field of health care and establishes the foundations of the national health care system is Article 49 of the Constitution of Ukraine [2].

Chapter 22 “Public Health” of the Association Agreement between Ukraine and the European Union defines Ukraine's European aspirations to strengthen the health care system and its potential, increase its safety and protect human health as a prerequisite for sustainable development and economic growth, development developed and sustainable democracy and market economy, in particular Article 427 defines the main areas of cooperation between Ukraine and the European Union, primarily through “strengthening Ukraine's health care system and its capacity through reforms” [3].

In order to properly comply with the above norms, the Ministry of Health in 2016 proposed and supported the World Health Organization “Concept for the reform of health care financing in Ukraine.” In accordance with the provisions of this concept, the reform of the medical sector in Ukraine is proposed to be carried out in the following areas:

- 1) optimization of medical infrastructure by closing or re-profiling institutions with low workload and weak technical base and creation of large intensive care hospitals;
- 2) redistribution of resources through the introduction of a new mechanism for financing medical services:
 - introduction of a co-payment system, when the state makes a clear commitment to provide a predetermined free amount of medical services, and citizens have to pay for additional services privately;
 - gradual transition to payment to medical institutions of the final result of actually provided medical services on the principle of “money follows the patient”;
 - granting medical budgetary institutions financial and managerial autonomy by transforming them into state and municipal non-profit enterprises;
- 3) the transition from command-administrative methods to the state-public management model [4].

As can be seen from the Concept of Health Care Financing Reform, the integration and optimization of the health care sector requires the creation of hospital districts, for

decision-making on secondary health care facilities among cities of regional significance, districts and united territorial communities [5, p.11].

Before researching the interaction between health care facilities, it is necessary to dwell on the definition of the term “hospital district”. Among the doctrinal definitions, the definition proposed by Mykhalchuk V.M. occupies a prominent place, noting that the hospital district is a territorial association of health care institutions of several districts into a single medical space on the criterion of accessibility, population, existing medical institutions [6, p.161].

Regarding the normative definition of the term “hospital district”, it should be noted that this was regulated by the Resolution of the Cabinet of Ministers of Ukraine of November 27, 2019 № 1074 “Some issues of hospital districts”, according to which the hospital district was defined as a functional association of security institutions health, located in the relevant territory, which provides secondary (specialized) and emergency medical care to the population of such territory [7].

However, on June 19, 2020, the Cabinet of Ministers of Ukraine № 589 amends the previously adopted resolution of November 27, 2019 № 1074 “Some issues of creating hospital districts”. The changes, in particular, concern the conceptual apparatus of the Procedure for the creation of hospital districts. Therefore, the term “hospital district” is removed, but at the same time the Procedure is supplemented by a new term “health care facilities”, which is proposed to mean multidisciplinary health care facilities of state and communal ownership, which meet the criteria for defining a multidisciplinary hospital. treatment of the first or second level or can be increased to it [8].

- Also, within the hospital district will be provided:
- systematic interaction between the subjects of the hospital district;
 - efficient use of resources of the health care system and investments for the development of a capable network of the hospital district;
 - modernization of the medical care system, etc. [8].

Another innovation of the above-mentioned Resolution of the Cabinet of Ministers of Ukraine is that the competence of the Ministry of Health includes the right to form a commission to consider proposals to determine the list of health care support institutions, which may include representatives of the Ministry of Health and other central executive bodies. state bodies, the public and public associations, international organizations [8].

Therefore, given the above circumstances, we consider it necessary to propose our own doctrinal definition, according to which the hospital district is proposed to understand the voluntary association of communities (in a single medical space) as a system of technologically related but legally and financially autonomous hospitals located throughout area or part (depending on the size of the area, population density, infrastructure), which is formed in order to increase the availability of medical services and care for patients.

The hospital district must include at least one multidisciplinary intensive care unit of the first and / or second level and other health care facilities. The center of the hospital district is defined as a settlement (which is geographically closest to the center of the district), usually a city with a population of over 40 thousand people, which houses a multidisciplinary intensive care hospital of the second level. Today, the Cabinet of Ministers of Ukraine approved the list and composition of hospital districts in 13 regions of Ukraine (Dnipropetrovsk, Zhytomyr, Zaporizhia, Kyiv, Poltava, Luhansk, Ternopil, Rivne, Khmelnytsky, Kherson, Chernihiv, Chernivtsi regions and Kyiv) [9].

Moreover, a capable network should be established within the hospital district, consisting of health care support facilities and other health care facilities, including multidisciplinary children's hospitals, perinatal centers, specialized centers and health care facilities that provide medical care for oncological, infectious diseases, tuberculosis and other socially significant diseases. That is, almost every hospital district includes: medical-diagnostic center, planned and rehabilitative treatment hospitals, ambulance station with ambulance stations, temporary-based ambulance stations and specialized ambulance crews, hospice (palliative care facility) care and psychological support for the terminally ill). Primary health care centers for primary health care are based on the administrative territory of hospital districts [6].

Provision of diagnostic tests for the needs of primary care and planned outpatient specialized care will be provided by outpatient departments of hospitals of planned treatment or consultative-diagnostic polyclinics. In acute cases, outpatient specialized care will be provided by hospital specialists for intensive care [6].

As we can see, the hospital district is a kind of tool for community cooperation to decide on secondary health care facilities among cities of regional significance, districts and OTG. That is, the hospital district is a collaboration tool for network planning. The following indicators have been set in Ukraine as planned: 200 thousand populations per level II intensive care hospital, 120 thousand per level I hospital [10].

Thus, the hospital council is a platform for negotiation and assistance in the interaction of health care facilities within the hospital district. The latter does not make any decisions, but only allows to work out solutions, to develop a common vision – what should be the future of the hospital network of this district as a whole. As V.M. Mykhalchuk notes, with whom we fully agree: “The task of the hospital council is to develop a draft 5-year development plan for the hospital district. And therefore – to determine what investments are needed to bring hospitals to the modern level” [6, p.171].

However, with the establishment of hospital councils and the empowerment to create multi-year district development plans based on the interaction of health care facilities, it is assumed that the latter will be realistic and therefore supported by all communities, the state and the international community as a whole. attracting additional funds

for the development of the health care system in Ukraine.

A new effective mechanism of the regional hospital interaction with the health care facilities of the hospital district is the creation and operation of a training center for continuous postgraduate training of medical workers (doctors, paramedics) on the basis of the regional hospital. This will effectively improve the professional skills of all medical workers of the regional hospital and other medical institutions of the district [11, p.306].

We unequivocally believe that in order to successfully reform the health care system and the effective interaction of hospitals in one hospital district, it is necessary to pay considerable attention to funding sources. Additional sources of funding should be: charitable assistance and grant funds; voluntary health insurance funds; payment of the hospital for the provision of services under agreements; receipts for services provided by the hospital in addition to the standards of free medical care; for services provided to patients on their own initiative; voluntary contributions and donations, and other sources not prohibited by current legislation [12].

Therefore, in order to ensure the interaction and effective functioning of hospital districts, it is advisable to base the formation of a model for managing their development cross-sectoral management approach as a way to identify and implement new opportunities to solve pressing problems based on coordination of interests and integration of public, governmental, business institutions [5].

All subjects of intersectoral interaction and cooperation should be focused on the development of hospital districts, active participation in the implementation of the basic functions of the implementation of management mechanisms, namely [13]:

- regulatory – the development of levers and ways to stimulate the establishment of relations between the subjects of interaction in the process of solving problems of health care development;
- preventive – the implementation of opportunities for cooperation to prevent threats in the development and implementation of strategic goals for the development of hospital districts;
- integrative – pooling of resources on the basis of partnership in the implementation of development projects;
- diagnostic – identification and representation of interests and opportunities of subjects of intersectoral cooperation and identification of problems that need to be addressed as a matter of priority;
- innovative – search and introduction of innovative technologies in the context of achieving the goal of creating hospital districts.

DISCUSSION

Thus, our study shows that the interaction of health care institutions within one hospital district is a driving force in strengthening the state health care system, is its main component, as it solves the most important issues on the ground, namely the preservation of life and human health [14].

Although the hospital district does not act as a separate legal entity, a separate level of territorial organization of power, but it plays the role of a mechanism for coordination and joint decision-making by representatives of local authorities, whose territories it covers. The boundaries and composition of each district are formed on the basis of the criteria for the formation of the district, established by the Procedure for the establishment of hospital districts.

As a result of the study, we can say that hospital districts are created as “functional associations of hospitals located in a certain area.” The health care facilities covered by the hospital district remain the property and subordination of the local authorities that are members of the hospital district.

We can note that the next step in improving secondary health care is the creation of hospital councils to coordinate actions, develop proposals for the organization, operation of health care within a single hospital district, preparation and approval of long-term development plans for hospital districts for 5 years. resources). To finance the gradual restructuring of hospital health care facilities, it is proposed to create a separate program of the State Budget. Optimizing the network through hospital districts will solve most of the problems of the secondary level of health care, as it will balance the local autonomy and controllability of the process by the Government, as well as create appropriate financial incentives [15].

CONCLUSIONS

Thus, the innovation process in the field of health care is the key to the effective functioning of health care facilities, the achievement of general medical goals and the provision of timely care to sick people. The study showed that the innovation process requires the use of a procedurally oriented approach in the management of health care organizations, which will strengthen the interaction of health care facilities within one hospital district, and the latter in turn will not only overcome urgent problems, but also will open new perspectives for the development of the national health care system.

REFERENCES

1. Konstituciya Ukrainy. Dokument 254k/96-VR [The Constitution of Ukraine. Document 254k / 96-BP]. (in Ukrainian).
2. Mizhnarodnij pakt pro ekonomichni, socialni i kulturni prava. Dokument 995-042 [International Covenant on Economic, Social and Cultural Rights. Document 995-042]. (in Ukrainian).
3. Ugoda pro asociaciyu mizh Ukrainoyu z odniyeyi storoni, ta Yevropejskim Soyuzom, Yevropejskim spivtovaristvom z atomnoyi energiyi i yihnimi derzhavami-chlenami, z inshoyi storoni. Dokument № 984-011 [Association Agreement between Ukraine, of the one part, and the European Union, the European Atomic Energy Community and their Member States, of the other part. Document № 984-011]. (in Ukrainian).
4. Koncepciya reformi finansuvannya sistemi ohoroni zdorov'ya Ukrainy, pidgotovlena robochoyu grupoyu z pitan reformi finansuvannya ohoroni zdorov'ya pri MOZ Ukrainy: proekt [The concept of health care financing reform in Ukraine, prepared by the working group on health care financing reform at the Ministry of Health of Ukraine: draft]. (in Ukrainian).
5. Stovban M.P., Stovban I.V. Osnovni charakteristiki sistemi vzayemodiyi medichnih zakladiv v mezhah odnogo gospitalnogo okrugu. [The main characteristics of the system of interaction of medical institutions within one hospital district]. Scientific research. 2020;3 (30): 11-18. (in Ukrainian).
6. Mykhalchuk V.M., Stovban M.P. Osoblivosti vzayemodiyi medichnih zakladiv odnogo gospitalnogo okrugu v umovah zagostrennya epidemiologichnoyi situaciyi. [Features of interaction of medical institutions of one hospital district in the conditions of aggravation of an epidemiological situation]. Scientific perspectives. 2020; 2 (20): 158-176. (in Ukrainian).
7. Postanova Kabinetu Ministriv Ukrainy vid 27 listopada 2019 r. № 1074 «Deyaki pitannya stvorennya gospitalnih okrugiv [Resolution of the Cabinet of Ministers of Ukraine of November 27, 2019 № 1074 “Some issues of creating hospital districts”]. (in Ukrainian).
8. Postanova Kabinetu Ministriv Ukrainy vid 19.06.2020 roku № 589 «Pro vnesennya zmin do Postanovi Kabinetu Ministriv Ukrainy vid 27.11.2019 roku № 1074». Dokument № 589-2020-p. [Resolution of the Cabinet of Ministers of Ukraine of June 19, 2020 № 589 “On Amendments to the Resolution of the Cabinet of Ministers of Ukraine of November 27, 2019 № 1074”. Document № 589-2020-n]. (in Ukrainian).
9. Yuridichni aspekti funkcionuvannya likaren v mezhah gospitalnih okrugiv. Proekt USAID «Pidtrimka reformi ohoroni zdorov'ya [Legal aspects of the functioning of hospitals within hospital districts. USAID Health Care Reform Support Project]. (in Ukrainian).
10. Metodichni rekomendaciyi z pitan peretvorennya zakladiv ohoroni zdorov'ya z byudzhetnih ustanov na komunalni nekomercijni pidpriyemstva [Methodical recommendations on transformation of health care institutions from budgetary institutions into communal non-profit enterprises]. (in Ukrainian).
11. Heese H. S. Specialization and competition in healthcare delivery networks. Health Care Management Science. 2019; 12(3):306–324.
12. Slabky G.O., Lobas V.M. Organizaciya diyalnosti oblasnoyi likarni v umovah reformuvannya sistemi medichnoyi dopomogi naseleennyu. Metodichni rekomendaciyi [Organization of the regional hospital in terms of reforming the system of medical care]. 2013. (in Ukrainian).
13. Koshova S. P. Krut A.H. Charakteristika stresostijkosti ta adaptivnogo potencialu pri navchanni likariv v pisyadiplomnij osviti [Characteristics of stress resistance and adaptive potential in the training of doctors in the system of postgraduate education]. URL: https://www.researchgate.net/publication/329041763_Characteristics_of_stress_resistance_and_adaptive_potential_in_the_training_of_doctors_in_the_system_of_postgraduate_education. (in Ukrainian).
14. Andrushchenko H., Shandova N., Hbur Z. et al. Enterprise competitiveness management by introducing virtual reality technologies. Academy of Strategic Management Journal 2019; 18(1): 1-6.
15. Kotliar L., Akimov O., Krasivskyy O. et al. Assessment of Possibility of Integration of Experience of Leading Countries of The World in Training of Public Administration Specialists. Sys Rev Pharm 2020; 11(11): 656-662. doi:10.31838/srp.2020.11.95.

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REVIEW ARTICLE

DEVELOPMENT OF PERINATAL MEDICINE IN UKRAINE IN THE CONTEXT OF INTERNATIONAL APPROACHES

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ABSTRACT

The aim: To realize analysis and assessment of completeness and efficacy in the field of perinatal aid regionalization in Ukraine.

Materials and methods: A retrospective analysis has been carried out as well as assessment of inculcation steps concerning regionalization of perinatal health care in Ukraine according to the data of state and branch statistics and monitoring (in 2013-2017). The methods used here are systemic approach, bibliography method, and statistical data evaluation.

Conclusions: It is shown the modern globally acknowledged three-level system of perinatal health care has been organized and functions in Ukraine, perinatal tertiary level centers are now act in the majority of regions. The perinatal health care realization during these last years is shown to be able to assure the providing of adequate perinatal aid taking into consideration the calculated data concerning the pregnant women concentration with high perinatal risks in third level institutions; these patients include pregnant women with heart defects (63.2-69.9%), circulatory system defects (48.5-50.5%), diabetes mellitus (46.7-53.3%); in institutions of the second-third levels, there are 74.2-83.0% of patients with severe gestoses. According to functional possibilities of perinatal aid institutions of different levels, they assure 62%-64.5% of births with body mass 500-999 g and 53.9%-55.3% of ones with body mass 1000-1499 g in perinatal clinics of the third level; it guarantees the survival of newborn babies with body mass 500-999 g and 1000-1499 g during their first 168 h reaching 60.1-65.1% and 89.4%-90.4%, respectively.

Efficacy of perinatal aid regionalization is confirmed by a positive tendency of perinatal mortality index; it has become significantly lower: in 2010, the perinatal mortality reached 10.54 cases per 1,000 of newborn alive and dead babies, this index having dropped to 8.89 in 2019. The maternal mortality levels have also decreased from 23.5 up to 14.9 cases per 100,000 of babies born alive.

Perinatal aid regionalization in Ukraine is being realized according to international strategies permitting to provide effective perinatal aid to patients at each level of its provision depending on patient's need.

KEY WORDS: Perinatal health care, regionalization, pregnant women morbidity, newborns morbidity

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INTRODUCTION

The world community at any stage of mankind development determines some priorities to assure the population health protection as the leading resource necessary for life maintenance on the Earth. Such directions of medicine development are usually elaborated by different international institutions. Among the most important global health problems, the leading one is the problem of mother and child health protection including the protection of women reproductive health. It is clear from a series of international documents including the following:

- Convention on the Human Rights [1];
- Convention on the Rights of the Children [2];
- Program of Actions of the International Conference on the Problems of Population and Development (Cairo) [3];
- Action Platform Accepted by the IV Global Conference about the State of Women [4];

- Health-21: Fundamentals of Health Policy for all in the WHO European Region: Introduction (European Series for Health of all) [5];
- UNO Millennium Declaration – Millennium Development Goals for 2000-2015 [6];
- Resolution of the General Assembly of the UNO “Goals of Permanent Development. 2016-2030” [7];
- Global Strategy for Women's, Children's and Adolescents' Health (2016–2030). Every Woman, Every Child [8].

These documents, especially three last ones, include target indices of mother and children health which are to be achieved by all countries during a clearly determined period.

For example, the list of development goals during the next years of this millennium (2000) declares:

- to decrease the babies mortality by two thirds;
- to decrease the mothers mortality by three quarters;

• to assure the common access to reproductive medicine. The achievement of such Goals has globally built the health of women and children, including, without any doubt, the situation in Ukraine [9].

The results of these documents realization were summed up, and next new tasks for the next period of human history were proposed for the UNO order of the day [7]. In 2015, new Goals of Persistent Development were formulated, well grounded, and confirmed by representatives of 193 countries.

There are 17 such Goals. The third one is “the support of better health”. It is formulated as an integral requirement containing, however, a series of detailed tasks. They include, in particular, the necessity to decrease:

- maternal mortality on the global scale below 70 cases per 100,000 of alive born babies;
- neonatal mortality at least to 12 cases per 1,000 of alive born babies in each country;

mortality of children below five years at least to 25 cases per 1,000 of alive born babies in each country.

More detailed steps regarding the protection of women and children health are contained in the European plan of actions for the protection of sexual and reproductive health during 2017-2020 based on the Declaration of Human Rights.

The leading principles of this Plan include:

- each person's right for the highest health level;
- acknowledgement of the fact the health to be the state of complete physical, psychical, and social well-being, not only the absence of diseases and physical defects;
- concordance with general understanding of situation, politics, and priorities of the strategy given in the “Health-2020”;
- conformity with international goals and tasks, in particular with actual goals of the Order of day in the field of permanent development up to 2030 and Global Strategy for Women's, Children's and Adolescents' Health (2016–2030) [8];
- succession in health care services providing, principle requiring the health care to be spread on all the human life periods (life stages).

Three goals are presented in the European Plan of Actions (A, B, C). The goal B consists in approaches promoting the reproductive health and well-being protection, including also reproductive rights realization. It foresees the shortening of unsatisfied need scale in contraception, decreases of maternal mortality and morbidity levels for avoidable cases including the causes of dangerous abortions, decrease of perinatal mortality and morbidity levels for avoidable cases, promoting of infertility prophylaxis, providing of infertility diagnostics and treatment.

THE AIM

Aim of the study was to realize analysis and assessment of completeness and efficacy in the field of perinatal aid regionalization in Ukraine.

MATERIALS AND METHODS

A retrospective analysis has been carried out as well as assessment of inculcation steps concerning regionalization of perinatal health care in Ukraine according to the data of state and branch statistics and monitoring (in 2013-2017). The methods used here are systemic approach, bibliography method, and statistical data evaluation.

REVIEW

In the course of perinatal aid regionalization (PAR) supported by international organizations, a system has been worked out and implemented including the management algorithm for women and newborn babies with perinatal risks as well as the teaching strategy for medical staff for perinatal centers to assure the perinatal care and management of newborn babies with extremely low body weight at the moment of birth [10].

We have proved the efficacy and success of perinatal aid regionalization in some regions of Ukraine have been achieved due to:

- formation in each region of an organizational structure by attributing of obstetrics clinics to certain levels of perinatal aid;
- setting up of organizational structure to correspondence with territorial necessities, taking into account geographical accessibility, geographical necessity, staff and logistic resources of perinatal aid institutions, quantity of pregnant women with different degrees of perinatal pathology risks and mortality;
- working out of schemas (itineraries) for territorial transport intended for pregnant women, parturient women, and newborn babies with high risk of maternal and perinatal mortality in institutions of perinatal aid of adequate level.

From the date of the Program confirmation, a three-level perinatal aid system has been organized in all the Ukraine regions, third-level PCs having appeared in the majority of them, excluding Vinnytsia, Zakarpattia, Kyiv, Mykolayiv, Odessa, Kherson, Cherkasy, Chernivtsi, and Chernigiv regions. Unfortunately, three of them are situated on territories being not controlled by Ukrainian administration (such towns as Donetsk, Lugansk, and Simpheropol).

Full of value functioning of perinatal centers permits to affirm the achievement of goals having been mentioned at the moment of creation of the conception concerning the perinatal aid regionalization in our country.

One of such goals was the concentration of pregnant women with severe extra-genital pathologies preventing child-bearing in perinatal centers of the third level. Our analysis shows in 2014-2017 the index of delivery concentration for such women with impaired cardiac functions in third-level perinatal aid institutions comparing to their total quantity in Ukraine to reach 63.2-69.9%, this index in Zhytomyr, Zaporizhzhia, Kirovograd, Kharkiv, Poltava, and Rivne districts being 92.2, 90.29, 85.0, 98.9, 100, and 100%, respectively.

As concerns cases of pregnant women with circulatory problems, the situation is the following. Generally saying,

almost a half of such patients (48.5-50.5%) are often concentrated and managed at third level institutions. At the same time, it is possible to concentrate in such institutions significantly more women with pathologies mentioned above. Consequently, this index in some regions is evidently higher reaching 80.7, 88.9, and 84.9% in Kirovograd, Poltava, and Kharkiv districts, respectively [11].

As concerns pregnant patients with diabetes mellitus, 46.7-53.3% of them are taken to third level perinatal aid institutions. Both the correct selection and rational medical itineraries for pregnant patients with such pathology permit to increase this index in Kharkiv, Zhytomyr, and Poltava districts up to 99.3, 100, and 100%, respectively.

Correct medical itineraries for pregnant patients with severe gestoses are provided in Kirovograd, Poltava, Kharkiv, and Khmelnytski districts, more than a half of their patients with such pathology being taken to third-level PCs with all the possibilities to provide all the necessary health care services according to standards based on the medicine of evidence.

During the period of perinatal aid regionalization in Ukraine, alive babies are mostly born in third-level obstetrics centers, including 62-64.5% of babies with the body mass 500-999 g at the moment of birth and 53.9-55.3% of ones with this index reaching 1000-1499 g.

In regions possessing third-level PCs the situation is significantly better. For example, the percent of babies with extremely low body mass at the moment of birth (500-999 g) who have been born in such centers reaches 90% in Zhytomyr region, the concentration indices for such babies in Kharkiv region, Kyiv-City, and Poltava region being 92.1, 70.2, and 100%, respectively.

The index of delivery concentration for newborn babies with the body mass of 1000-1499 g at the moment of birth reaches in third-level PCs in Ukraine as a whole 53.9%-55.3%, these indices in Zaporizhzhia, Poltava, and Kharkiv districts being 80.4%, 89.7%, and 88.4%, respectively.

Consequently, we may assess more positive features due to accessibility of highly specialized perinatal aid in regions where third-level PCs have been organized.

Index of neonatal transfers is an additional index of perinatal aid regionalization accepted also in other European countries. It describes the quantity (portion, percent) of newborn babies having been transported to other perinatal aid institutions. The known current index of emergent newborn transfer in countries of European Community reaches 0.5-1.0 per 100 babies born alive.

Year in year out, the index of neonatal transfers becomes lower, especially in regions where third level perinatal centers are organized and function. In such regions as Dnipropetrovsk, Kirovograd, Poltava, Kharkiv and in Kyiv-City this index varies from 0.7 up to 3.9%.

The goal of perinatal aid regionalization is to increase the quality and availability of perinatal aid taking into account the rational use of existing system providing health care services to women of reproductive age, pregnant women, parturient ones as well as to newborn babies; it is necessary to assure all the possibilities for management of babies with low and extremely low body mass at the moment of birth.

Nowadays, the decrease of perinatal and baby mortality in developed countries is due, first all, to increased quality of health care for children with extremely low body mass.

According to the data obtained from monitoring and assessment of perinatal aid regionalization in Ukraine as a whole, for newborn babies with extremely low body mass at the moment of the birth, the survival frequency dynamics during their first 168 h of life in 2014-2017 was wave-like; in cases of the body mass 500-999 g, the survival frequencies were 65.1, 63.9, 64.9, and 60.1% in 2014, 2015, 2016, and 2017, respectively. For newborn babies with the body mass 1.000-1.499 g the frequencies for the same years were 89.4, 90.4, 90.2, and 88.5%, respectively. These data become closer to indices known for the USA, Japan, and the majority of Western Europe countries [12].

According to monitoring data obtained during these last 4 years, some rather high survival indices for newborn babies with extremely low body mass at the moment of birth are registered in Dnipropetrovsk and Mykolayiv regions and in Kyiv-City; such indices are lower (below 60%) in Ivano-Frankivsk, Kirovograd, Sumy, Khmelnytski regions.

Significantly lesser geographical differences are found for survival indices of newborn babies whose body mass at the moment of birth reaches 1000.0-1499.0 g: the data obtained are 83.8-96.8, 86.2-95.9, 80.5-100, and 81.0-100% in 2014, 2015, 2016, and 2017, respectively [12].

Efficacy of perinatal aid regionalization is confirmed by a positive tendency of perinatal mortality index; it has become significantly lower: in 2010 the perinatal mortality reached 10.54 cases per 1,000 newborn alive and dead babies, this index having dropped to 8.89 in 2019. The maternal mortality data have also decreased from 23.5 up to 14.9 cases per 100,000 of babies born alive.

DISCUSSION

Both the realization of strategic goals of international documents and the data of analysis concerning the health level of mothers and children in Ukraine have become a basis for elaboration and realization of some organizational measures to improve the existing situation.

As a fact, the level of morbidity and disease prevalence among adolescent girls being future mothers is for the present rather high and becomes worse from year to year. In 2000, morbidity and prevalence were 8,370.1 and 14,446.3 per 10,000 of adolescent girls; in 2017, however, these indices have reached 12,440.7 and 22,103.9, respectively [11, 13]. It is quite predictable the prevalence of some extra-genital diseases and syndromes in pregnant women remains as high as before. Defects of circulation and of urogenital systems are registered in 6.6-7.6% and in 13.1-13.9% of pregnant patients, respectively. In addition, about 30% of pregnant women are victims of anemia [11]. It is clear that about a half of pregnant women suffer from different extra-genital pathologies being a negative influence factor for pregnancy and delivery course as well as for intra-uterine fetus development and also for newborn, carrying a high risk for mother's and child's life and health.

Table 1. Comparative data of perinatal reproductive losses among full term and premature newborn babies in Ukraine 2016

Index	Full term + premature newborns	Full term newborns	Premature newborns	Difference of indices (by times)
Perinatal mortality (per 1,000 newborn alive + still babies)	8.66	4.80	135.23	28.2
Early neonatal mortality (per 1,000 alive newborn babies)	3.05	1.50	63.11	42.1
Still births (per 1,000 newborn alive and still babies)	5.68	2.67	76.98	28.8
Morbidity of newborn babies (per 1,000 alive born babies)	157.7	123.8	792.0	6.4

Without any doubt, this conclusion is confirmed by the analysis of causes of perinatal, neonatal, and baby mortality as well as of still births. For example, more than a half of mortality cases (53.1%) in the mortality structure of children during the first year of their life are due to conditions having been developed during the prenatal period. In the still births structure, about 75.5% of all cases are results of intra-uterine hypoxia and asphyxia. The same is the cause of about 58.5% baby deaths in their early neonatal period [14].

An important problem for Ukrainian health care during many years is non-carrying of pregnancy, especially as a result of preterm delivery, its level in Ukraine varying in limits of 4-5%. At the same time, the health level of preterm newborn babies and their survival index are a permanent cause of our anxiety. We have carried out a comparative study of perinatal reproductive losses among full term and premature newborns. Our results (see Table 1) are an unbiased confirmation of such situation.

The data of analysis presented here have become an evident background for changes in organization of health care providing for newborn babies.

To increase the availability and quality of health care aid for mothers and babies, it was necessary to perfect a lot of medical institutions aiming to organize the three-level service of perinatal aid providing, such a service being known to function in many developed countries.

From the end of the XX century, the regionalization of perinatal medical aid became a standard of perinatal health care. It includes guarantees of its availability and assuring of its succession and step-by-step character based on the clear distribution of perinatal aid institutions according to levels of health care services, implementation of unified standards, recommendations, and order of patient hospitalization and transfer to institutions of different levels [10, 15]. It became an organizational model on the way of medical aid optimization for mothers and children; it assures the step-by-step providing of medical services in institutions of three levels, taking into consideration regional peculiarities; such a system foresees the timeliness, availability, adequacy, efficacy, and safety of the aid accompanied by rational cost expenditure for aims of the health protection; such a system promotes also the decrease of maternal and perinatal mortality as well as of morbidity and disability rates.

Here we discuss the perinatal aid realization as a component of the health care system reformation as a whole.

The realization of perinatal aid regionalization has been carried out under some legal conditions. It was, first of all, the realization of the Decree of the President of Ukraine

(12.03.2010) concerning the implementation of economical reforms program during 2010-2014; the program foresaw the modernization of the tertiary (highly specialized) health care system including also perinatal aid and organization of perinatal centers (PCs) of tertiary perinatal aid [16]. Realization of the document mentioned was carried out through the fulfillment of the National Project "New Life Brings New Quality of Maternity and Childhood Protection".

A series of decrees of the Ministry of Health of Ukraine has been prepared and published, especially the decree № 514 "On the Confirmation of the Approximate Regulations for a Perinatal Center with In-Patient Department and of the Approximate Regulations for a Perinatal Center Belonging to a Health Care Institution" on the 15.08.2011, the decree № 726 "On the Perfection of Organization Concerning the Aid Providing to Mothers and Newborn Babies in Perinatal Centers" published on the 31.10.2011, and the decree № 1881 "On the Confirmation of the Secondary (Specialized) Health Care Volume Providing which is to Be Guaranteed by Multi-Profile Intensive Therapy Hospitals of the First and Second Levels as well as Changes to the Order of Perinatal Aid Regionalization" published on the 19.10.2018 [17, 18, 19].

These measures having been taken, new approaches for practical realization aiming the formation of three-level perinatal aid system were found together with monitoring fulfillment to evaluate its completeness and efficacy.

CONCLUSIONS

Perinatal aid realization in Ukraine is now carried out according to international strategies permitting to provide effective perinatal aid to patients at each level of its provision depending on patient's need. A modern and globally accepted system of three-level perinatal aid has been organized in the majority of regions where tertiary level perinatal centers function.

The system accepted has determined the directions of practical realization for three-level perinatal aid system as well as monitoring methods and assessment of this system completeness and efficacy.

The perinatal aid regionalization has permitted to assure the highly technological aid in perinatal institutions of the third level for pregnant women with high perinatal risks; these patients include pregnant women with heart defects (63.2-69%), circulatory system ones (48.5-50.5%), diabetes mellitus (46.7%-53.3%); in institutions of second-third levels, there are 74.2-83.0% of patients with severe gestoses.

According to functional possibilities of perinatal aid institutions of different levels, they assure 62%-64.5% of births with newborn body mass 500-999 g and 53.9%-55.3% of ones with newborn body mass 1000-1499 g in perinatal clinics of the third level; it guarantees the better survival of newborn babies with body masses 500-999 g and 1000-1499 g during their first 168 h of life: it reaches 60.1-65.1% and 89.4-90.4% of such newborns, respectively.

Efficacy of perinatal aid regionalization is confirmed by a positive tendency of perinatal mortality index; it has become significantly lower: in 2010 the perinatal mortality reached 10.54 cases per 1,000 newborn alive and dead babies, this index having dropped to 8.89 in 2019. The maternal mortality data have also decreased from 23.5 up to 14.9 cases per 100,000 of babies born alive

REFERENCES

1. Konvetsiia pro prava dytyny vid 20 lystopada 1989 roku (Konvetsiia ratyfikovana Postanovoiu Verkhovnoi Rady No 789-XII vid 27.02.91) [Convention on the Rights of the Children [the 20th of November 1989] (Ratified by the Verkhovna Rada Decree No 789-XII on the 27.02.91)]. (In Ukrainian).
2. Zahalna deklaratsiia prav liudyny vid 10 hrudnia 1948 roku [Universal Declaration of Human Rights [the 10th of December 1948]. Official Herald of Ukraine. 2008;93;3103:89. (In Ukrainian).
3. Program of Actions of the International Conference on the Problems of Population and Development, 1994/ International Conference on the Problems of Population and Development, Cairo, 5th-13th of September 1994]. New-York: ONU. 1995.
4. Platforma dii, pryiniata Chetvertoiu vsesvitnoiu konferentsiieiu pro stanovyshche zhinok vid 15 veresnia 1995 roku [Action Platform Accepted by the Fourth Global Conference about the State of Women published on the 15th of September 1995. (In Ukrainian).
5. Zdorov'e-21: Osnovy politiki dostizheniya zdorov'ya dlya vseh v Evropejskom regione VOZ: vvedenie (Evropejskaya seriya po dostizheniyu zdorov'ya dlya vseh, 6). ISBN 92 890 4349 0 (Klasyfikatsiya NLM: WA 540 GA1) ISSN 1012-7380. [Health-21: Fundamentals of Health Policy for all in the WHO European Region: Introduction (European Series for Health of all). (In Russian).
6. UNO Millennium Declaration – Millennium Development Goals for 2000-2015. <https://www.un.org/millenniumgoals/>.
7. Tsili staloho rozvytku 2016-2030 [Goals of Permanent Development. 2016-2030]. <http://www.un.org.ua/ua/tsili-rozvytku-tysiacholittia/tsili-staloho-rozvytku>. (In Ukrainian).
8. The Global Strategy for Women's, Children's and Adolescents' Health (2016-2030) _Every Woman Every Child. <http://www.who.int/life-course/partners/global-strategy/en>.
9. Rynhach N.O. Otsinka dosiahnennia Tsili Rozvytku Tysiacholittia shchodo znyzhennia dytiachoi smertnosti [Assessment of Achievements. Goals of Millennium Development Concerning Children Mortality Decrease]. 2013;2(20):25-36. doi:10.15407/dse2013.02.028 N. (In Ukrainian).
10. Moiseienko R.O., Vaisberh Yu.R., Holianovskiy V.O. et al. Natsionalni pidkhody do vprovadzhennia systemy rehionalizatsii perynatalnoi dopomohy v Ukraini za redaktsiieiu Moiseienko R. O. [National Approaches to the Implementation of the Perinatal Aid Regionalization in Ukraine]. Kyiv: Ministry of Health of Ukraine; 2012, 136 pp. (In Ukrainian).
11. Shchorichna dopovid "Pro stan zdorovia naselennia, sanitarno-epidemichnu sytuatsiiu ta rezultaty diialnosti systemy okhorony zdorovia Ukrainy. 2017 rik." [Annual Report "On the Health State of Population, Sanitary/Epidemic Situation, and Results of Health Care System Functioning in Ukraine. 2017"]. Ministry of Health of Ukraine. State Enterprise "Ukrainian Institute of Strategic Investigations of the Ministry of Health of Ukraine". Kyiv: Medical Exposition Center "Medinform". 2018. (In Ukrainian).
12. Znamenska T. K., Vorobiova O. V., Dudina O. O et al. Kharakterystyka diialnosti zakladiv perynatalnoi dopomohy v Ukraini: neonatolohichna sluzhba [Peculiarities of perinatal aid institutions activity in Ukraine]. Neonatologia, khirurgia ta perynatalna medytsyna. 2019;4(34):38-47. (In Ukrainian).
13. Hoida N.H., Dudina O.O. Zdorovia zhinok reproduktyvnoho viku. Panorama okhorony zdorovia naselennia Ukrainy [Health of Reproductive Age Women. Panorama of Population Health Care in Ukraine]. Kyiv, 2003, p. 62-64. (In Ukrainian).
14. Znamenska T.K., Antypkin Yu.H., Ariaiev M.L. et al. Neonatolohiia u trokh tomakh za redaktsiieiu dokt. med. nauk, prof. T. K. Znamenskoj [Neonatology. Manual in 3 tomes edited by Znamenska T.K. (Professor, Doctor of Medical Sciences)]. Lviv: publisher Marchenko T.V. 2020;1:408. (In Ukrainian).
15. Antypkin Yu. H., Znamenska T.K., Marushko, R.V. et al. Stan medychnoi dopomohy novonarodzhonym v Ukraini [State of the neonatal health care in Ukraine]. Neonatologia, khirurgia ta perynatalna medytsyna. 2020;4(38):5-24. (In Ukrainian).
16. Ukaz Prezydenta Ukrainy vid 12 bereznia 2012 roku № 187/2012 "Natsionalnyi plan dii na 2012 rik shchodo vprovadzhennia Prohramy ekonomichnykh reform na 2010-2014 roky "Zamozhne suspilstvo, konkurentospromozhna ekonomika, efektyvna derzhava" [Decree of the President of Ukraine published on the 12th of March 2012 № 187/2012 "National Plan of Actions in 2012 Concerning the Implementation of the Program of Economical Reforms in 2010-2014 "Prosperous Society, Competitive Economics, Effective State". (In Ukrainian).
17. Nakaz Ministerstva okhorony zdorovia Ukrainy vid 15.08.2011 № 514 "Pro zatverdzhennia Prymirnoho statutu Perynatalnoho tsentru zi statsionarom ta Prymirnoho polozhennia pro Perynatalnyi tsentr u skladi zakladiv okhorony zdorovia" [Decree of the Ministry of Health of Ukraine published on the 15.08.2011 № 514 "On the Confirmation of the Approximate Regulations for a Perinatal Center with In-Patient Department and of the Approximate Regulations for a Perinatal Center Belonging to a Health Care Institution"]. (In Ukrainian).
18. Nakaz Ministerstva okhorony zdorovia Ukrainy vid 31.10.2011 № 726 "Pro udoskonalennia orhanizatsii nadannia dopomohy materiam ta novonarodzhonym v perynatalnykh tsentrakh" [Decree of the Ministry of Health of Ukraine published on the 31.10.2011 № 726 "On the Perfection of Organization Concerning the Aid Providing to Mothers and Newborn Babies in Perinatal Centers"]. (In Ukrainian).
19. Nakaz Ministerstva okhorony zdorovia Ukrainy vid 19.10.2018 № 1881 "Pro zatverdzhennia Obiemu nadannia vtorynnoi (spetsializovanoi) medychnoi dopomohy, shcho povynen zabezpechuvatysia bahatoprofilnymy likarniamy intensyvnoho likuvannia pershoho ta druhoho rivnia, ta Zmin do Poriadku rehionalizatsii perynatalnoi dopomohy". [Decree of the Ministry of Health of Ukraine published on the 19.10.2018 № 1881 "On the Confirmation of the Secondary (Specialized) Health Care Volume Providing which is to Be Guaranteed by Multi-Profile Intensive Therapy Hospitals of the First and Second Levels as well as Changes do the Order of Perinatal Aid Regionalization"]. (In Ukrainian).

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REVIEW ARTICLE

AGE-RELATED MACULAR DEGENERATION – CURRENT STATE OF THE PROBLEM AND PROPHYLAXIS METHODS

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ABSTRACT

The aim: Analyze the ophthalmic studies on diagnostics and treatment of patients with age-related macular degeneration to optimize diagnostics and management tactics.

Materials and methods: The analysis of scientific papers due to age-related macular degeneration, vitamin D and its functions from scientometric databases: PubMed, Scopus, Web of Science. The methods were next: systematic approach, analysis, summarization and comparison.

Conclusions: Age-related macular degeneration is a chronic, progressive disease among people older than 50 years. Late diagnostics and inappropriate treatment may lead to irreversible central vision loss and social disadaptation. Modern studies on the pathogenesis and treatment of this pathology (that are due to the role of the immune system, antioxidants and microelements) demonstrate the effectiveness and prospects for further development around the world to find new ways to solve this problem.

KEY WORDS: age-related macular degeneration, vitamin D, vitamin D receptor, oxidative stress, immune response

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INTRODUCTION

Nowadays irreversible vision loss is one of the global problems. This is not only a medical problem, but also a socio-economic one. Age-related macular degeneration (AMD) is third in the world (causes about 6,6% of cases of blindness) after cataract and glaucoma, and each year this amount continues to grow, adding 600,000 new cases [1 - 4]. This can be characterized by the fact that in the developed world the average life expectancy is increasing, the nation is aging, the incidence of chronic diseases is growing, and the population has more opportunities for adequate diagnosis of eye diseases.

Wong and colleagues, analyzing the main trends in the incidence of AMD, has estimated that by 2020 around 196 million people will suffer from this disease in the world, and by 2040 this figure will almost double to 288 million people [5, 6]. European research shows that by 2050, 77 million people in Europe will suffer from AMD. The incidence of new cases will increase by 75% [7].

A prospective multicenter randomized clinical trial of age-related macular degeneration (AREDS – Age-Related Eye Disease Study) [8] has found that more than 10% of the population aged 65-74 had symptoms and signs of AMD, whereas in population older than 75 years this figure has increased significantly and was 25%, while among people older than 85 years – was more than 30%. It has been reported that in the presence of symptoms and signs of AMD in one eye, the other eye is affected in 5 years [9]. AMD does not cause complete blindness among people older than 50 years, this disease significantly affects their perception of the outside world: every day it becomes

harder to go shopping, to recognize the faces of beloved ones, people are gradually losing the ability to self-care. Rapid loss of vision occurs when AMD becomes exudative. Measures that slow down the AMD transition from dry to exudative form by the correction of pathogenetic changes, thus, are relevant. This, in turn, is the social significance of this issue around the world.

THE AIM

Analyze the ophthalmic studies on diagnostics and treatment of patients with age-related macular degeneration to optimize diagnostics and management tactics.

MATERIALS AND METHODS

The analysis of scientific papers due to age-related macular degeneration, vitamin D and its functions from scientometric databases: PubMed, Scopus, Web of Science. The methods were next: systematic approach, analysis, summarization and comparison.

REVIEW AND DISCUSSION

Age-related macular degeneration (AMD) is a multifactorial disease: metabolic and genetic factors play a role in its pathogenesis. One of the main causes of AMD today is considered to be oxidative stress and inflammation, which cause irreversible progressive loss of retinal photoreceptors [10, 11]. As one of the most highly differentiated nerve tissues in the human body, the retina is extremely sensitive

to hypoxia and ischemia [10]. As a result of numerous biochemical reactions, a significant amount of free radicals is formed, which have a detrimental effect on retinal cells.

There are the following processes in the pathogenesis of AMD [12 -16]:

1) primary aging of the retinal pigment epithelium (RPE) and Bruch's membrane – macular pigment – is the only antioxidant in the retina that actively neutralizes the action of free radicals and passively retains or absorbs blue light, which causes photooxidative damage;

2) damage of the retina by the products of lipid peroxidation – activation of free radical oxidation causes the damage of proteins, nucleic acids, especially lipids of cell membranes, which are very easily involved in the free radical reaction chain. Disturbance of the balance between oxidative and antioxidant systems affects the integrity of the complex of photoreceptors and RPE, leads to the accumulation of cell breakdown products, lipofuscin granules and the formation of drusen;

3) primary genetic defects – inherited nature of AMD with autonomous-dominant type of inheritance. It was found that people who are relatives in the first generation are 3 times more likely to get AMD, provided that one person has already shown signs of AMD;

4) pathological changes in the blood supply of the eyeball – impaired microcirculation in the choriocapillaris – the only source of blood supply of the macular area – due to the background of age-related changes in the RPE and Bruch's membrane may be the beginning of the dystrophic process. In the presence of atherosclerosis, the risk of developing AMD increases 3 times (localization of plaque in the common carotid artery – 2,5 times, in the bifurcation of the carotid arteries – 4,7 times).

According to the classification, AMD is divided into dry (non-exudative) and wet (exudative) form, with a predominance of dry (about 90%) in the incidence of the population [8, 17]. The AREDS classification, proposed by the American Academy of Ophthalmology, is the most often used one in the world. According to this classification, dry AMD includes the following stages:

category 1 – absence of AMD – absence or insignificant number of small drusen (up to 63 microns in diameter according to optical coherence tomography);

category 2 – early stage of AMD – a significant number of small drusen, a small number of medium size drusen (diameter 64–124 microns) or changes in the RPE;

category 3 – intermediate stage of AMD – a significant number of medium size drusen, at least one large drusen (diameter more than 125 microns) or geographical atrophy of the retina, which does not affect the central fovea;

category 4 – late stage of AMD – geographical atrophy of the retina, which affects the central fovea.

The wet form of AMD involves exudative detachment of the retinal RPE and retinal neuroepithelium, choroidal neovascularization and the formation of fibrovascular scar in the central fovea of the retina.

Nowadays, scientists around the world recommend the use of antioxidant drugs in treatment of dry AMD. One

of the good combinations is a special formula AREDS2, which includes: 500 mg of vitamin C, 400 ME of vitamin E, 10 mg of lutein, 2 mg of zeaxanthin, 80 mg of zinc in the form zinc oxide, 2 mg of copper in the form of copper oxide [18 - 20]. Intravitreal injections of anti-VEGF factor inhibitors (aflibercept, bevacizumab, ranibizumab) are used to treat the wet form of AMD [9, 17]. However, these injections have a limited duration of action on patients and require frequent use (every few months), which to some extent limits patients and their relatives.

In recent years, many studies have been conducted on the role of vitamin D in chronic eye diseases, including AMD [21 - 25]. Performing the functions of both vitamin and hormone in the human body, its active metabolites are involved in the regulation of calcium-phosphorus metabolism, cell proliferation and have an immunomodulatory effect. Its receptors (vitamin D receptor – VDR) are found in many organs, including the retina and immune system cells [26 - 28, 31, 32].

Vitamin D is not a biologically active vitamin; its clinical effects are manifested after interaction with specific receptors located in cell nuclei, after activation in liver and kidneys [29, 30]. These conditions give the second name to vitamin D – D-hormone. Vitamin D is a combination of several different compounds (seco-steroids), but only D_2 and D_3 types are biologically important:

D_1 – ergocalciferol in combination with lumisterol;

D_2 – ergocalciferol, enters the body with plant products (bread, etc.). It is synthesized from ergosterol – sterol secreted by yeast fungi. It is produced under the influence of ultraviolet light;

D_3 – cholecalciferol, 80% of vitamin D_3 is formed in the skin from dehydrocholesterol under the action of ultraviolet light. 20% of it enters the body with food of animal origin (fish oil, liver, egg yolk);

D_4 – dehydrocholesterol, is found in the body and skin of animals and humans. Due to the action of ultraviolet light on human skin it synthesizes vitamin D_3 ;

D_5 – sitocalciferol, is extracted from wheat grains by chemical synthesis; is a nutrient component of wheat germ.

D_6 – sigma-calciferol, is found in plant foods, has little value, but may be an alternative for people who are vegetarians.

Absorption of ergocalciferol (D_2) from food occurs in the duodenum with the participation of bile acids [33, 34].

Cholecalciferol (D_3) is formed from the precursor of 7-dehydrocholesterol (located in the malpighian layer of the skin) under the action of ultraviolet light [29, 30].

Once in the human body, vitamin D is incorporated into the structure of chylomicrons, circulates in the blood and binds to vitamin D-binding protein, from which it is separated in the liver [33, 34].

Then in the liver (especially in hepatocytes) 25-OH-hydroxycholecalciferol (calcidol) is formed from both forms of vitamin D as a result of hydroxylation (addition of the OH group) [29, 30]. This form is both a depot and a transport, and it is determined in the blood to estimate the level of vitamin D. The hydroxylation reaction is a substrate-de-

pendent process, proceeds rapidly and causes an increase in serum 25-OH-D₃. [29, 30] The half-life time of 25-OH-D₃ in blood is up to 30 days, which can be explained by the relatively high affinity of 25(OH)D₃ to vitamin D-binding protein [29, 30]. Some amount of vitamin D is deposited in adipose and muscle tissue.

After this the second stage of hydroxylation is done in the kidneys with the help of parathyroid hormone (hormone of the parathyroid glands). It includes the interaction with 1-hydroxylase enzyme (localized in the mitochondria of the proximal convoluted tubules of the kidneys). And there is the formation of the active form – 1,25(OH)₂-dihydroxycholecalciferol. From 0,3 µg to 1,0 µg of calcitriol is formed per day [29, 30]. It is calcitriol that provides the main biological effects of vitamin D in the body: increasing the serum calcium concentration by increasing its absorption from the intestine and reabsorption in the kidneys [29, 30, 33]. The half-life time of 1,25(OH)₂D₃ in the blood is 4 hours. When the concentration of calcium and phosphorus in the blood reaches normal values, the activity of 24-hydroxylase enzyme increases and 24,25-dihydroxycholecalciferol is formed. It fixes calcium and phosphorus in the bone tissue [29, 30]. Parathyroid hormone is regulated by a feedback mechanism – an increase in the concentration of calcitriol in the blood causes a decrease in its secretion [29, 30, 35]. Also, the processes of 1-hydroxylation are influenced by sex hormones (androgens, estrogen), prolactin, calcitonin and others [29, 30].

Most of the metabolites of vitamin D in the blood are associated with albumin (10–20%) or vitamin D-binding protein (80–90%). The complex of vitamin D and transport protein is able to bind with specific receptors and enter the cell, where vitamin D exhibits active properties. Only a small fraction (0,02–0,05% of 25-hydroxyvitamin D and 0,2–0,6% of 1,25-dihydroxyvitamin D) of vitamin D metabolites is present in the blood in the free state [29, 30]. The concentration of non-protein metabolites of vitamin D is maintained at a fairly stable level even in liver disease and reduced production of vitamin D-binding protein and therefore is not a good indicator of the dynamics of vitamin D status of the body [29, 36].

Because vitamin D is a fat-soluble vitamin, it is able to accumulate in the human body in various organs. The largest amount is contained in the subcutaneous fat and liver [29]. Thus, there is always some depot of vitamin D, from which this compound is consumed in case of insufficient food intake.

Vitamin D production is inhibited by indoor glass, clouds, air pollution, clothing and sunscreen. The use of sunscreen with a factor of 15 (SPF 15) reduces the synthesis of vitamin D in the skin by 99% [37].

Sufficient amount of fat and bile are needed to absorb the vitamin into the blood from the intestines [29, 33, 34]. Therefore, for better absorption of vitamin D, it should be taken with vegetable fats. With sufficient amount of fat and bile, vitamin D is absorbed up to 90%, but in their absence – only up to 60%. The absorption of synthetic vitamins D does not depend on the amount of fat and bile, so

pharmacological drugs may be more effective than natural compounds [29, 30, 33, 34].

One of the functions of vitamin D is an anti-inflammatory effect [21, 26, 27].

VDRs to 1,25(OH)₂D₃ have been identified in more than 38 tissues, where vitamin D clearly controls vital genes associated with bone metabolism, oxidative damage, chronic disease and inflammation [21, 26, 27].

VDR is expressed by macrophages and dendritic cells, suggesting that vitamin D plays an important role in modulating the inflammatory response [26, 27, 39]. 1,25(OH)₂D₃ can be synthesized by both cell types because they express the enzymes 25-hydroxylase and α1-hydroxylase, which allow to produce 25(OH)D₃ and 1,25(OH)₂D₃, respectively [39, 41, 42]. In macrophages and dendritic cells, the enzyme α1-hydroxylase is predominantly regulated by inflammatory mediators such as interferon-γ (IFN-γ) and lipopolysaccharides [39, 43].

Macrophages are cells with a high capacity to produce cytokines, in particular TNF-α, which is one of the most important products secreted by these cells [39, 44]. Transcriptional activation of the TNF-α gene in macrophages largely depends on the activation of NF-κB transcription, which is the main regulator of immune, inflammatory and stress responses [39, 45]. In lipopolysaccharide-stimulated mouse macrophages, 1,25(OH)₂D₃ regulates the NF-κB (IκB-α) inhibitor by increasing mRNA stability and reducing IκB-α phosphorylation. An increase in the level of IκB-α leads to a decrease in the nuclear translocation of NF-κB, thereby causing a decrease in activity. Given the key role of NF-κB as a transcription factor for inflammatory mediators, it should be assumed that 1,25(OH)₂D₃ has anti-inflammatory effects in macrophages [39, 46]. In addition, 1,25(OH)₂D₃ inhibits the expression of TLR2 and TLR4 protein and mRNA in human monocytes. [39, 47]. Incubation of isolated monocytes with 1,25(OH)₂D₃ attenuates the expression of proinflammatory cytokines such as IL-1, IL-6 and TNF-α [39, 48, 49, 50].

Some studies show that hypovitaminosis of vitamin D is associated with higher levels of serum inflammatory biomarkers, such as IL-6, TNF-α and C-reactive protein (CRP), in healthy [39, 51 - 54] and obese people.

Studies have shown the presence of VDR in immune system cells and α1-hydroxylase in macrophages and dendritic cells. The data obtained indicate the local production of 1,25(OH)₂-dihydroxycholecalciferol, which has auto- and paracrine properties at the site of inflammation [26, 27, 55]. Next, 1,25(OH)₂D₃ binds to VDR and modulates tissue gene expression in a specific way. Some cells, including cells of the immune system, have α1-hydroxylase and VDR and can synthesize the hormonal form of vitamin D from circulating in the blood 25(OH)D₃, and therefore extrarenal α1-hydroxylase acts differently in response to parathyroid hormone, calcium and phosphorus compared with renal α1-hydroxylase. Thus, extrarenal α1-hydroxylase is not regulated by parathyroid hormone, the secretion of 1,25(OH)₂D₃ depends on the substrate concentration of 25(OH)D₃. The process is substrate-dependent and

requires a sufficient level of saturation of the body with vitamin D [26, 27, 55].

In a number of studies, scientists have observed that cells from foci of inflammation (compared to healthy cells of the same organism) have an increase in the concentration of active metabolites of vitamin D, which may indicate its anti-inflammatory effect [26, 27, 56]. Active metabolites of vitamin D with the help of cytokines inhibit the occurrence of severe inflammation in various organs and tissues of the body, where there are receptors for vitamin D, including eye tissues. Nuclear receptors for calcitriol are found in cells of the central and peripheral nervous system (neurons of the brain, glial cells, spinal cord) [26, 56, 57].

The daily requirement of vitamin D is 400 IU for children and 200 IU for adults, sufficient supply of vitamin D is in the range of 40-100 ng/ml. Decreased levels of vitamin D in the blood cause a state of its deficiency and insufficiency, thus disrupting metabolic processes in the body [29, 30].

The action of vitamin D is of interest to scientists around the world. There are many studies that observe the effects of vitamin D metabolites on AMD. However, data from various studies have led to controversial conclusions, not giving the opportunity to unambiguously answer questions about the benefits of adding vitamin D drugs to stabilize the process.

CONCLUSIONS

Age-related macular degeneration is a chronic, progressive disease among people older than 50 years. Late diagnostics and inappropriate treatment may lead to irreversible central vision loss and social disadaptation. Modern studies on the pathogenesis and treatment of this pathology (that are due to the role of the immune system, antioxidants and microelements) demonstrate the effectiveness and prospects for further development around the world to find new ways to solve this problem.

REFERENCES

1. Prenner J.L., Halperin L.S., Rycroft C., et al. Disease Burden in the Treatment of Age-Related Macular Degeneration: Findings From a Time-and-Motion Study. *American Journal of Ophthalmology*. 2015;160(4):725-731.
2. World Health Organization: Prevention of blindness and visual impairment. Priority eye diseases-corneal opacities. 2010. <http://www.who.int/blindness/causes/priority/en/index9.html>.
3. Vitovskaya O. Strategy of health promotion in ophthalmology. *RMJ Klinicheskaya ophthalmologiya*. 2013;3: 88-91. (in Russian).
4. Pasechnikova N.V., Rukov S.O., Vitovska O.P. et al. Analis stany ophthalmologichnoi dopomogu naseleennyi Ukrainu y 2006-2011 rokah. *Ophthalmological journal*. 2012;6: 131-140. (in Ukrainian).
5. Wong T.Y., Chakravarthy U., Klein R. et al. The natural history and prognosis of neovascular age-related macular degeneration: a systematic review of the literature and meta-analysis. *Ophthalmology*. 2008; 115: 116-26.
6. Wong W.L., Su X., Li X. et al. Global prevalence of age-related macular degeneration and disease burden projection for 2020 and 2040: a systematic review and meta-analysis. *Lancet Glob Health*. 2014. [http://dx.doi.org/10.1016/S2214-109X\(13\)70145-1](http://dx.doi.org/10.1016/S2214-109X(13)70145-1).
7. Age related macular degeneration to affect 77 million Europeans by 2050. *British Medical Journal*. 11 November 2019. <https://medicalxpress.com/news/2019-11-age-macular-degeneration-affect-million.html>
8. Age-Related Eye Disease Study Research Group. The Age-Related Eye Disease Study (AREDS): design implications. AREDS report no. 1. *Controlled clinical trials*. 1999; 20(6): 573-600. [https://doi.org/10.1016/s0197-2456\(99\)00031-8](https://doi.org/10.1016/s0197-2456(99)00031-8)
9. Age-related macular degeneration NICE guideline. 2018. www.nice.org.uk/guidance/ng82.
10. Anderson D.H., Radeke M.J., Gallo N.B. et al. The pivotal role of the complement system in aging and age-related macular degeneration: hypothesis re-visited. *Prog Retin Eye Res*. 2010;29:95-112.
11. Chakravarthy U., Wong T., Fletcher A. et al. Clinical risk factors for age-related macular degeneration: a systematic re- view and meta-analysis. *BMC Ophthalmology*. 2010;10:31.
12. Bellezza I. Oxidative Stress in Age-Related Macular Degeneration: Nrf2 as Therapeutic Target. *Frontiers in pharmacology*. 2018;9: 1280. <https://doi.org/10.3389/fphar.2018.01280>.
13. Tuo J., Bojanowski C. M., Chan C.C. Genetic factors of age-related macular degeneration. *Progress in retinal and eye research*. 2004;23(2):229-249. <https://doi.org/10.1016/j.preteyeres.2004.02.001>.
14. Lipecz A., Miller L., Kovacs I. et al. Microvascular contributions to age-related macular degeneration (AMD): from mechanisms of choriocapillaris aging to novel interventions. *GeroScience*. 2019;41(6): 813-845. <https://doi.org/10.1007/s11357-019-00138-3>.
15. Farazdaghi M.K., Ebrahimi K.B. Role of the Choroid in Age-related Macular Degeneration: A Current Review. *Journal of ophthalmic & vision research*. 2019;14(1): 78-87. https://doi.org/10.4103/jovr.jovr_125_18.
16. Heesterbeek T. J., Lorés-Motta L., Hoyng C.B. et al. Risk factors for progression of age-related macular degeneration.. *Ophthalmic Physiol Opt*. 2020; 40(2): 140-170. doi: 10.1111/opo.12675. PMID: PMC7155063.
17. Flaxe C.J., Adelman R. A., Bailey S. T. et al. Age-Related Macular Degeneration Preferred Practice Pattern. *Ophthalmology* 2020; 127(1):1-65. DOI: 10.1016/j.ophtha.2019.09.024.
18. Chew E. Y., Clemons T., SanGiovanni J. P. et al. AREDS2 Research Group. The Age-Related Eye Disease Study 2 (AREDS2): study design and baseline characteristics (AREDS2 report number 1). *Ophthalmology*. 2012;119(11): 2282-2289. <https://doi.org/10.1016/j.ophtha.2012.05.027>.
19. Age-Related Eye Disease Study 2 Research Group. Lutein + zeaxanthin and omega-3 fatty acids for age-related macular degeneration: the Age-Related Eye Disease Study 2 (AREDS2) randomized clinical trial. *JAMA*. 2013;309(19): 2005-2015. <https://doi.org/10.1001/jama.2013.4997>.
20. Keenan T. D., Agrón E., Domalpally A. et al. Progression of Geographic Atrophy in Age-related Macular Degeneration: AREDS2 Report Number 16. *Ophthalmology*. 2018; 125(12): 1913-1928. <https://doi.org/10.1016/j.ophtha.2018.05.028>.
21. Skowron K., Pawlicka I., Gil K. The role of vitamin D in the pathogenesis of ocular diseases. *Folia medica Cracoviensia*. 2018;58(2): 103-118. <https://doi.org/10.24425/fmc.2018.124662>.
22. Wu S., Sun J. Vitamin D, vitamin D receptor, and macroautophagy in inflammation and infection. *Discovery medicine*. 2011;11(59): 325-335.
23. Merle B., Silver R. E., Rosner B., Seddon J. M. Associations Between Vitamin D Intake and Progression to Incident Advanced Age-Related Macular Degeneration. *Investigative ophthalmology & visual science*. 2017;58(11): 4569-4578. <https://doi.org/10.1167/iovs.17-21673>.

24. Kaarniranta K., Pawlowska E., Szczepanska J. et al. Can vitamin D protect against age-related macular degeneration or slow its progression?. *Acta biochimica Polonica*. 2019;66(2): 147–158. https://doi.org/10.18388/abp.2018_2810.
25. Golan S., Shalev V., Treister G. et al. Reconsidering the connection between vitamin D levels and age-related macular degeneration. *Eye (London, England)*. 2011;25(9): 1122–1129. <https://doi.org/10.1038/eye.2011.174>.
26. Bivona G., Agnello L., Ciaccio M. The immunological implication of the new vitamin D metabolism. *Central-European journal of immunology*. 2018; 43(3):331–334. <https://doi.org/10.5114/ceji.2018.80053>.
27. Ambati J., Atkinson J. P., Gelfand B. D. Immunology of age-related macular degeneration. *Nature reviews. Immunology*. 2013;13(6): 438–451. <https://doi.org/10.1038/nri3459>.
28. Millen A. E., Voland R., Sondel S. A. et al. Vitamin D status and early age-related macular degeneration in postmenopausal women. *Archives of ophthalmology (Chicago, Ill. : 1960)*. 2011; 129(4): 481–489. <https://doi.org/10.1001/archophthalmol.2011.48>.
29. Holick M.F. Vitamin D requirements for humans of all ages: new increased requirements for women and men 50 years and older. *Osteoporos Int*. 1998;8(2):24–9. doi: 10.1007/pl00022729.
30. Hilger J., Friedel A., Herr R. et al. A systematic review of vitamin D status in populations worldwide. *The British journal of nutrition*. 2014; 111(1): 23–45. <https://doi.org/10.1017/S0007114513001840>.
31. Mousa A., Misso M., Teede H. et al. Effect of vitamin D supplementation on inflammation: protocol for a systematic review. *BMJ*. 2016;6(4): e010804. <https://doi.org/10.1136/bmjopen-2015-010804>.
32. Morrison M. A., Silveira A. C., Huynh N. et al. Systems biology-based analysis implicates a novel role for vitamin D metabolism in the pathogenesis of age-related macular degeneration. *Human genomics*. 2011;5(6): 538–568. <https://doi.org/10.1186/1479-7364-5-6-538>.
33. Maurya V. K., Aggarwal M. Factors influencing the absorption of vitamin D in GIT: an overview. *Journal of food science and technology*. 2017; 54(12): 3753–3765. <https://doi.org/10.1007/s13197-017-2840-0>.
34. Ross A.C., Taylor C.L., Yaktine A.L. et al. Institute of Medicine (US) Committee to Review Dietary Reference Intakes for Vitamin D and Calcium;. *Dietary Reference Intakes for Calcium and Vitamin D*. Washington (DC): National Academies Press (US). 2011:3.
35. Carrillo-López N., Fernández-Martín J. L., Cannata-Andía J. B. Papel de calcio, calcitriol y sus receptores en la regulación de la paratiroides [The role of calcium, calcitriol and their receptors in parathyroid regulation]. *Nefrología : publicación oficial de la Sociedad Española Nefrología* 2009;29(2): 103–108. <https://doi.org/10.3265/Nefrología.2009.29.2.5154.en.full>.
36. Yousefzadeh P., Shapses S. A., Wang X. Vitamin D Binding Protein Impact on 25-Hydroxyvitamin D Levels under Different Physiologic and Pathologic Conditions. *International journal of endocrinology*. 2014;981581. <https://doi.org/10.1155/2014/981581>.
37. Passeron T., Bouillon R., Callender V. et al. Sunscreen photoprotection and vitamin D status. *The British journal of dermatology*. 2019; 181(5): 916–931. <https://doi.org/10.1111/bjd.17992>.
38. Bishop E., Ismailova A., Dimeloe S. K. et al. Vitamin D and immune regulation: antibacterial, antiviral, anti-inflammatory. *JBMR*. 2020. <https://doi.org/10.1002/jbm4.10405>.
39. Dadrass A., Mohamadzadeh Salamat K., Hamidi K., Azizbeigi, K. Anti-inflammatory effects of vitamin D and resistance training in men with type 2 diabetes mellitus and vitamin D deficiency: a randomized, double-blinded, placebo-controlled clinical trial. *Journal of diabetes and metabolic disorders*. 2019; 18(2): 323–331. <https://doi.org/10.1007/s40200-019-00416-z>.
40. Das G. Vitamin D and type 2 diabetes. *Pract Diabetes*. 2017;34(1):19–24. doi: 10.1002/pdi.2072.
41. Shab-Bidar S., Neyestani T.R., Djazayeri A. et al. Improvement of vitamin D status resulted in amelioration of biomarkers of systemic inflammation in the subjects with type 2 diabetes. *Diabetes Metab Res Rev*. 2012;28:424–430. doi: 10.1002/dmrr.2290.
42. Miller E.G., Sethi P., Nowson C.A. et al. Effects of progressive resistance training and weight loss versus weight loss alone on inflammatory and endothelial biomarkers in older adults with type 2 diabetes. *Eur J Appl Physiol*. 2017;117(8):1669–1678. doi: 10.1007/s00421-017-3657-2.
43. Calton E.K., Kevin N., Keane K.N. et al. The impact of vitamin D levels on inflammatory status: a systematic review of immune cell studies. *PLoS One*. 2015;10(11):e0141770. doi: 10.1371/journal.pone.0141770.
44. Haussler M.R., Haussler C.A., Bartik L. et al. Vitamin D receptor: molecular signaling and actions of nutritional ligands in disease prevention. *Nutr Rev*. 2008;66:98–112. doi: 10.1111/j.1753-4887.2008.00093.x.
45. Sigmundsdottir H., Pan J., Debes G.F. et al. DCs metabolize sunlight-induced vitamin D3 to “program” T cell attraction to the epidermal chemokine CCL27. *Nat Immunol*. 2007;8:285–293. doi: 10.1038/ni1433.
46. Jablonski K.L., Chonchol M., Pierce G.L. et al. 25-Hydroxyvitamin D deficiency is associated with inflammation-linked vascular endothelial dysfunction in middle-aged and older adults. *Hypertension*. 2011;57:63–69. doi: 10.1161/HYPERTENSIONAHA.110.160929.
47. Zhang Z., Zhao M., Li Q. et al. Acetyl-L-carnitine inhibits TNF-alpha-induced insulin resistance via AMPK pathway in rat skeletal muscle cells. *FEBS Lett*. 2009;583(2):470–474. doi: 10.1016/j.febslet.2008.12.053.
48. Nabata A., Kuroki M., Ueba H. et al. C-reactive protein induces endothelial cell apoptosis and matrix metalloproteinase-9 production in human mononuclear cells: implications for the destabilization of atherosclerotic plaque. *Atherosclerosis*. 2008;196:129–135. doi: 10.1016/j.atherosclerosis.2007.03.003.
49. Salamat K.M., Azarbayjani M.A., Yusuf A., Dehghan F. The response of pre-inflammatory cytokines factors to different exercises (endurance, resistance, concurrent) in overweight men. *Alex J Med*. 2016;52:367–370. doi: 10.1016/j.ajme.2015.12.007.
50. Mora S., Lee I.M., Buring J.E., Ridker P.M. Association of physical activity and body mass index with novel and traditional cardiovascular biomarkers in women. *JAMA*. 2006;295(12):1412–1419. doi: 10.1001/jama.295.12.1412.
51. Penninx B.W., Kritchevsky S.B., Newman A.B. et al. Inflammatory markers and incident mobility limitation in the elderly. *J Am Geriatr Soc*. 2004;52:1105–1113. doi: 10.1111/j.1532-5415.2004.52308.x.
52. Levinger I., Goodman C., Peake J. et al. Inflammation, hepatic enzymes and resistance training in individuals with metabolic risk factors. *Diabet UK Diabet Med*. 2009;26(6):220–227. doi: 10.1111/j.1464-5491.2009.02679.x.
53. Hopps E., Canino B., Caimi G. Effects of exercise on inflammation markers in type 2 diabetic subjects. *Acta Diabetol*. 2011;48(3):183–189. doi: 10.1007/s00592-011-0278-9.
54. Christiansen T., Paulsen S.K., Bruun J.M. et al. Exercise training versus diet-induced weight-loss on metabolic risk factors and inflammatory markers in obese subjects: a 12-weeks randomized intervention study. *Am J Physiol Endocrinol Metab*. 2010;298(4):E824–E831. doi: 10.1152/ajpendo.00574.2009.
55. Lagishetty V., Chun R. F., Liu N. Q. et al. 1alpha-hydroxylase and innate immune responses to 25-hydroxyvitamin D in colonic cell lines. *The Journal of steroid biochemistry and molecular biology*. 2010; 121(1-2): 228–233. <https://doi.org/10.1016/j.jsbmb.2010.02.004>.

56. Aranow C. Vitamin D and the immune system. *Journal of investigative medicine : the official publication of the American Federation for Clinical Research*. 2011; 59(6): 881–886. <https://doi.org/10.2310/JIM.0b013e31821b8755>.
57. Bikle D. Vitamin D: Production, Metabolism, and Mechanisms of Action. [Updated 2017 Aug 11]. *Endotext*. South Dartmouth (MA): MDText.com, Inc. 2000. <https://www.ncbi.nlm.nih.gov/books/NBK278935/>

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REVIEW ARTICLE

HEALTH OF THE TEACHER OF HIGHER EDUCATION INSTITUTIONS (EFFICIENCY – DEVELOPMENT)

DOI: 10.36740/WLek202103239

Olena M. Dubovyk¹, Violetta Y. Dubovyk²¹NATIONAL PEDAGOGICAL DRAGOMANOV UNIVERSITY, KYIV, UKRAINE²BOGOMOLETS NATIONAL MEDICAL UNIVERSITY, KYIV, UKRAINE**ABSTRACT**

The aim: Of the work is to find a scientifically based approach to improve the health of teachers on the basis of a comprehensive socio-hygienic analysis of the factors that affect the state of their health. Identify the main aspects of psychological work with teachers to support the mechanisms of self-regulation of their psychological health.

Materials and methods: Theoretical and methodological analysis of psychological and pedagogical literature; comparison; generalization; systematization.

The article presents the current problem of modernity – the mental health of teachers of higher education. Criteria, quality categories, levels, principles of ensuring the mental health of the teacher as a person are analyzed. The components of mental health are compared.

Conclusions: The concept of professional psychological health as a process of scientific understanding of the teachers practice involves the development of a comprehensive program for teacher's health care, which will include all areas: informational, preventional, diagnostical, rehabilitational and treatment.

Higher education teachers are active participants in the preservation and promotion of health at the state, social and personal levels. They should form the concept of health in students during the process of their professional activities. Teachers use various forms of organizational, educational, volunteer work and different new technologies to preserve their own health and create the environment with the appropriate social conditions, where students can take responsibility for their own actions, deeds, work, leading a healthy lifestyle.

KEY WORDS: Mental health, professional activity, psychology

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INTRODUCTION

The public health professionals focus on the formation of a new policy in the system of health care. People's health is the key to the successful activity of the representatives of professions "man – man", because the disease significantly impedes the professional activity. This problem is extremely urgent for teachers of higher education institutions [1,3,6].

Profession of a teacher put into the category of "risk", as the most susceptible to professional deformation and mental burnout, in comparison with other socio-economic professions. Studies of pedagogical activity showed that it has a number of features that allow us to characterize it as potentially emotionally stimulating. This is work of the heart and nerves where spiritual forces must be expended literally every day and at all times [7].

The high emotional load of pedagogical work results from the presence of stress factors such as high dynamism, lack of time, work overload, the complexity of pedagogical situations, social assessment, the need for frequent and intensive contacts, the productivity of the teacher's motivational work, creative input into the student's personality, interaction with different social groups, etc [1,8,9].

THE AIM

The responsible nature of the labor activity of teachers in institutions of higher education is characterized by emotional violence and a significant number of factors that cause different

stressogenic situations and reduce their quality of life. Literature has published single works devoted to this problem. Researchers L. Karamushka, A. Markova, L. Mitina, Y. Povaryonkov, M. Pryazhnikov, T. Titarenko, N. Chepeleva, T. Yatsenko [1,3,6] studied the professional and psychological health of the teacher, psychological properties of the personality of teachers, features of their emotional response and coping behavior. The authors consider it necessary to evaluate the teacher's professional health by analyzing the integrity and interrelation of ideas about health and the factors that underlie it. Also, the purpose of the work is to find a scientifically based approach to improve the health of teachers on the basis of a comprehensive socio-hygienic analysis of the factors that affect the state of their health. Identify the main aspects of psychological work with teachers to support the mechanisms of self-regulation of their psychological health [9,10].

MATERIALS AND METHODS

Theoretical and methodological analysis of psychological and pedagogical literature; comparison; generalization; systematization.

REVIEW AND DISCUSSION

Scientists (O. Maklakov, G. Nikiforov, N. Ostapchuk, G. Pecherkina) consider psychological health in the context of

the professional approach as a form of professional activity and introduce the notion of “professional psychological health”, which means the ability of the body to protect the necessary compensatory and protective mechanisms that ensure professional reliability and productivity in all conditions of professional activity [1,7].

In the complex of sciences, which ensure the development of scientific and practical concept of professional health of the teacher, the psychological sciences, which study different forms of individual experience, intrinsic world of personality can be used as a methodological basis for determining the ground of supervision of teacher's professional health in higher education institutions [2,11].

The problem of health and healthy personality was formulated in the psychodynamic theory, which described the causes of human mental disorders and the means help for their treatment. Traditional psychoanalysis (Z. Freud), the school of object relations (M. Klein), and self-psychology (H. Kohut) viewed health in the context of the concept of “adaptation”. Analytical psychology (K. Jung) considered the implementation of transcendental function, which ensures sensitivity to archetypes, to be the sign of a healthy person. The humanistic approach (A. Maslow, K. Rogers) regards psychological health as a condition and result of the creative act that allows a person to reach to the top of their achievements. Gestalt therapy (F. Perls), psychological health refers to the formation of an authentic person who is the author of his life and is responsible for it. Ontopsychology (A. Meneghetti) considers health as a realization of the self (in-in-se) [1,12,13].

In professions, which are connected with the system of relations “man-man”, the orientation to the other human, as equal participant of interaction, has great importance [2,14]. There are a limited number of professions where a value-based approach to professional activity has a similar effect on the individual destiny of the professional and the destiny of another person. The main of such professions is the teaching profession.

The success of pedagogical activity in many ways depends not only on how the teacher is able to coordinate their behavior, doings, expressions, emotions and feelings, but also in the state of physical, psychological and social well-being. All components, have an impact on the success of joint work of the teacher and the student.

The statute of the World Health Organization defines health as “a state of complete physical, spiritual and social well-being, and not only the absence of diseases and defects. In other words, health is not only a medical definition, but also an assemblage of physical and social parameters that can be assessed and influenced. An absolutely healthy person is person without of any deviations from the norms of the age and body. Practically healthy people are those who have some abnormalities, but the body functions well in these environmental conditions, including the workload [15].

There are two positions in the definitions of health and norms: traditionally medical and psychological. Medicine considers the norm as a measure of the probability of

occurrence of disease, and psychology – in terms of the formation of positive personal forces for health ensuring [3,16].

The illness is inevitably connected with the failure of adaptive function, and personal (mental) health means a certain level of disadaptation in its traditional sense.

Mental health is not only the absence of conflicts, frustrations, problems, it means maturity, preservation and activeness of the mechanisms of personal self-regulation, which ensure full human functioning [2,4,5]. Thus, the notions of mental health, adaptation and norms are not the same. Moreover, the adaptive type of behavior of the teacher is unconstructive at all stages of professional functioning and leads to the stage of stagnation and reduction of professional activity.

Scientists are committed to the idea of the multilevel organization of teacher's professional health, according to which the high level of personal health is responsible for mental orientation, determining the general sense of life, the attitude to others and to themselves, which has a regulating effect. The help aimed directly at immediate elimination of somatic, mental and psychological disorders in the teacher. This is one of the main tasks of modern medicine [1,4].

Boltivets S. investigated the development of the professional under the conditions of negative changes in the health environment and analyzed approaches to the essence of the phenomenon “health”. He asserts that health is generally considered as a complex, rich construct, which has a heterogeneous structure, combines a variety of components, reflects the fundamental aspects of human existence. The scientist states that mental health ensures the processual integrity of the person, which is adequate to the inner nature, interacts with itself and the environment [17].

The mental health of the teacher is a measure of ability to act as an active and autonomous subject of their own life in a changing world. An important factor of mental health is cognitive abilities, activity, desire for self-knowledge, self-education and self-improvement.

According to the World Health Organization, mental health is a reserve of human force through which a person can cope with stress or complications arising in exceptional circumstances [1,3]. Mental health is a state that promotes the fullest physical, mental and emotional person development and contains high consciousness, developed thinking, remarkable inner moral strength [6,18].

The teaching profession belongs to the category of socionomics and involves constant self-improvement, self-regulation in teaching, communication with a large number of students and colleagues, it is difficult to overestimate the importance of mental health. Moral health is equally important for the teacher of higher education institutions, which is determined by the moral principles that are the basis of social life [7,19]. The main features include a conscious attitude to work, a high level of academic culture, active rejection of habits. According to scientists, moral health is a set of characteristics of the motivational and need-informative sphere in life, the basis of which is

determined by the system of values, guidelines and motives of individual behavior in society [20].

The purpose of psychological work with the teacher is to launch new productive mechanisms to ensure the development process. Mechanisms of personal self-regulation of the existential level should be characterized, firstly, by globality, the ability to determine development and, secondly, by dynamism, the ability to develop themselves, which creates the motive and interest to be healthy.

The teacher of higher education institutions in most cases needs both medical and socio-psychological care, which includes the formation of the necessary qualities and skills to accumulate functional reserves in the body. In addition, in the new economic conditions of life reform, a fundamentally new approach to the concept of “health” and its subjective value is being created [21].

Protection and recovery of professional health of the teacher involves strengthening the interdisciplinary links between medicine, psychology, psychophysiology, psychotherapy, hygiene, as well as economics, computer science, labor law, which will consider the category of health as an integral quality in the system “health – efficiency – efficiency – development” [1,3]. At the same time, we believe that in the complex of sciences that provide the development of scientific and practical concept of professional health of the teacher, psychological sciences should dominate as sciences that study various forms of individual experience, the inner world of man.

The main problem is low health assessment, sharply reduced self-awareness of teachers about the values of health. It is necessary to increase the awareness of educators about the true state of health, the causes of diseases and to acquaint them in detail with preventive measures and means to improve physical and mental health. The overriding task of developing the competence of educators in the field of health is the formation of a socio-psychological attitude to the growing role of responsibility for their own health [19].

The problem of mental health and the struggle for professional longevity clearly manifests itself in relation to the activities of teachers of higher education institutions, which are entrusted with educational, diagnostic and corrective, developmental and educational functions. The importance of good psychological health and hygienic lifestyle for teachers is quite clear, because such activities require constant energy expenditure [12,22].

Teachers have a stressful profession, so that's why they need some rehabilitation procedures. This calls for the need to use new technologies for the diagnosis of physical and mental health. There is necessary to create complexes of psychological, psychotherapeutic and sports and balneological rehabilitation procedures. It is a question of teachers training of receptions of mental self-regulation. They should take part in psychological training and sports for improving their efficiency [12,22].

The main priority is the professional longevity of teachers. It can be achieved only by harmonizing the personality and by gradually overcoming and eradicating the neurotic components of one's own inner world, increasing the de-

gree of authenticity, consistency of the integral characteristics of the teacher's personality. We are talking about the concept of teachers professional development, according to which there are three integral characteristics: pedagogical orientation, competence and flexibility. They are the objects of professional development of the teacher and an indicator of his professional health and professional longevity.

The first direction in solving the problem of harmonization and humanization of the teacher's personality is the education and maintenance of motivation for teaching and cooperation with students. The second direction is to provide socio-psychological conditions for improving the level of pedagogical competence, especially communicative and conflict competence [16,18].

The third direction can be defined as the psychological provision of conditions for the development of pedagogical flexibility, directly related to the creative potential of the teacher. The view that the concepts of “creatively gifted personality” and “psychologically normal individual” are almost equivalent is becoming more and more common. Only the realization of creative talents (whatever their scale) contributes to mental health [1,6,18].

The main indicator of professional health is professional efficiency. This is the maximum possible efficiency of the specialist, due to the functional state of his body. The concept of “professional efficiency” connects in a natural complex the functional state of the organism, its changes in a particular activity, physiological and psychological consequences of this activity, as well as the quality and effectiveness of professional activity. Thus, combination of all these concepts can form a mental, physical and social well-being [4,23].

CONCLUSIONS

Psychological health of teacher in the context of professional health is psychological well-being and defines professional health as a dynamic state. It is based on the inner well-being (coherence) of the individual, which allows you to update your individual and age-psychological capabilities at any stage of development.

Thus, it should be concluded that the professional activity of the teacher has its own specifics and its implementation depends on both subjective and objective reasons. The main condition for effective, full-fledged, successful and high-quality activities is the professional health of a teacher of higher education. Professional health includes physical, psychological and social aspects. The formation of professional health depends on psychological health as a system, which in turn includes axiological, instrumental and motivational components; professional self-determination, training, adaptation and some other factors that arise in the process of employment. Therefore, promoting the preservation, strengthening, and in some cases restoring the professional health of teachers through a system of special measures, as well as self-preservation and healthy living of the profession, should be one of the priorities in improving the quality of education.

REFERENCES

- Maksimenko S.D., Cehmister Ja.V., Koval' I.A. et al. Medichna psihologija: Pidruchnik – 2-ge vidannja [Medical Psychology: Textbook – 2nd edition]. Kyiv: Slovo; 2014, p. 516-520. (In Ukrainian).
- Cohen R., Moed A., Shoshani A. Teacher's conditional regard and student's need satisfaction and agentic engagement: a multilevel motivation mediation model. *J Youth Adolesc.* 2020;49(4):790-803. doi: 10.1007/s10964-019-01114-y.
- Mytyna L.M., Mytyn H.V., Anysymova O.A. Professionalnaia deiatelnost y zdorove pedahoha. [Professional activity and health of the teacher]. Moscow: Akademyia; 2005, p. 51-53 (In Russian).
- Amemiya J., Wang M.-T. Transactional relations between motivational beliefs and help seeking from teachers and peers across adolescence. *J Youth Adolesc.* 2016;46:1743-1757. doi:10.1007/s10964-016-0623-y.
- Mahipalan M., Sheena S. Workplace spirituality and subjective happiness among high school teachers: gratitude as a moderator. *Explore.* 2019;15(2):107-114. doi: 10.1016/j.explore.2018.07.002.
- Mytyna L.M. Psihologu ob uchitele. Lichnostno-professionalnoe razvitie uchitelya: psihologicheskoe sodержanie, diagnostika, tehnologiya, korrektsionno-razvivayushchie programmy. Uchebnoe posobie. [For psychologist about the teacher. Teacher's personal and professional development: psychological content, diagnostics, technology, correctional and developmental programs. Textbook]. Moscow: PY RAO, MHPPU; 2010, 121-126 p. (In Russian).
- De Ruiter J.A., Poorthuis A., Aldrup K. Teachers' emotional experiences in response to daily events with individual students varying in perceived past disruptive behavior. *J Sch Psychol.* 2020;82:85-102. doi: 10.1016/j.jsp.2020.08.005.
- Vasyleva O.S., Fylatov F.R. Psihologiya zdorovya. Fenomen zdorovya v kulture, psihologicheskoy nauke i obydennom soznanii. [Psychology of the health. The phenomenon of health in culture, psychological science and everyday consciousness]. Rostov-na-Donu; 2005, p. 110-186. (In Russian).
- Gurung R. A. R. Health Psychology. A cultural approach. – 2nd edition. R.A.R. Gurung. Belmont, CA, USA: Wadsworth; 2010, p. 515-518.
- Husak P.M. Vidpovidalne stavlennia do zdorovia: Teoriia ta tehnolohiia: monohrafiia. [Health Responsibility: Theory and Technology: A Monograph]. Lutsk: VAT «Volynobdrukarnia»; 2009, p. 239-252. (In Ukrainian).
- Corbin C.M., Alamos P., Lowenstein A.E. et al. The role of teacher-student relationships in predicting teachers' personal accomplishment and emotional exhaustion. *J Sch Psychol.* 2019;77:1-12. doi: 10.1016/j.jsp.2019.10.001.
- Makela S., Aaltonen S., Korhonen T. Diversity of leisure-time sport activities in adolescence as a predictor of leisure-time physical activity in adulthood. *Scand J Med Sci Sports.* 2017;27(12):1902-1912. doi: 10.1111/sms.12837.
- Dendle C., Baulch J., Pellicano R. et al. Medical student psychological distress and academic performance. *J Medical Teacher.* 2018;40(12):1257-1263. doi: 10.1080/0142159X.2018.1427222.
- Aronsson G., Theorell T., Grape T. et al. A systematic review including meta-analysis of work environment and burnout symptoms. *J BMC Public Health.* 2017;17(1):264. doi: 10.1186/s12889-017-4153-7.
- Azer S. A., Guerrero A.P.S., Walsh A. Enhancing learning approaches: practical tips for students and teachers. *J Med Teach.* 2013;35(6):433-443. doi: 10.3109/0142159X.2013.775413.
- Bernotaite L., Malinauskiene V. Workplace bullying and mental health among teachers in relation to psychosocial job characteristics and burnout. *Int J Occup Med Environ Health.* 2017;30(4):629-640. doi: 10.13075/ijomeh.1896.00943.
- Posluns K., Gall T. L. Dear Mental Health Practitioners, Take Care of Yourself: a Literature Review on Self-Care. *Int J Adv Couns.* 2020;42(1):1-20. doi: 10.1007/s10447-019-09382-w.
- Gluschkoff K., Elovainio M., Kinnunen U. et al. Work stress, poor recovery and burnout in teachers. *J Occup Med (Lond).* 2016;66(7):564-70. doi: 10.1093/occmed/kqw086.
- Molero-Jurado M.D.M., Pérez-Fuentes M.D.C., Atria L. Burnout, Perceived Efficacy, and Job Satisfaction: Perception of the Educational Context in High School Teachers. *J Biomed Res Int.* 2019. doi: 10.1155/2019/1021408.
- Wegner R., Berger P., Poschadel B. Et al. Burnout hazard in teachers results of a clinical-psychological intervention study. *J Occup Med Toxicol.* 2011;6(1):37. doi: 10.1186/1745-6673-6-37.
- Milatz A., Luftenegger M., Schober B. Teachers' Relationship Closeness with Students as a Resource for Teacher Wellbeing: A Response Surface Analytical Approach. *J Front Psychol.* 2015;6. doi: 10.3389/fpsyg.2015.01949.
- Ching F.N.Y., So W.W.M., Lo S.K. et al. Preservice teachers' neuroscience literacy and perceptions of neuroscience in education: Implications for teacher education. *J Trends Neurosci Educ.* 2020;21. doi: 10.1016/j.tine.2020.100144.
- Parker E.A., McArdle P.F., Gioia D. et al. An Onsite Fitness Facility and Integrative Wellness Program Positively Impacted Health-Related Outcomes Among Teachers and Staff at an Urban Elementary/Middle School. *J Glob Adv Health Med.* 2019;8. doi: 10.1177/2164956119873276.

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REVIEW ARTICLE

AN OVERVIEW OF AUTOIMMUNITY IN IMPLANTATION FAILURE: A LITERATURE REVIEW

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ABSTRACT

The aim: This review was aimed to understand the role of different types of autoantibodies like antiphospholipid, antithyroid, antisperm, antinuclear, anti-ovarian autoantibodies and heat shock protein HSP 60 in the process of implantation in the normal way of conceiving and IVF and also to estimate that how the presence of these autoantibodies affect the normal pregnancy outcome.

Materials and methods: This review process performed in the obstetrics and gynaecology postgraduate department, Bogomolets national medical university, Kyiv, Ukraine. It was a review of already published papers not to need the ethical board committee's approval. By following the literature review guidelines, this paper was written and searched for relevant studies regarding autoantibodies and implantation, published in medical literature till 2020 were included in this review process. The search is done for studies published till 2020 in the English language from the Medline database, including Google Scholar, PubMed, Web of Science and Cochrane library database.

Conclusions: Our recent work found that the involvement of APA, ANA and/or ATA in recipients of oocyte donations did not affect their pregnancy outcomes. Some researchers did not give any clear conclusion about these risks, and some stated that the use of some immunodepressant agents could be useful to reduce the harmful effects of these autoantibodies associated with implantation failure. Each autoantibody has a different mechanism of action to create the pathological state, some have direct effect, and some indirectly impact implantation. In future, further high-quality studies need to be performed for better understanding.

KEY WORDS: autoimmunity, immunosuppression, miscarriage, IVF failure, implantation

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INTRODUCTION

The implantation process involves the interaction of the human blastocyst and the uterine epithelium [1-4]. Several autoimmune factors have been implicated in influencing implantation failure. Recent studies have investigated the contribution of autoimmune factors in implantation in women undergoing in-vitro fertilization [5-7]. Antiphospholipid antibodies more frequently identified in women planing in-vitro fertilization; their presence appears to affect the outcome of live birth rates, miscarriage, or pregnancy [8-10]. Antithyroid antibodies are commonly found in reproductive age women, but implantation rates and miscarriage rates are not connected with normal thyroid function [11, 12]. Antinuclear antibodies may be a marker for underlying autoimmune disease when coupled with specific signs and symptoms, but low-titer antibodies do not influence in-vitro fertilization outcome [13, 14]. Fertilization failure is often associated with high titers of anti-sperm antibodies in seminal plasma, sperm, or women's mucosal immune system [15, 16]. During implantation, growth factors may interact with adhesion molecules and other matrix-associated proteins [17]. This study mainly focuses on Implantation representing a critical developmental process characterized by the interaction of two immunologically and genetically distinct tissues.

THE AIM

This review was aimed to understand the role of different types of autoantibodies like antiphospholipid, antithyroid, antisperm, antinuclear, anti-ovarian autoantibodies and heat shock protein HSP 60 in the process of implantation in the normal way of conceiving and IVF and also to estimate that how the presence of these autoantibodies affect the normal pregnancy outcome.

MATERIALS AND METHODS

This review process performed in the obstetrics and gynaecology postgraduate department, Bogomolets national medical university, Kyiv, Ukraine. It was a review of already published papers not to need the ethical board committee's approval. By following the literature review guidelines, this paper was written and searched for relevant studies regarding autoantibodies and implantation, published in medical literature till 2020 were included in this review process. The search is done for studies published till 2020 in the English language from the Medline database, including Google Scholar, PubMed, Web of Science and Cochrane library database. The following keywords were searched: implantation,

autoimmunity, miscarriage, infertility, spontaneous abortion, IVF, autoantibodies. The references of all main and review articles were checked to ensure the relatedness according to searched terms. The research studies that were specifically associated with our searched terms were included in this review. All collected articles were in the English language, and most females were the subjects of discussion. The studies associated with an inadequate description of the analytical method, short communications, letters and irrelevant to our searched terms were excluded. We searched the citations online, and were downloaded in one folder. The high-quality parameters were taken into account for assessing each study, i.e. study design, sample size and calculations, age of subjects, inclusion and exclusion criteria, use of control, proper utilization of statistical test and proper explaining of results. The studies which fulfil the criteria of research were selected for this review.

REVIEW AND DISCUSSION

PROCESS OF IMPLANTATION

Immunopathological mechanisms in patients with antiphospholipid syndrome resulting from binding of IgG to both platelet and endothelial membrane phospholipid may lead to uterine vessels thrombosis and vasoconstriction [18]. This relationship can cause the platelet membrane's instability and hyper aggregation by mechanisms such as protein C activation inhibitors for endothelial prostacyclin synthase activity [19]. Also, this may inhibit the activity of prekallikrein and activator release of endothelial plasminogen. In recent years, different types of reproductive defects have been referred to as autoimmune components. Immunological effects, including fertilization, implantation, and placental development, are significant at several stages of the reproductive cycle. Severe clinical disorder – antiphospholipid syndrome or, more simply, anti-cardiolipin syndrome – has been shown to include the development of elevated serum levels of cardiolipin autoantibodies [20].

In a relatively healthy population, IgG anti-cardiolipin autoantibodies are prevalent at 1.75 per cent. In this study, 14.3% were found to have LGG auto anti-cardiolipin compared to none in the corresponding control group. Implant failure is a chemical pregnancy in the IVF-embryo transfer (ET) system [21]. Therefore, it is tempting to conclude that, in light of the evidence previously provided here, an implantation failure may be associated with high anti-cardiolipin auto-antibodies vitamins found in the serum of these patients [22].

AUTOIMMUNE FACTORS POTENTIALLY RELEVANT TO IN-VITRO FERTILIZATION FAILURE

The role of autoimmune factors in the implantation of in vitro fertilization (IVF) women has been investigated in recent studies [23].

ANTIPHOSPHOLIPID ANTIBODIES

Antiphospholipid antibodies [IgG, IgM, IgA] that respond to negatively charged phospholipids are antibodies that are acquired [24]. Antiphospholipid antibodies (APAs) associated initially with progressive slow thrombosis and placenta infarction, some of which were labelled as thrombophilic. When considering implantation and pregnancy, APAs are more properly categorized as autoimmune reality because of its complex nature [25]. HCG released from placenta inhibited in vitro migration of trophoblast, inhibited invasion and multinucleated cell formation, inhibited trophoblast cell adhesion molecules, and inhibited complement to the surface of the trophoblast, causing inflammatory reactions [26].

APAs are said to increase living birth levels combined with chronic pregnancy loss and heparin and low-dose aspirin therapy [27, 28]. Several public reports show that the number of positive APAs is more frequent in patients who have either IVF or IVF failed instead of controls [9, 29]. Positive APAs were not associated with lower rates of pregnancy in IVF-related women. Recent findings have revealed the lack of follicular fluid APAs that do not adversely affect women undergoing IVF reproductive outcomes. Also, clinical studies of IVF-positive women with APAs show that heparin and aspirin are not improved in women with implantation or pregnancy [30].

ANTITHYROID ANTIBODIES

Severe disease, postpartum thyroiditis, and autoantibodies to thyroglobulin and thyroid peroxidase (microsomal antigen) are present in patients with Hashimoto thyroiditis. Antithyroid (ATAs) may be a marker in other autoimmune diseases or identify women who do not meet the increased demand for early pregnancy thyroid hormones [31, 32]. The pathophysiological role of ATA in pregnancy loss is based on two working hypotheses. Lifted thyroid antibodies can lead directly to pregnancy loss through biological interaction between hormones and antibodies [33]. Instead of the actual cause of pregnancy loss, ATAs may also be secondary to autoimmune diseases. Such ATAs may represent an abnormal immunological response related to pregnancy [34]. However, the future risk of miscarriage was not affected by the thyroid antibody's status in a prospective trial of 870 women with unexplained recurrent pregnancy loss with ATA and normal thyroid function [35]. Most studies indicate that 14–18% of women undergoing IVF are ATA-positive. In our extensive study, ATAs were not found more frequently in women subject to IVF (144 out of 873 or 16.4%) than in normal controls (29 out of 200 or 14.5%) [36]. No variance in results was observed in assessing the biochemical loss, clinical loss, delivery or failure rate of implantation compared to or without ATA among 873 women subject to IVF. Smaller studies have shown that women with ATA who have been IVF have experienced an increased rate of miscarriage [37]. However, the rate of delivery of levothyroxine to these women did not change. We do not test women with ATA implantation failure, nor do we think that ATA's presence in women with euthyroid changes IVF.

ANTISPERM ANTIBODIES

Antigens that are extraneous to both male and female immune systems are present in sperm cells. In seminal plasma, male or female serum, or cervical mucus, anti-pulmonary (AP) antigens (APAs) can be induced with sperm exposure to the immune system [16, 38]. ASAs have been identified in 10-15% of men with infertility and in 15-20% of women with unexplained infertility. The reported prevalence and suspected value depend on the population, the specimen's source (serum, cervical mucus, semen) and the test methods [39]. Antibodies are expected to interfere with the fertilization process through various mechanisms, such as sperm transport in the female genital tract, altered sperm training or acrosomal reactions, inhibiting fertilization disorders or early embryo implantation.

The sperm binding to the pellucid zones (ZP), the sperm penetration of the pellucid zone, the zoom of the reaction zone, the gamete's fusion, the embryo cleavage and the development of the embryo are possible locations where ASAs interfere with fertilization [40]. Several studies have documented the effect of sperm-bound SAs on fertilization levels after IVF [41]. Several of these studies tend to suggest a decrease in the rate of oocyte implantation or embryo fertilization with sperm-like ASAs; however, most of these studies have been retrospective in patients with inadequate single IVF fertilization [42, 43]. In the study, pairs with low oocyte fertilization rates and ASAs were compared with average fertilisation rates without infertility [37]. Due to the sample's nature, significant differences in oocyte fertilization, implantation and pregnancy rates are expected. Checking for ASA in pairs with failed IVF fertilization may be required, but it is unnecessary to check for couples with IVF implant failure [44].

ANTINUCLEAR ANTIBODIES

Many specific antinuclear antibodies (ANAs) target molecules on the apoptotic cell surface. Both molecules have an immune function and have been postulated to lead to the abnormal release of APA or ANA in human and mouse autoimmune models, along with phospholipids in the apoptotic cell region [45, 46]. The cause of elevated APA and ANA rates in individuals with autoimmune disorders may be a significant cell abnormality, such as increased apoptosis or decreased clearance of apoptotic cells [47]. The new analysis has shown that ANA and APA are secondary to endometriosis-induced autoimmune reactions in women with implant failure. ANAs were present in 27 of 100 endometriosis patients than 18 of 62 endometriosis-free patients [48]. Most of the studies that tested positive ANA in IVF patients suggested an increase in ANA incidence than controls; in fact, many of these results were limited to small patients and many autoimmune antibodies. The study showed improved implantation and clinical pregnancy rates of short-term immunosuppression with Prednisolone during IVF, while live birth rates differed slightly from controls [49]. A retrospective randomized clinical review of females undergoing IVF who had positive ANA shows a

lack of progress in females' implantation or pregnancy with heparin and aspirin. More studies are needed to determine ANA's potential role in patients with failed implantation [50, 51].

ANTI-OVARIAN ANTIBODIES

Anti-ovarian antibodies (AOAs) are a heterogeneous anti-ooplasm group that includes ooplasm, pellucid region, granular membrane, theca folliculi internal cells and lutein cells [52]. Several research studies related AOA to menstrual diseases such as amenorrhea and oligomenorrhea. Some authors have suggested the prevalence of AOA in patients with failed implantation and fertilization, indicating a critical AOA role in infertility [53]. Most of the studies reported are small or non-randomized and prospective, so the role of AOA in reproductive failure is difficult to draw meaningful conclusions. Increased AOA prevalence in IVF failure may be associated with more widespread immune deregulation of implant failure [54]. Cross-reactions with heat-shocking protein 90-b of positive AOA sera of infertile women and others with ovarian failure. Several recent small studies have suggested that AOA may be used as a marker for assessing the use of corticosteroids in patients with previous IVF failure. Ovarian hypofunction and ovarian failure may be associated with AOA, but further studies are needed if a failed implantation is to be identified [55].

ROLE OF HEAT SHOCK PROTEIN HSP 60 IN IMPLANTATION FAILURE

Heat shock protein 60 (HSP60) is a chaperone protein involved in proteins transfer and refolding proteins. Importance of HSP60 in sperm capacitation and sperm-oocyte membrane binding facility was confirmed; therefore, in this study, the effect of HSP60 on the rate of *in vitro* fertilization and the cleavage rate in mouse embryo was investigated [18]. The present study demonstrated that HSP60 in low dose positively affected two-cell embryo development; however, it did not significantly affect the fertilization rate. Conversely, HSP60 had adverse effects on the fertilization and cleavage rates at higher doses [18, 56].

Ironically, although HSP60 did not have a low-dose effect on fertilization, it positively affected two-cell embryos' growth. A positive effect from the two-cell stage to the blastocyst stage was observed at a low dose of cleavage but was not significant [57]. Preimplantation mouse oocyte and embryo ZP is permeable to macromolecules up to 170 kD, with reduced permeability at approximately 110kD. As a result, HSP60 is easy for ZP to pass and affect the newly formed zygote with a 57-69 kD [58]. In the early stages of embryogenesis in a natural state, HSP 60 is expressed during the final follicle maturation (Graafian follicles), indicating the positive function of HSP 60 during preimplantation [59]. The mouse embryo cleavage rate, particularly from morula to blastocyst development, was reduced when antibodies to HSP60 and HSP 70 were added to the IVF media, which strongly supports

Table I. Implantation failure and auto-antibodies [18].

Autoantibody	Frequency in women undergoing in-vitro fertilization compared with controls	Association with implantation failure	Other known associations
Antiphospholipid antibodies	Increased	Unproven	Recurrent pregnancy loss
Antithyroid antibodies	No difference	Unproven	Thyroiditis
Antisperm antibodies	No difference	Unproven	Fertilization failure
Antinuclear antibodies	Slightly increased	Unproven	Autoimmune disease
Antiovarian antibodies	No difference	Unproven	Ovarian failure

these chaperones importance in preimplant mice [60]. Also, HSP60 is essential for its antiapoptotic and mitotic functions in early embryogenesis.

Although researchers realize, high oxygen concentrations in the IVF media may lead to apoptosis during IVF processes due to oxidation stress [61]. Therefore, it is no surprise that HSP60 has a positive effect on the growth of two cells in the embryo [62]. Therefore, unless the zygote was properly exposed to HSP60, this exogenous chaperone protein may have had a more significant impact on embryo production at the blastocyst stage [63]. Besides, HSP60 was responsive to its antiapoptotic influence, as the proportion of clogged embryos arrested decreased when 10 ng/mL of HSP60 was added to the fertilization medium [64]. HSP60 may neutralize the reactive oxygen species (ROS) in mice produced in vitro embryos, thereby preventing apoptosis stress [65].

Our primary concern for this review was to analyze the autoantibodies in relation to gynaecology and reproductive immunology. We reviewed the most common autoantibodies that affect the normal pregnancy outcome. This article highlighted several critical autoimmune factors involved in implantation that highlight their potential role in the reproduction process. Autoantibodies and early embryo mortality have a very critical role in association with implantation failure. This fact remains a critical issue facing IVF scientists struggling to implant the vast majority of embryos. The implantation failure might result from reduced uterine receptivity, embryonic defects, sperm defects, recurrence of the embryo or zones of hardening, or multifactorial causes (thin endometrium, altered expression of adhesive molecules, and possible immune factors). Our recent work found that the involvement of APA, ANA and/or ATA in recipients of oocyte donations did not affect their pregnancy outcomes (see table I).

Previously it has been suggested that APA found more frequently in individuals undergoing IVF and maybe the reason for the pregnancy loss [27, 29]. In some other studies, it was found that APA does not affect individuals undergoing IVF. Similarly, antithyroid antibodies (ATA) also responsible for miscarriage in individuals undergoing IVF. The individuals with normal thyroid function do not show any pregnancy-related complication [35]. ATA antibodies have a direct and indirect effect, so that it may be the secondary to autoimmune diseases. An antigenic substance in sperm cells triggers the immune response

and production of antisperm antibodies (ASA) that cause infertility in both genders. Antinuclear antibodies (ANA) and APA play a role in implantation failure; the mechanism behind their action follows hypotheses: be they increase the process of apoptosis or decrease the clearance of apoptotic cells. About anti-ovarian antibodies (AOA), there was a contrast in the conclusion of different researchers; some states that AOA play a role in implantation failure and leads to infertility and other mentioned that its difficult to draw some conclusion about it. Maybe this uncertainty is because of overlying multiple coexisting conditions.

The heat shock protein HSP60 in one murine research study demonstrated that it does not affect the fertilization at a low dose. In contrast, at high dose, it adversely affects the fertilization and hence implantation. Measurement of these autoantibodies clinically can be implicated as essential laboratory screening parameter before implantation in the expectant individuals to increase the ratio of positive pregnancy outcome. Increasing the awareness of this screening among the health care professional and timely diagnosis and management will develop the possibility of high implantation success ratio in expectant individual. It is not clearly understood that the presence of some autoantibodies affects normal pregnancy outcome. Researchers have different opinions about autoimmune antibodies; some suggested that they are a risk factor for implantation, and other states that their presence does not impact the normal pregnancy outcome. According to this study, the harmful effects of these autoantibodies on implantation dominate, but some uncertainties exist. In future, further studies need to be done to reveal these uncertainties and for better understanding.

CONCLUSIONS

Normal implantation of the embryo in the absence of any pathology is crucial for normal pregnancy outcome. The autoimmune antibodies are a significant risk factor for implantation failure both in normal conceiving and in IVF. The prophylactic measurement and management of these autoantibodies in the expectant individuals before conceiving may provide the opportunity to reduce the associated risks and increase the ratio of normal pregnancy outcome. Some scientists strongly suggested that the presence of autoantibodies like antiphospholipid, antithyroid, antisperm antibodies, antinuclear, anti-ovarian

autoantibodies and heat shock protein HSP 60 are mostly associated with adverse outcome in terms of implantation, some other opposed these conclusions and stated that presence of some of these antibodies does not always lead to abnormal pregnancy outcome. Our recent work found that the involvement of APA, ANA and/or ATA in recipients of oocyte donations did not affect their pregnancy outcomes. Some researchers did not give any clear conclusion about these risks, and some stated that the use of some immunodepressant agents could be useful to reduce the harmful effects of these autoantibodies associated with implantation failure. Each autoantibody has a different mechanism of action to create the pathological state, some have direct effect, and some indirectly impact implantation. In future, further high-quality studies need to be performed for better understanding.

REFERENCES

- Chen X., Man G.C.W., Liu Y. et al. Physiological and pathological angiogenesis in endometrium at the time of embryo implantation. *Am J Reprod Immunol.* 2017;78(2):e12693.
- Sugihara K., Kabir-Salmani M., Byrne J. et al. Induction of trophinin in human endometrial surface epithelia by CG β and IL-1 β . *FEBS Lett.* 2008;582(2):197-202.
- Ashary N., Tiwari A., Modi D. Embryo implantation: war in times of love. *Endocrinology.* 2018;159(2):1188-1198.
- Kliman H.J., Frankfurter D. Clinical approach to recurrent implantation failure: evidence-based evaluation of the endometrium. *Fertility and sterility.* 2019;111(4):618-628.
- Porcu-Buisson G., Lambert M., Lyonnet L. et al. Soluble MHC Class I chain-related molecule serum levels are predictive markers of implantation failure and successful term pregnancies following IVF. *Hum Reprod.* 2007;22(8):2261-2266.
- Di Rosa R., Ferrero S., Cifani N. et al. In vitro fertilization and autoimmunity: Evidence from an observational study. *European Journal of Obstetrics & Gynecology and Reproductive Biology.* 2019;234:137-142.
- Muller V., Ob'edkova K., Krikheli I. et al. Successful pregnancy outcome in women with recurrent IVF failure and Anti-hCG autoimmunity: a report of three cases. *Case reports in immunology.* 2016.
- Yoshinaga K. Review of factors essential for blastocyst implantation for their modulating effects on the maternal immune system. *Semin Cell Dev Biol.* 2008.
- Hong Y.H., Kim S.J., Moon K.Y. et al. Impact of presence of antiphospholipid antibodies on in vitro fertilization outcome. *Obstetrics & gynecology science.* 2018;61(3):359.
- El Hasbani G., Khamashta M., Uthman I. Antiphospholipid syndrome and infertility. *Lupus.* 2020;29(2):105-117.
- Chaouat G., Ledée-Bataille N., Dubanchet S. Immune cells in uteroplacental tissues throughout pregnancy: a brief review. *Reproductive biomedicine online.* 2007;14(2):256-266.
- Leiva P., Schwarze J.E., Vasquez P. et al. There is no association between the presence of antithyroid antibodies and increased reproductive loss in pregnant women after ART: a systematic review and meta-analysis. *JBRA assisted reproduction.* 2017;21(4):361.
- Cavalcante M.B., Cavalcante C.T.M.B., Sarno M. et al. Antinuclear antibodies and recurrent miscarriage: Systematic review and meta-analysis. *Am J Reprod Immunol.* 2020;83(3):e13215.
- Fan J., Zhong Y., Chen C. Impacts of anti-dsDNA antibody on in vitro fertilization-embryo transfer and frozen-thawed embryo transfer. *Journal of immunology research.* 2017.
- Shibahara H., Wakimoto Y., Fukui A. et al. Anti-sperm antibodies and reproductive failures. *Am J Reprod Immunol.* 2020:e13337.
- As V., Dhama K., Chakraborty S. et al. Role of antisperm antibodies in infertility, pregnancy, and potential for contraceptive and antifertility vaccine designs: research progress and pioneering vision. *Vaccines.* 2019;7(3):116.
- Kutteh W.H. Antiphospholipid antibody-associated recurrent pregnancy loss: treatment with heparin and low-dose aspirin is superior to low-dose aspirin alone. *American journal of obstetrics and gynecology.* 1996;174(5):1584-1589.
- Abdi Z., Mohsenzadeh S., Anarkooli I.J. et al. The effect of hsp60 on fertilization and pre-implantation embryo development in mice: an in vitro study. *Acta Endocrinologica (Bucharest).* 2019;15(2):153.
- Cline A.M., Kutteh W.H. Is there a role of autoimmunity in implantation failure after in-vitro fertilization? *Curr Opin Obstet Gynecol.* 2009;21(3):291-295.
- Zhong Y-P., Ying Y., Wu H-T. et al. Relationship between antithyroid antibody and pregnancy outcome following in vitro fertilization and embryo transfer. *Int J Med Sci.* 2012;9(2):121.
- Carp H.J., Selmi C., Shoenfeld Y. The autoimmune bases of infertility and pregnancy loss. *J Autoimmun.* 2012;38(2-3):J266-J274.
- Ebrahimi M., Asbagh F.A. The role of autoimmunity in premature ovarian failure. *Iranian journal of reproductive medicine.* 2015;13(8):461.
- Birkenfeld A., Mukaida T., Minichiello L. et al. Incidence of autoimmune antibodies in failed embryo transfer cycles. *Am J Reprod Immunol.* 1994;31(2-3):65-68.
- Tartakovsky B., Bermas B.L., Sthoeger Z. et al. Immunology: Defective maternal—fetal interaction in a murine autoimmune model. *Hum Reprod.* 1996;11(11):2408-2411.
- Stern C., Chamley L., Hale L. et al. Antibodies to β 2 glycoprotein I are associated with in vitro fertilization implantation failure as well as recurrent miscarriage: results of a prevalence study. *Fertility and sterility.* 1998;70(5):938-944.
- Geva E., Amit A., Lerner-Geva L. et al. Autoimmunity and reproduction. *Fertility and Sterility.* 1997;67(4):599-611.
- Khole V. Does ovarian autoimmunity play a role in the pathophysiology of premature ovarian insufficiency? *Journal of mid-life health.* 2010;1(1):9.
- Saccone G., Berghella V., Maruotti G.M. et al. Antiphospholipid antibody profile based obstetric outcomes of primary antiphospholipid syndrome: the PREGNANTS study. *American journal of obstetrics and gynecology.* 2017;216(5):525.
- Kokcu A., Yavuz E., Celik H. et al. A panoramic view to relationships between reproductive failure and immunological factors. *Arch Gynecol Obstet.* 2012;286(5):1283-1289.
- Kwak-Kim J., Skariah A., Wu L. et al. Humoral and cellular autoimmunity in women with recurrent pregnancy losses and repeated implantation failures: A possible role of vitamin D. *Autoimmunity reviews.* 2016;15(10):943-947.
- Kikuchi K., Shibahara H., Hirano Y. et al. Antinuclear antibody reduces the pregnancy rate in the first IVF-ET treatment cycle but not the cumulative pregnancy rate without specific medication. *Am J Reprod Immunol.* 2003;50(4):363-367.
- Li C., Zhou J., Huang Z. et al. The Clinical Value and Variation of Antithyroid Antibodies during Pregnancy. *Dis Markers.* 2020.
- Xie J., Jiang L., Sadhukhan A. et al. Effect of antithyroid antibodies on women with recurrent miscarriage: A meta-analysis. *Am J Reprod Immunol.* 2020;83(6):e13238.

34. Monteleone P, Parrini D, Faviana P et al. Female infertility related to thyroid autoimmunity: the ovarian follicle hypothesis. *Am J Reprod Immunol.* 2011;66(2):108-114.
35. Haller-Kikkatalo K., Altmae S., Tagoma A. et al. Autoimmune activation toward embryo implantation is rare in immune-privileged human endometrium. *Semin Reprod Med.* 2014.
36. Kling C., Steinmann J., Westphal E. et al. Adverse effects of intradermal allogeneic lymphocyte immunotherapy: acute reactions and role of autoimmunity. *Hum Reprod.* 2006;21(2):429-435.
37. Tomassetti C., Meuleman C., Pexsters A. et al. Endometriosis, recurrent miscarriage and implantation failure: is there an immunological link? *Reproductive biomedicine online.* 2006;13(1):58-64.
38. Gleicher N., Weghofer A., Barad D.H. Cutting edge assessment of the impact of autoimmunity on female reproductive success. *J Autoimmun.* 2012;38(2-3):J74-J80.
39. Matteo M., Greco P., Setti P.L. et al. Preliminary evidence for high anti-PLAC1 antibody levels in infertile patients with repeated unexplained implantation failure. *Placenta.* 2013;34(4):335-339.
40. Fawzy M., El-Refaeey A-A.A. Does combined prednisolone and low molecular weight heparin have a role in unexplained implantation failure? *Arch Gynecol Obstet.* 2014;289(3):677-680.
41. Margalioth E., Ben-Chetrit A., Gal M. et al. Investigation and treatment of repeated implantation failure following IVF-ET. *Hum Reprod.* 2006;21(12):3036-3043.
42. Fatemi H., Popovic-Todorovic B. Implantation in assisted reproduction: a look at endometrial receptivity. *Reproductive biomedicine online.* 2013;27(5):530-538.
43. Ya Sin A.L., Ya Sin A.L., Ba Sha W.S. The epidemiology of anti-sperm antibodies among couples with unexplained infertility in North West Bank, Palestine. *Journal of clinical and diagnostic research: JCDR.* 2016;10(3):QC01.
44. Bashiri A., Halper K.I., Orvieto R. Recurrent Implantation Failure-update overview on etiology, diagnosis, treatment and future directions. *Reprod Biol Endocrinol.* 2018;16(1):121.
45. Lee Y.L., Ng H.P., Lau K.S. et al. Increased fetal abortion rate in autoimmune thyroid disease is related to circulating TPO autoantibodies in an autoimmune thyroiditis animal model. *Fertility and Sterility.* 2009;91(5):2104-2109.
46. Deroux A., Dumestre-Perard C., Dunand-Faure C. et al. Female infertility and serum auto-antibodies: a systematic review. *Clin Rev Allergy Immunol.* 2017;53(1):78-86.
47. Raziell A., Schachter M., Strassburger D. et al. Favorable influence of local injury to the endometrium in intracytoplasmic sperm injection patients with high-order implantation failure. *Fertility and sterility.* 2007;87(1):198-201.
48. Roca V.I., Calafat M.J., Larooca L. et al. Potential immunomodulatory role of VIP in the implantation sites of prediabetic nonobese diabetic mice. 2009.
49. Ghazeeri G.S., Kutteh W.H. Autoimmune factors in reproductive failure. *Curr Opin Obstet Gynecol.* 2001;13(3):287-291. doi: 10.1097/00001703-200106000-00007.
50. Li Y., Wang Y., Lan Y. et al. Antinuclear antibodies in follicular fluid may reduce efficacy of in vitro fertilization and embryo transfer by invading endometrium and granular cells. *Am J Reprod Immunol.* 2020;84(4):e13289.
51. Ola B., Li T-C. Implantation failure following in-vitro fertilization. *Curr Opin Obstet Gynecol.* 2006;18(4):440-445.
52. Bizjak M., Selmi C., Praprotnik S. et al. Silicone implants and lymphoma: the role of inflammation. *J Autoimmun.* 2015;65:64-73.
53. NG S.C., Gilman-Sachs A., Thaker P. et al. Expression of intracellular Th1 and Th2 cytokines in women with recurrent spontaneous abortion, implantation failures after IVF/ET or normal pregnancy. *Am J Reprod Immunol.* 2002;48(2):77-86.
54. Cohen Tervaert J.W., Colaris M.J., van der Hulst R.R. Silicone breast implants and autoimmune rheumatic diseases: myth or reality. *Curr Opin Rheumatol.* 2017;29(4):348-354.
55. Levi Setti P., Colombo G., Savasi V. et al. Implantation failure in assisted reproduction technology and a critical approach to treatment. *Ann NY Acad Sci.* 2004;1034(1):184-199.
56. Mekinian A., Cohen J., Alijotas-Reig J. et al. Unexplained recurrent miscarriage and recurrent implantation failure: is there a place for immunomodulation? *Am J Reprod Immunol.* 2016;76(1):8-28.
57. Ly D.K., Aziz N., Safi J. et al. Evidence-based management of infertile couples with repeated implantation failure following IVF. *Current Women's Health Reviews.* 2010;6(3):200-218.
58. Iborra A., Palacio J.R., Martínez P. Oxidative stress and autoimmune response in the infertile woman. *Immunology of Gametes and Embryo Implantation.* 88: Karger Publishers; 2005; p. 150-162.
59. Geva E., Amit A., Lerner-Geva L. et al. Autoimmune disorders: another possible cause for in-vitro fertilization and embryo transfer failure. *Hum Reprod.* 1995;10(10):2560-2563.
60. Sthoeger Z.M., Mozes E., Tartakovsky B. Anti-cardiolipin antibodies induce pregnancy failure by impairing embryonic implantation. *Proceedings of the National Academy of Sciences.* 1993;90(14):6464-6467.
61. Gajbhiye R., Suryawanshi A., Khan S. et al. Multiple endometrial antigens are targeted in autoimmune endometriosis. *Reproductive BioMedicine Online.* 2008;16(6):817-824.
62. Potdar N., Gelbaya T.A., Konje J.C. et al. Adjunct low-molecular-weight heparin to improve live birth rate after recurrent implantation failure: a systematic review and meta-analysis. *Human reproduction update.* 2013;19(6):674-684.
63. Kushnir V.A., Solouki S., Sarig-Meth T. et al. Systemic inflammation and autoimmunity in women with chronic endometritis. *American Journal of Reproductive Immunology.* 2016;75(6):672-677.
64. Özkurt Z., Kazazoğlu E. Zirconia dental implants: a literature review. *J Oral Implantol.* 2011;37(3):367-376. doi: 10.1563/aaid-joi-d-09-00079.
65. Van Mourik M.S., Macklon N.S., Heijnen C.J. Embryonic implantation: cytokines, adhesion molecules, and immune cells in establishing an implantation environment. *Journal of leukocyte biology.* 2009;85(1):4-19.

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REVIEW ARTICLE

WOMEN'S MODERNISM IN MEDICAL SCIENCE OF WESTERN UKRAINE – SOFIA OKUNEVSKA-MORACHEVSKA, SOFIA PARFANOVYCH AND VOLODYMYRA KRUSHELNYTSKA

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ABSTRACT

The aim: The purpose of this article is to identify through the analysis of biographical and scientific Sofia Okunevska-Morachevska, Sofia Parfanovych and Volodymyra Krushelnytska common features of personal and professional development to understand the scientific, social and cultural parts of their activities in the context of the history of national medical tradition.

Materials and methods: We will try to consider in general terms the life and professional path of Sofia Okunevska-Morachevska, Sofia Parfanovych, Volodymyra Krushelnytska, highlighting common features and analyzing them in contexts of social, political, and cultural features of the era.

Conclusions: Analyzing the biographical milestones and scientific achievements of women physicians in Western Ukraine in the late XIX – early XX century, we concluded that these personalities of Ukrainian medicine can be combined with a number of characteristics, thus demonstrating the continuity and longevity of the national female medical elite in Ukraine.

KEY WORDS: Women Physicians, History of Medicine, Okunevska-Morachevska, Parfanovych, Krushelnytska

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INTRODUCTION

The national history of medicine in the process of its development and the final formation of official versions of the presentation has experienced many upheavals and changes. For a long time, it was only part of the Soviet history of the formation of medical knowledge, where a number of personalities who joined its creation were silenced.

Life stories of Ukrainian women physicians in the late XIX and early XX centuries are multifaceted and very difficult. Throughout their own lives, and sometimes at their cost, they have tried to prove their right to science and practice by breaking a kind of double circle of silence – national – with an unspoken or official taboo on everything “Ukrainian”, and gender – with a ban or, rather, lack of legitimacy for everything “feminine”.

However, it should be noted that the scientific and social activities of Ukrainian women physicians have repeatedly come to the attention of researchers in the history of medicine, in particular, the thorough investigations of I. Bilavych [1-2], J. Hanitkevych [3-5], O. Danyliak deserve attention [6] I. Datsenko [7], Ol. Ohm. Kitseri, Ol. Ol.Kitsery, N. Kitsery [8-9], G. Lavryk [10-11]. At the same time, the fact that in the textbooks and manuals on the history of medicine, courses of lectures and practical classes sufficient attention is paid to the figures of Sofia Okunevska-Morachevska, Sofia Parfanovych and Volodymyra Krushelnytska don't stay unnoticeable. There is

also a lack of comprehensive research on the scientific achievements of women physicians in the late XIX- early XX century, as well as researches that would consider the activities of the latter in the context of social and political life of Ukrainian intellectuals.

In addition to the actual scientific, historical and medical context, it seems indisputable that both a hundred years ago and now the problem of women's realization in science in particular has been and is very acute. Many foreign studies in recent years have stubbornly argued that women do not have a place in science, but at least that it is worth fighting for. In particular, foreign researchers such as Luke Holman and others argue that, in fact, in all fields of science, including medicine, men make up the vast majority, especially at higher levels of scientific activity. This fact seems paradoxical also because in recent years the role of women in science is constantly growing, for example in the so-called STEM-sciences [12]. Similar conclusions are made by other authors [13-18], arguing that there is an increase in the number of women in science over the past 50 years. However, there is a much smaller number of scientific publications by women scientists and the fields of science where they are represented, as well as some negative social attitudes in society responsible for gender discrimination. Moreover, the issue of access to education for women is still relevant, even at the level of primary, secondary and high schools, being one of the greatest social and gender challenges of

our time. In particular, recent UNISEF studies show that approximately 132 million girls are still out of school, and the proportion of girls who do not even receive primary education is about 34.3 million girls [19-20].

It is also important that the modern era, in the context of which we consider the figures of Sofia Okunevska-Morachevska, Sofia Parfanovych, Volodymyra Krushelnytska, was characterized not only by the active growth of the role of women and the search for ways of self-realization, but also by a special interest in the national.

The problem of Ukrainian national identity is one of the key ones in the domestic versions of modernism, it is enough to mention only political attempts to understand and implement the Ukrainian national idea – from the Ukrainian People's Republic to the whole generation of the Shot Renaissance.

Thus, the figures of Sofia Okunevska-Morachevska, Sofia Parfanovych, Volodymyra Krushelnytska deserve detailed consideration and attention for at least three reasons: the formation of adequate coverage of the history of medicine in Ukraine, as well as in terms of gender and national issues.

THE AIM

The purpose of this article is to identify through the analysis of biographical and scientific Sofia Okunevska-Morachevska, Sofia Parfanovych and Volodymyra Krushelnytska common features of personal and professional development to understand the scientific, social and cultural parts of their activities in the context of the history of national medical tradition.

MATERIALS AND METHODS

We will try to consider in general terms the life and professional path of Sofia Okunevska-Morachevska, Sofia Parfanovych, Volodymyra Krushelnytska, highlighting common features and analyzing them in contexts of social, political, and cultural features of the era.

REVIEW AND DISCUSSION

Analyzing the biographical milestones and scientific achievements of women physicians in Western Ukraine in the late XIX-early XX century, we concluded that these personalities of Ukrainian medicine can be combined with a number of characteristics, thus demonstrating the continuity and longevity of the national female medical elite.

Sofia Okunevska-Morachevska, who started the triad of Ukrainian women physicians of this period, can definitely be considered the first woman physician not only in Western Ukraine, but also the first one in Ukrainian medical history.

Sofia Okunevska-Morachevska was born on May 12, 1865 in a small village near Ternopil in the family of a priest [8]. Despite the ban on education for Ukrainians at the time, she received permission to enter and take exams at the Lviv Academic Gymnasium, which caused a sensation throughout Galicia.

In 1896, Sofia graduated from the University of Zurich, becoming the first female physician in the Austro-Hungarian Empire and the first Ukrainian woman in Western Ukraine who got a university education. While studying at the university, Sofia married Polish physician, chemist, scientist and literary critic Vaclav Morachevsky. Sofia Okunevska-Morachevska passed the exams at the Medical Faculty of Lviv University, obtained a doctorate in medicine, nostrified her diploma in Krakow and later started up her own medical practice in Lviv. With a doctorate, she began treatment for cervical cancer with radium according to the method of Marie Skłodowska-Curie, about which she wrote: «There are many such specialists in Germany and Switzerland, and they are not laughed at there, but respected more than a physician who treats with chemicals» [21].

Sofia Okunevska-Morachevska took an active part in the creation of the Ukrainian medical educational space – organized courses for nurses and obstetricians, worked on creating a dictionary of Ukrainian medical terminology [8]. In Gminda and Svatobožice (Austro-Hungarian Empire) she worked as a physician in camps for Ukrainian emigrants. She herself understood that this would erase her further career as a physician and scientist, but even here she remained true to herself, and here she was the first to challenge the Austrian government for its abuse of Ukrainians [8].

She died on February 24, 1926 in hospital from purulent appendicitis complicated by peritonitis.

Sofia Parfanovych was born on June 7, 1898 in Lviv, in the family of a railway employee and came from noble Ukrainian family. After graduating from the women's gymnasium, she entered the medical faculty of Lviv University, where she became the first Ukrainian student. Due to the tension of the social and political atmosphere, she emigrated to Prague, where continued her studies. After returning to Ukraine, she graduated Lviv University, and she began working as a physician at Lviv General Hospital as an obstetrician and gynaecologist. Sofia Parfanovych began her first private medical practice in internal medicine and children's diseases in 1927 and put a lot of energy into overcoming prejudice against women physicians.

During these years, her works were actively published in the “Medical Bulletin” – ‘a megaphone’ of scientific achievements of Ukrainian physicians in the early XX century. At the end of World War II, Sofia Parfanovych emigrated to Austria, where she successfully continued practical and scientific work. She was the author of numerous specialized medical works: “Pathology and therapy of pediatric pyothorax”, “Mold (fungus) as a gynecological disease”, “Protein therapy of some women's diseases”, “Detention of the placenta after childbirth”, “Tuberculosis of the female genitals”, “Anesthesia of childbirth”, “Hysterectomy or other treatment”, “First aid and patient care” and others.

An important stage in Sofia Parfanovich's biography was her work at the medical college, where she was the head master. The availability of special education for Ukrainian girls and women remained extremely important for her (until 1939, the Polish authorities banned such education for Ukrainian women). [6, 22].

In 1949 she moved to the USA, received permission to practice medicine. She died in 1968 in Detroit.

Volodymyra Krushelnytska is another famous woman physician of Galicia in the early XX century. She was born on January 3, 1903 in Kolomyia in a famous family of public figures of that time. Volodymyra got her primary education in Prykarpattia and continued her studies at the Vienna Gymnasium. In 1919-1925 she was a student of the Medical Faculty of the University of Vienna, after graduating she chose dermatology as her specialty.

Two years later, she returned to Western Ukraine and started up her own practice, while leading an active public life. In 1927, Volodymyra Krushelnytska entered the medical faculty of Lviv University, receiving in 1929 the title of doctor of medicine. In 1930, Volodymyra Krushelnytska moved to Kharkiv and began her research work on the study of sepsis in miners of Donetsk region, and studied the problems of etiology and therapy of lupus erythematosus at the Institute of Venereology and Dermatology [11].

Volodymyra Krushelnytska took an active part in the work of the Ukrainian anti-alcohol society “Renaissance”, where she collaborated with Sofia Parfanovych. She often published educational, scientific and popular articles for women. As G. Lavryk notes, relying on archival materials, conducted classes on the elimination of illiteracy [10].

After the entire Krushelnytsky family moved to Kharkiv, all family members were arrested for political reasons (two brothers were shot, and all other family members were sent to the Solovetsky Special Camp – the largest Soviet concentration camp).

In the camp, she first worked hard on the construction of the White Sea-Baltic Canal, and later as a physician at the camp hospital. Volodymyra was shot dead on December 8, 1937 in Solovki (Russia) [2].

None of the female physicians were just silent women in science or just practitioners. They, it would seem, wanted to be realized as much as possible in the most various spheres of activity – from, actually, clinical medicine and up to educational activities.

All the women physicians we studied were adherents of the idea of national unity, bearers of Ukrainian in science, in particular, in medicine. Their relations with the then political regimes and authorities were not only difficult, but also sometimes tragic. Aiming at the development of Ukrainian medical science, the women we defined were forced, first, at the cost of incredible efforts to obtain a decent – usually European education, and then, roughly speaking, to fight the ‘windmills of power’, trying to implement their knowledge and the results of their own scientific research.

In our opinion, Sofiya Okunevska-Morachevska, Sofiya Parfanovych, Volodymyra Krushelnytska can be called the first women physicians of Ukrainian modernism who managed to break the existing social stereotypes, began to create a new scientific and social reality, changing the world and medicine not with loud phrases, but completely. according to I. Franko “quiet, tireless work”.

CONCLUSIONS

Analyzing the biographical milestones and scientific achievements of women physicians in Western Ukraine in the late XIX – early XX century, we concluded that these personalities of Ukrainian medicine can be combined with a number of characteristics, thus demonstrating the continuity and longevity of the national female medical elite in Ukraine.

Thus, we can identify the main criteria that combine the common features of the professional development of national physicians in the late XIX- early XX century: professional, scientific, cultural, social and political.

In addition, it is recommended for medical students to add to the study of the course “History of Medicine” the topic “Ukrainian women physicians: from the past to the present”, in particular these figures. Preparation of multimedia research projects on this topic remains relevant as an independent work of students.

REFERENCES

1. Bilavych I. Zhinky-medyky v kulturno-osvitnomu rozvytku ukrainstva Halychyny naprykintsi KhKh – na pochatku KhKh storichchia. *Hirska shkola Ukr. Karpat.* 2016;14:32-35. (In Ukrainian).
2. Bilavych I. Vnesok ukrainskykh likariv u rozvytok vitchyznianoï nauky ta medychnoi opyky ditei i doroslykh (kinets KhKh — pochatok KhKh st.). *Liudynoznavchi studii. Pedahohika.* 2015;31:25–33. (In Ukrainian).
3. Hanitkevych Ya. Doktor z rodyny Krushelnytskykh. *Reabilitovani istoriieiu. Kharkivska oblast. Kharkiv;* 2014, s. 120–124. (In Ukrainian).
4. Hanitkevych Ya. Volodymyra Krushelnytska – likar, naukoved-dermatoveneroloh, hromadskiy diiach. *Ukrainski likari-vcheni pershoi polovyny KhKh st. ta yikhni naukovi shkoly : biohr. narysy ta bibliohr. Lviv;*2002, s. 429–435. (In Ukrainian).
5. Hanitkevych Ya. *Ukrainska medytsyna Lvova do pochatku Druhoi svitovoi viiny.* NTSh. 2006. <http://ntsh.org/content/ukrayinska-medicina-lvova-do-pochatku-drugoyi-svitovoyi-viiny>. (In Ukrainian).
6. Danyliak O. Sofii Parfanovych – ukrainsky likar i prosvitnyk (do 120-richchia z dnia narodzhennia). *Pratsi NTSh. Med. nauky.* 2018;52(1):117-125. (In Ukrainian).
7. Datsenko I. Pryklad dlia pokolin: do 100-richchia vid dnia narodzhennia d-ra Sofii Parfanovych-Volchuk. *Narod. Zdor.* 1998;7(8):6-7. (In Ukrainian).
8. Kitsera O.O., Kitsera N.I. Sofiia Atanasivna Okunevska-Morachevska — persha zhinka-likar Bukovyny i Halychyny (1865—1926). *Zhin. likar.* 2011;1. <https://z-l.com.ua/upload/journals/33/block33site12.pdf>. (In Ukrainian).
9. Kitsera O.O., Kitsera N.I. Sofiia Parfanovych (1898-1968) – likar akusher-hinekoloh, pysmennytsia i hromadska diiachka (do 110-richchia z dnia narodzhennia). *Zhin. likar.* 2009;1:44. <https://z-l.com.ua/article/276>. (In Ukrainian).
10. Lavryk H. Volodymyra Krushelnytska, abo likar-dermatoloh svitovoho rivnia. 2019. <https://photo-lviv.in.ua/volodimira-krushelnitska-abo-likar-dermatolog-svitovogo-rivnya/>. (In Ukrainian).
11. Lavryk H.V., Metelska L.S. Z kohorty znyshchenykh: do 115-richchia z dnia narodzhennia Volodymyry Krushelnytskoi. *Natsionalna pamiat (na vshanuvannia zhertv totalitaryzmu): mizhuniversitytetskyi zbirnyk naukovykh prats. Vyp. II.* Lviv, 2018, s. 71–76. (In Ukrainian).
12. Holman L., Stuart-Fox D., Hauser C.E. The gender gap in science: How long until women are equally represented? *PLoS Biol.* 2018;16(4): e2004956.

13. Cech E.A., Blair-Loy M. Perceiving Glass Ceilings? Meritocratic versus Structural Explanations of Gender Inequality among Women in Science and Technology. *Soc Probl.* 2010;57(3):371-397.
14. Ceci S.J. Women in Academic Science: Experimental Findings From Hiring Studies. *Educational Psychologist.* 2018; 53(1):22-41.
15. Huang J., Gates A.J., Sinatra R. et al. Historical comparison of gender inequality in scientific careers across countries and disciplines. *PNAS.* 2020;117(9):4609-16. <https://doi.org/10.1073/pnas.1914221117>.
16. Kollmayer M., Schrober B., Spiel C. Gender stereotypes in education: Development, consequences, and interventions *European Journal of Developmental Psychology.* 2018;15(4):361-77. <https://doi.org/10.1080/17405629.2016.1193483>.
17. Makarova E., Aeschlimann B., Herzog W. The Gender Gap in STEM Fields: The Impact of the Gender Stereotype of Math and Science on Secondary Students' Career Aspirations *Front. Educ.* 2019. <https://doi.org/10.3389/educ.2019.00060>.
18. Blair-Loy M., Cech E.A. Demands and Devotion: Cultural Meanings of Work and Overload Among Women Researchers and Professionals in Science and Technology Industries. *Sociological Forum.* 2017;32(1):5-27.
19. UNICEF. Gender equality in education benefits every child. <https://www.unicef.org/education/girls-education>.
20. What is the impact of child marriage? *Girls Not Brides.* www.girlsnotbrides.org/what-is-the-impact/.
21. Osypchuk N. Ztsiliuvata suspilstvo i liudei: persha zhinka-likarka Bukovyny y Halychyny Sofia Okunevska. *Ukraina Moloda.* 2020;40. <https://umoloda.kyiv.ua/number/3589/196/146150/>. (In Ukrainian).
22. Stytsiuk N. Sofia Parfanovych – a Woman Doctor, an Innovator of Medical Education in Ukraine: some actual issues. *Archive of Clinical Medicine.* 2020;26(2):acm202027. <https://doi.org/10.21802/acm.2020.2.7>. (In Ukrainian).

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ABSTRACT BOOK

INTERNATIONAL SCIENTIFIC AND PRACTICAL CONFERENCE,
DEDICATED TO THE WORLD HEALTH DAY 2021

APRIL 2, 2021, BOGOMOLETS NATIONAL MEDICAL UNIVERSITY, KYIV, UKRAINE

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Congratulations from the Rector of Bogomolets National Medical University to the participants of the Scientific and Practical Conference with international participation dedicated to the World Health Day 2021.

Dear conference participants,

On behalf of the staff of one of the oldest higher educational institutions in Ukraine, I sincerely congratulate you on the celebration of the 2021 World Health Day in the framework of the International Scientific and Practical Forum on this occasion!

Bogomolets National Medical University, together with the entire international community, always participates in the celebration of important events of the WHO, one of which is World Health Day. Every year, the University organizes events for this important event, which since 2007 have been held in the format of international scientific and practical conferences. The purpose of such events is to attract the attention of scientists, health practitioners, politicians, publicity, other involved structures to the most important health problems and comprehensively consider approaches to their solution.

We are proud that in different years, active participants in the international conferences held at the University were representatives of the WHO Regional Office for Europe, including the current Regional Director Hans Henri P. Kluge, advisers of WHO/Europe Gerald Rockenschaub, Agis Tsuros, Halyna Perfileva, Kees de Joncheere, representatives of the WHO Office in Ukraine Igor Pokanevych, Dorit Nitsan, Roberto Gnezotto.

It is extremely important that the consideration of priority issues of public health takes place in a powerful scientific and expert environment, with the participation of representatives of well-known scientific schools, practical healthcare, management and legislative structures, professional associations and public associations within the framework of an intersectoral and multidisciplinary approach.

Such an integrated approach is due to the complexity and scale of existing health problems and the emergence of new, previously unknown ones that require consolidation of the efforts of the international community. After all, the global threats to public health caused by the epidemic of noncommunicable diseases, drug resistance, aging, migration and urbanization, widening health inequalities, environmental degradation and climate change were supplemented in 2020 by the COVID-19 pandemic, which jeopardized progress in the fight against diseases and the achievement of the Sustainable Development Goals on health.

The search for ways to resist global health threats in the XXI century brings together the desire of health professionals, scientists, teachers, health managers from around the world to promote global solidarity in the interests of health security, availability of medicines and vaccines, including against COVID-19, strengthening national health systems, ensuring their readiness for pandemics and other health emergencies, improving health indicators, upgrading the quality and availability of health care, and overcoming health inequalities and so on.

For this reason, the conference program provides consideration of a wide range of topics, with the participation of scientists and practitioners of various specialties, including epidemiologists, infectious disease specialists, public health specialists, managers, general practice/family medicine experts, pediatricians, gerontologists, pharmacologists, social workers, representatives of patient organizations, etc.

Discussion of various health problems in the context of WHO-recommended strategies will strengthen the evidence base, justify perspective ways to solve them.

The 2021 World Health Day Conference is a testament of our contribution to addressing priority public health issues together, taking into account current trends and effective threat countering mechanisms.

I am confident that the coverage of new scientific achievements, constructive discussions and open dialogue, a partnership approach to solving current public health problems will contribute to the improvement of strategies to combat the causes of disease, improve areas and measures to preserve and promote health, achieve universal health care coverage and efficiency of medical care, the formation of a favorable environment for health, improving the quality of life.

I wish the participants of the conference successful work, generation of new ideas in the context of solving current health problems!

**Rector of Bogomolets National
Medical University,
Professor**

Iurii Kuchyn

Greetings from the President of the National Academy of Medical Sciences of Ukraine, Academician of the National Academy of Medical Sciences of Ukraine, Corresponding Member of the National Academy of Sciences of Ukraine, Professor V. I. Tsymbaliuk to the participants of the International Scientific and Practical Conference dedicated to the World Health Day 2021.

Dear conference participants, scientists, educators, healthcare professionals, and students!

I congratulate you on the occasion of World Health Day and the start of the traditional annual International Scientific and Practical conference on this extraordinary date!

The organization of such a forum in the leading higher medical educational institution of the country together with the National Academy of Medical Sciences of Ukraine indicates the priority attention of the scientific and educational community to the issues of public health and well-being, with a special emphasis on measures to counter global threats and emergencies in healthcare, primarily the COVID-19 pandemic.

The combination of our efforts towards the integration of academic and university science creates a reliable platform for a consolidated approach in the fight against modern challenges and threats to public health with the broad participation of managerial, legislative, educational, information and educational links, representatives of all involved sectors of society.

The high need to consolidate measures for countering the global burden of diseases is due to the current epidemiological landscape of morbidity, a complex set of interrelated health determinants, and the destructive impact of pandemic manifestations on national health systems. This creates a high need for new professional knowledge, approaches, strategies, partnerships that will contribute to the adaptation of health services to the challenges of the XXI century; the overall coverage of the population with high-quality medical services.

WHO has identified 10 global health issues to track in 2021, which relate to strengthening solidarity for health safety; accelerating access to tests, medicines and vaccines against COVID-19; improving health by bringing services closer to the population; reducing health inequalities; combating infectious and noncommunicable diseases, with antimicrobial resistance; preventing mental health disorders, accelerating effective recovery from a pandemic; implementing global leadership in research and data collection.

The success of solving the priority problems of health care lies in the plane of close interdisciplinary, intersectoral, international cooperation, which is demonstrated by this scientific forum.

Its program provides consideration of a wide range of scientific and practical issues, including trends in population health; activities and resource provision of health care systems; creation of e-health; development of public health services; modern technologies of treatment and prevention of diseases, medical and legal regulation, psychological aspects of health, etc. This choice is natural given the multidimensionality of health in today's changing world and the obstacles to meeting the medical and social needs of different segments of the population.

Consideration of the conference, critical assessment of the situation, identification of priority ways to prevent and reduce obstacles to ensuring a high level of health and well-being of the population is an extremely important step in implementing the forum's goals and setting new goals for future research.

It is extremely gratifying that the leading academic institutions take an active part in holding such a scientific and practical event and actively cover the achievements of domestic academic science.

I am confident that the active communication of scientists, organizers and health professionals and other areas involved in this forum will offer promising solutions, expand professional contacts, increase the number of partners, launch and implement new initiatives in the future.

I wish all the participants of the International Scientific and Practical Conference dedicated to the 2021 World Health Day inspiration, productive creative work, fruitful discussion and significant results.

**President of the NAMS of Ukraine,
Academician of the NAMS of Ukraine,
Corresponding Member of the NAS of Ukraine,
Professor**

Vitalii Tsymbaliuk

THE EFFECT OF NICOTINE ON THE FORMATION OF CHRONIC GASTRODUODENAL PATHOLOGY IN TEENAGER

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Introduction: Worldwide, about 7 million people die annually from diseases caused by smoking, in Ukraine - 85 thousand people, which is about 12% of total mortality. According to statistics, about 8.2 million adult Ukrainians smoke and 25.5% are teenagers. A quarter of teenagers smoke only 1-2 times a month, while 29.0% of boys and 16.3% of girls can be classified as daily smokers. Smoking is a risk factor for many diseases, namely diseases of the respiratory system, cardiovascular system, gastrointestinal tract, oncological pathology of various localization, osteoporosis. Passive smoking of a child at an early age causes the emergence of chronic respiratory pathology, due to a violation of the local immune protection and the manifestation of allergic pathology. It should be noted that during smoking more than a thousand chemical compounds enter the body, 196 of which are toxic, 14 - narcotic, more than 50 - carcinogenic, which have both direct and indirect negative effects on organs and tissues and the body as a whole.

The aim: To establish the effect of nicotine on the formation of chronic gastroduodenal pathology (CGDP) in adolescents.

Materials and methods: We observed 136 teenagers aged 12-17 years with verified CGDP. All patients underwent a study of urinary cotinine (an active metabolite of nicotine) to identify active smokers. To verify CGDP, all adolescents underwent esophagogastroduodenoscopy (EGDS) with targeted biopsy of the gastric mucosa membrane (MM) and MM of the duodenum for further morphological and immunohistochemical examination. The level of acidic and neutral mucopolysaccharides, prostaglandin E was determined by immunohistochemical examination.

Results: The analysis of the obtained results showed that $44.1 \pm 4.3\%$ of adolescents actively smoke. CGDP in adolescent smokers was characterized by a prolonged course and a high recurrence rate. Dull abdominal pain and heartburn prevailed among the complaints. According to the results of EGDS, most of them were diagnosed destructive changes of the stomach and duodenum MM against the background of a decrease in acid-forming gastric function and disorders of motility of the stomach. In a histological examination $63.6 \pm 14.5\%$ of active smokers were diagnosed with H. pylori infection against the background of a pronounced degree of inflammation of the stomach MM and microcirculatory disorders in the form of hemorrhages and microthrombosis. In $72.7 \pm 13.4\%$ of adolescent smokers there was a violation of the cytoprotective function of the mucosa membrane, namely decrease in the level of production of neutral mucopolysaccharides and prostaglandin E2.

Conclusions: Thus, studies confirm the effect of nicotine on the formation of CGDP in adolescents. The microcirculatory disorders established by us against the background of the expressed inflammation of mucosa membrane of stomach and duodenum contribute to the development of disorders of preepithelial and epithelial protective barrier of the MM of organs of a gastroduodenal zone. Insufficient blood supply against the background of a reduced production of cytoprotective factors of the mucosa membrane of the stomach and duodenum deepens the inflammatory process and leads to a recurrent course of CGDP in children.

KEY WORDS: smoking, microcirculatory disorders, inflammation

ETHICAL AND LEGAL PRINCIPLES OF PROVIDING MEDICAL CARE TO CITIZENS ON THE TERRITORY OF UKRAINE

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Introduction: In Ukraine, experts point to the very low level of implementation and protection of human rights in the field of health care. This situation is mainly due to lack of legal awareness and legal culture. Namely, in order to skillfully use their rights, patients need to know them. Professor S.G. Stetsenko, a well-known specialist in the field of medical law, considering the general structure of medical activity, called the relations that arise in various areas of health care, medical relations.

The aim: The aim of this study was to identify the legal and ethical principles of providing medical care to citizens in Ukraine.

Materials and methods: To achieve this goal, a formal legal method was used, which refers to special scientific methods. All citizens of the state are well aware that the Constitution of Ukraine guarantees everyone the right to health care, which is ensured by systematic activities of state and other organizations. This is stated in Article 283 of the Civil Code of Ukraine and Article 6 of the Fundamentals of the legislation of Ukraine on health care (hereinafter «Fundamentals»). Foreigners or stateless people who are legally staying on the territory of Ukraine have the same right, because patients' rights have no borders.

But quite few people know about Article 10 of the Fundamentals, which states that in accordance with the requirements, citizens of Ukraine are obliged to take care of their health and the health of children, not to harm the health of other citizens; to undergo preventive medical checkups and vaccinations in cases provided by law; to provide emergency care to other citizens who are in a life-threatening condition.

The following rights of patients, which are specified in the following articles of the Fundamentals, are most often applied in practice. According to the first part of Article 34 and Article 38, a patient has the right to freely choose a doctor and to choose methods of treatment, as well as the right to demand a change of doctor. Article 35 stipulates that primary medical and preventive care is provided mainly on a territorial basis. The right to receive reliable and full information about the state of one's health is regulated by Article

39 of the Fundamentals and Article 285 of the Civil Code of Ukraine. The right to secrecy about one's health, about the fact of seeking medical help, about the diagnosis, as well as about the information obtained during the medical checkup is confirmed by Article 391 of the Fundamentals and Article 286 of the Civil Code. Secrecy of health condition refers to personal data protected by law (according to Article 23 of the Law of Ukraine «On Information»).

Results: As a result of the analysis, there were defined articles of the Fundamentals and the Civil Code of Ukraine, which guarantee the protection of the rights of citizens of our state and those foreigners who are legally staying on its territory, as well as the legislation ensuring ethical relations between doctor and patient.

Conclusions: After studying the above rights of patients, which are most often used in practice, we can draw the following conclusions:

- citizens of Ukraine and foreigners, legally living on the territory, have the right to health care and are protected by the Constitution of Ukraine and the law through the systematic activities of state organizations that organize comprehensive interaction of medical institutions;
- the state regulates the observance of ethical norms of the relationship between doctor and patient on the basis of the above mentioned articles of the legislation of Ukraine;
- the patient can be sure of the confidentiality not only of the diagnosis, but also of the fact of consulting a doctor, which to some extent is a guarantee of a person's right to privacy.

KEY WORDS: legislation, patient, foreigner, confidentiality.

CHARACTERISTICS OF CHANGES IN MALIGNANT TUMORS OF THE LARYNX, TRACHEA, BRONCHI AND LUNGS IN THE TRANSCARPATHIAN REGION

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Introduction: Ensuring the main strategic task of the health care system to provide the population with affordable and quality medical care, development and implementation of preventive measures, effective forms and methods of specialized and highly specialized services is impossible without knowledge of basic indicators, trends and patterns of public health.

The aim: Study and analysis of the dynamics of malignant neoplasms of the larynx, trachea, bronchi and lungs at the regional level.

Materials and methods: The data of the state statistical reporting (forms №7, №35-healthy) and the database of the National Cancer Registry were analyzed.

Results: The incidence of laryngeal oncopathology during the study period decreased by 13.81%, while the level of malignant neoplasms of the trachea, bronchi and lungs increased by 23.80%.

The proportion of MN of the trachea, bronchi and lungs in the structure of MN of the respiratory organs exceeds the proportion of MN of the larynx. The proportion of cases of tracheal, bronchial and lung cancer increased by 17.15% during the study period, but the proportion of cases of laryngeal cancer decreased by 19.47%.

Among patients with a newly diagnosed malignant neoplasm of the larynx, the disease is most often detectable at stage III (from 44.68% in 2018 to 71.43% in 2015), while for malignant tumors of the trachea, bronchi and lungs place are most often detectable at stage IV and their quotient ranges from 39.89% in 2016 to 56.31% in 2018.

5-year survival of laryngeal cancer in 2015 was 1.56‰, and in 2019 - 1.62‰ (during the study period, the index increased by 3.80%), in turn, survival for 5 years or more of the trachea, bronchi and lungs cancer in 2015 amounted 2.57% and increased to 2.85% in 2019, which reflects an increase of 10.80%.

Regarding the proportion of deaths up to 1 year from the diagnosis of laryngeal cancer increased by 4.35% during the study period. As for the share of deaths from oncopathology of the trachea, bronchi and lungs from among those who were not registered, their share is higher and is about 19.44% - 25.71%. It was found that in all 100% of cases the diagnosis was also established at autopsy.

The death rate up to 1 year from the diagnosis of laryngeal malignancies, from the number of first registered, during the study period among both men and women was almost unchanged, and the mortality rate from trachea, bronchi and lung MN was higher among men and after 5 years decreased by 16.84%, while among women increased by 67.72%. Among patients with laryngeal MN special treatment is mainly combined or chemoradiation. At special treatment of MN of a trachea, bronchial tubes and lungs chemotherapeutic and combined methods of treatment prevail.

Conclusions: There is an increase in both the level and proportion of malignant neoplasms of the trachea, bronchi and lungs during the study period. Most often for the first time the diagnosis of MN on III - IV stages is established. The mortality rate from tracheal, bronchial and pulmonary MN is higher among men, and the main method of treatment of patients with laryngeal MN is chemoradiation, with tracheal, bronchial and pulmonary MN - chemotherapeutic and combined treatments.

KEY WORDS: respiratory system, morbidity, mortality, sex.

COMPARATIVE CLINICAL EFFICACY OF FIXED COMBINATION BUDESONIDE/FORMOTEROL VS MONTELUKAST + FORMOTEROL IN STEROID-NAIVE PATIENTS WITH BRONCHIAL ASTHMA COMBINED WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE WITH NEUTROPHILIC TYPE OF INFLAMMATION

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Introduction: The study of clinical and functional features and possible treatment options for combined pathology - bronchial asthma (BA) and chronic obstructive pulmonary disease (COPD) is one of the urgent problems of modern pulmonology.

There are ongoing discussions around the world on the diagnosis and personalized pathogenetically determined approach to the treatment of patients with the overlaps between asthma and COPD.

The aim: To evaluate the effectiveness and tolerability of two treatment regimens (fixed combination of inhaled corticosteroid/formoterol and leukotriene modifier and formoterol as basic therapy) in steroid-naïve patients with asthma combined with COPD with neutrophilic inflammation.

Materials and methods: 30 patients with asthma combined with COPD (24 female, 6 male) mean age ($59,9 \pm 3,5$) years, with a content of neutrophils in the blood $> 4000 /\mu\text{l}$, FEV1 on average ($65,9 \pm 2,9\%$) pred were randomized 1: 1 to receive: budesonide/formoterol 160/4.5 μg BID - Group I ($n=15$), or montelukast 10 mg OD and inhalation of formoterol 12 mcg BID Group II ($n=15$). The duration of therapy was 12 weeks.

General clinical methods, asthma control questionnaires - ACT (asthma control test), ACQ (asthma control questionnaire), CAT (COPD assessment test), physical tolerance study (6-minute test) were performed before and after the end of studied course.

Patients in both groups did not differ statistically significantly in demographics, disease duration, PFT, and smoking status.

Results: According to the results of the ACT questionnaire after 12 weeks of treatment, the total score in group I increased from ($15,6 \pm 1,3$) to ($19,0 \pm 0,7$) points, $p < 0,05$. The average ACQ score decreased from ($2,5 \pm 0,2$) to ($1,8 \pm 0,2$) points, $p < 0,05$; mMRC - from ($2,3 \pm 0,2$) to ($1,8 \pm 0,2$) points, $p < 0,05$; CAT - from ($18,8 \pm 1,7$) to ($15,3 \pm 1,4$) points, $p < 0,05$. In Group II there was also a positive trend in the evaluation of questionnaires ACT, ACQ, mMRC and CAT, but no significant dynamics of the studied indicators was found. In patients of Group I, the 6 minutes walking distance increased by 19 meters from ($305,7 \pm 22,0$) to ($324,7 \pm 23,1$) m, $p < 0,05$. In group II, the distance traveled remained almost at baseline. At the same time, patients of group I after treatment had a statistically significant decrease in dyspnea on the Borg scale before the test from ($2,4 \pm 0,2$) points to ($2,0 \pm 0,2$) points, $p < 0,05$ and after the test with ($3,5 \pm 0,2$) points to ($3,0 \pm 0,2$) points, $p < 0,05$.

Positive dynamics in clinical symptoms were accompanied with the improving the quality of life of patients - reduced the overall score of the questionnaire of quality of life of St. George's Hospital (SGRQ) from ($31,4 \pm 2,2$) to ($25,0 \pm 2,4$) points, $p < 0,05$, symptom score - from ($60,0 \pm 6,0$) to ($42,5 \pm 5,9$) points, $p < 0,05$, activity restriction from ($26,9 \pm 2,3$) to ($22,3 \pm 2,6$) points, $p < 0,05$;

Conclusions: the use of the combined drug budesonide/formoterol (160/4.5) mcg BID for 3 months was more effective compared with the modifier of leukotrienes and formoterol: helped reduce the clinical symptoms of both diseases and improve exercise tolerability in steroid-naïve patients with a combination of asthma and COPD with neutrophilic inflammation.

KEY WORDS: asthma; COPD, inhaled corticosteroids; budesonide; long acting beta-agonists; formoterol; management

EFFICACY AND TOLERABILITY OF METHOTREXATE IN THE TREATMENT OF PATIENTS WITH PULMONARY SARCOIDOSIS IN A DOSE-DEPENDENT MANNER

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Introduction: According to the recommendations of experts from the World Association of Sarcoidosis and Other Granulomatous Disorders (WASOG) for the use of MT in the treatment of patients with sarcoidosis, the drug is prescribed in a dose of 5 to 15 mg/week, depending on the extent of the process and the tolerability of the drug. The experience

was accumulated in observing a significant number of cases of insufficient effectiveness of the drug at a dose of 10 mg/week (slow rates of regression, stabilization of the process) in the course of our earlier studies. At the same time, increasing the MT dose to 15 mg/week increased the effectiveness of immunosuppressive therapy.

The aim is a comparative study of the efficacy and safety of methotrexate (MT) at a dose of 10 mg/week and 15 mg/week in patients with pulmonary sarcoidosis having contraindications to GCS therapy.

Material and methods: The study involved 44 patients with stage II pulmonary sarcoidosis (26 women and 18 men at the ages from 24 to 70) who have contraindications to the appointment of GCS therapy. In group 1 (28 patients), methotrexate was prescribed at a dose of 10 mg/week, in group 2 (16 patients), methotrexate was prescribed at a dose of 15 mg/week. The diagnosis and assessment of the dynamics of sarcoidosis were carried out taking into account clinical symptoms based on the results of chest CT-scan and body plethysmography. The significance of differences in indicators was determined using the Student's t-test and Fisher's exact test.

Results: The number of cases of clinical treatment without residual changes of a fibrous nature in the lung parenchyma in patients after treatment with methotrexate at a dose of 15 mg/week significantly increased compared to the same indicator in the group of patients after treatment at a dose of 10 mg/week (81.3% and 42.4 % respectively, $p = 0.02540$). An increase in the therapeutic dose of methotrexate from 10 mg/week to 15 mg/week leads to a decrease in the time it takes to achieve a clinical cure ((10.1 ± 0.5) months and (12.8 ± 0.8) months respectively, $p < 0.02$), indicating an accelerating rate of regression of sarcoidosis.

Side effects of methotrexate at a dose of 10 mg/week were observed in 10 of 28 patients (35.7%). In the group of patients taking methotrexate at a dose of 15 mg / week, the incidence of side effects was 37.5%.

Conclusion: In patients with pulmonary sarcoidosis, the number of cases of clinical cure without residual changes of fibrous nature significantly increases after treatment with methotrexate at a dose of 15 mg/week compared to the same indicator in the group of patients after treatment at a dose of 10 mg/week. Immunosuppressive therapy of patients with pulmonary sarcoidosis using the drug at doses of 10 and 15 mg/week is characterized by satisfactory tolerance.

KEY WORDS: pulmonary sarcoidosis, methotrexate, immunosuppressive therapy

COMPARATIVE ANALYSIS OF THE USE OF EPINEURAL SUTURE, HYDROGEL DURASEAL AND FIBRIN SEALANT TISSEEL IN THE RESTORATION OF DAMAGED SCIATIC NERVE

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Introduction: Microsurgical repair of peripheral nerve damage does not always give the desired results, and functional recovery is long and insufficient. Hydrogel compounds based on polyethylene glycol or fibrin have been suggested to reduce nerve ends injury. It is assumed that the coaptation of nerve ends with hydrogel can give better results of nerve regeneration compared to the epineural suture.

The aim: To conduct a comparative analysis of sciatic nerve regeneration and skeletal muscle changes after nerve repair with epineural suture, polyethylene glycol hydrogel and fibrin sealant.

Material and methods: In rats the sciatic nerve was crossed and sutured with 4 epineural sutures, 2 sutures with DuraSeal, and 2 sutures with Tisseel. On the 14th, 30th, and 60th day the density of myelin nerve fibers in the distal nerve and histological changes in m.gastrocnemius were examined.

Results: According to the results of morphometry, the density of myelin nerve fibers in the distal nerve increased in the group with DuraSeal and Tisseel at day 30 and day 60 compared with the epineural suture. On the 60th day the level of regeneration in the distal nerve stump was 21.5%, 29.2% and 32.1% of the values in the intact nerve. Remyelination and regeneration of large nerve fibers occurs with the use of DuraSeal, but complete elimination of the hydrogel at day 60 did not occur.

In m. gastrocnemius structural changes after denervation are characterized by a decrease in muscle fiber diameter and an increase in collagen density, mainly in the epimysia and perimysia, along the muscle vessels. Muscle malnutrition and fibrosis begin as early as on the 14th day after microsurgical nerve repair. In the DuraSeal group, fibrosis was delayed for up to 60 days and hypertrophy of some muscle fibers in the final term. In the Tisseel group, there was a delay in muscle fiber malnutrition and fibrosis for up to 30 days. The results indicate that well-timed repair of the damaged nerve by use of less traumatic microsurgical techniques can accelerate nerve regeneration and delay skeletal muscle malnutrition.

Conclusions: Application of DuraSeal and Tisseel with epineural suture does not interfere with nerve recovery, accelerates regeneration in the distal nerve stump and delays the malnutrition of denervated muscles.

KEY WORDS: muscle, sciatic nerve injury, epineural suture, DuraSeal, Tisseel.

COVERAGE OF MORAL, ETHICAL AND LEGAL PROBLEMS OF HEALTH INTERVENTIONS IN THE STUDYING OF SOCIAL MEDICINE AND PUBLIC HEALTH

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Introduction: Health professionals' work is closely related to solving numerous problems, both medical and non-medical in nature. Of great importance is forming an ethical and legal worldview and knowledge and skills in future Master of Medicine to solve specific problems in health care and the public health system from an ethical and deontological position based on legal norms.

The aim: Substantiation of the structure and purport (essence) of educational content on ethical-deontological and medico-legal health care issues in an educational course on social medicine and public health.

Materials and methods: The research methodology is based on the use of bibliographic and information-analytical methods and content analysis. We analyzed national educational standards governing the requirements for the preparation of Master of Medicine, recommendations of international organizations in health and medical education, including WHO, WHO / Europe, European Association of Schools of Public Health, Agency for Accreditation of Public Health Education, World Federation for Medical Education, Association of Medical School in Europe, etc.

Results: Based on the analysis of domestic regulatory and international and European recommendatory documents, the goals and objectives of training masters in ethical-deontological and medical-legal issues related to the public health system were determined. The purpose of training future masters was determined to form their social responsibility for professional activities in the health care system and the public health system in compliance with ethical and deontological norms and principles.

Study assignments included the assimilation of knowledge about the principles and rules of ethics; ethical issues in public health and medicine; the analysis of the main legislative and regulatory acts on these issues; as well as the acquisition of skills to solve ethical problems in public health based on ethical standards; on the justification for the adoption of appropriate decisions.

The educational content covers the essence of the concepts of "ethics", "morality", "bioethics", their principles, and rules. Particular attention is focused on the differences between medical ethics and public health ethics. The emphasis is on clarifying ethical and moral dilemmas in implementing medical practice and practice in the public health system. The program provides for the consideration of numerous activities in the public health system, the implementation of which may cause problems of a moral, ethical, or legal nature. This applies to vaccination issues, quarantine, contact tracing for sexually transmitted infections, placement in specialized institutions in connection with mental health problems, abortion rights, and the use of contraception, and others.

Given the collective nature of public health actions, they can, to a certain extent, limit the rights and freedoms of individuals. Thus, vaccination, which ensures the right of individual protection of each person against diseases controlled using immunoprophylaxis, and achieving the maximum population effect for society, may contradict the right to refuse vaccination, creates a potential threat to society's interests. The need for preventive measures aimed at protecting public health from the spread of HIV/AIDS may conflict with the protection of the rights of an AIDS patient or HIV-infected person, respect for his autonomy, mandatory registration of an infection case, voluntary consent to testing, epidemiological investigation, notification of partners and others.

These and other cases require healthcare professionals to comprehend the conflict of moral interests, the ability to build trusting relationships with civil society, deliver truthful and accessible information to consumers of services, conduct an open dialogue, awareness of responsibility and accountability to society. In the event of contradictions between common values and the rights or interests of an individual, it is important to consider the principles of social justice, democratic participation, creating benefits for a larger number of people, analyzing benefits and risks, political context, etc. Students are offered an analysis of possible contradictions and approaches to their solution in considering typical examples of clarifying such problems.

Conclusions: The educational content presented in the educational course on social medicine and public health on ethical-deontological and medical-legal issues of health care forms for future masters the competence component of solving the moral, ethical, and legal problems of interventions in the field of public health from the standpoint of respecting the rights of each individual and society in general, solving the conflict of interests of an individual and a group of people based on the provisions of the current legislation and taking into account bioethical principles.

KEY WORDS: medical ethics, public health ethics, ethical contradictions, legal problems, educational course.

BIostatistics Knowledge Self-Assessment Performed by Medical Students as a Motivational Factor of the Educational Process

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Introduction: The system of knowledge evaluation and checkup, including and self-assessment is a vital component of the educational process. This system allows you to set quantitative and qualitative measures of learning technology and manage the learning process. It also acts as an integral part of the process of diagnosing the acquired knowledge of learning subjects. As a didactic tool for learning management, it is aimed at ensuring the effectiveness of the formation of competencies, their effective application in practice, motivating learning activities and the formation of the need for self-education.

The aim of the study was to examine the issue of biostatistics knowledge self-assessment, performed by medical students who studied in various educational programs, its time consumption and efforts to master it.

Materials and methods: The information source is the results of a sociological survey of students of Bogomolets National Medical University, who successfully mastered the biostatistics educational course in various programs during the 2014–2016 academic year and 2018/2019 academic years. Experimental (EG) ($n = 272$) and control groups (CG) ($n = 257$) were formed and a pedagogical experiment was performed. EG students studied under the new program, which took twice as much time to master. The study was conducted using analytical, sociological and statistical methods.

Results: In the course of the experiment, questions of students' self-assessment of their knowledge of the basics of biostatistics were studied. A score of 2 to 5 points was offered. The survey showed that students are critical enough in assessing their subject knowledge, especially this concerns the students of EG. 11.6 ± 1.9 per 100 EG respondents and 10.9 ± 1.9 per 100 CG respondents rated their knowledge as «excellent». Regarding the assessment of knowledge as «good», this indicator is 53.1 ± 3.0 per 100 respondents in EG and is lower by 16.4% than in the CG of students – 63.5 ± 3.0 . 29.0 ± 2.8 per 100 EC students rated their knowledge as «satisfactory», which is 24.5% higher than 23.3 ± 2.6 among CG students. It is believed that, 6.1 ± 1.5 per 100 students of EG and 2.3 ± 0.9 per 100 students of CG have not mastered this subject during its studying.

Respondents were asked about the evaluation of teaching of biostatistics at the Department of Social Medicine and Public Health. It was suggested to rate the teaching level in grades of 1 to 5. It is gratifying to note that the vast majority of students in both groups rated the quality of teaching in this subject, mainly at 4 and 5 points. The difference is that 34.2 ± 2.9 per 100 EG students gave a score of 4 points, which was 28.2% less than in CG – 47.6 ± 3.1 . At the same time, 57.0 ± 3.0 per 100 EG students believed that teaching at the department was 5 points. This indicator was 26.7% higher than in CG – 45.4 ± 3.1 per 100 respondents.

During the research work, questions on the time and effort spent by students to prepare for the subject were raised. 58.8 ± 3.0 per 100 interviewed in EG and 57.7 ± 3.1 per 100 interviewed in CG considered that they had given sufficient time and made good efforts to master the biostatistics. 25.6 ± 2.6 per 100 students in EG and 28.5 ± 2.8 per 100 students in CG, which is 11.8% more than in the same EG index, recognized that not enough time and attention was paid to mastering biostatistics.

Conclusions: Biostatistics knowledge self-assessment performed by medical students shows that training in an extended program with a much larger amount of educational content, promotes better learning and preservation of knowledge, awareness of the importance of biostatistics as a complex but essential subject, and more adequate assessment of their knowledge.

KEY WORDS: biostatistics, self-assessment of knowledge, pedagogical experiment.

PREVENTIVE MEASURES FOR COVID-19 CLOSE CONTACTS

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Introduction: During COVID-19 pandemic it is extremely important to use effective post-exposure prophylaxis methods which are safe for mucous membranes and have virulicide activity against coronaviruses. The SARS-CoV-2 enters the human organism through mucous membranes of nasopharynx and eyes. A person infected by SARS-CoV-2 is the most contagious during the incubation period of the disease when viral shedding is the highest. Also it is known that high nasopharyngeal viral loads correlate with disease severity, poorer outcomes, and mortality. Recommendations for COVID-19 close contacts include general prevention measures. However, just following public health measures does not have a direct effect on the virus. To date, it has been proven that decamethoxin solution in concentration $41.8-62.5 \mu\text{g} / \text{ml}$ (0.004-0.006% solution) and ultraviolet radiation (UV) with wavelength 222-230 nm have virulicide effect against coronaviruses.

The aim: To evaluate the effectiveness of additional to general prevention measures use of decamethoxin eye drops and physiotherapy procedures, including inhalation of decamethoxin solution and irradiation of the mucous membranes of the nose and mouth by ultraviolet quartz lamp, in COVID-19 close contacts. The work was done at public expense.

Materials and methods: We examined 30 COVID-19 close contacts. 15 of subjects followed the current prevention measures. Another 15 people in addition to general

prevention measures were using 0.02 % decamethoxin eye drops, inhalation with 0.02 % decamethoxine solution - 4 ml via jet nebulizer for 10-15 minutes (through a facemask), irradiation of the mucous membranes of the nose and mouth by ultraviolet quartz lamp for 30 s once a day - for 10 days after contact. In this study we evaluated data obtained from questionnaire, PCR testing, clinical and radiological (computer tomography) methods of examination.

Results: The use of decamethoxin eye drops and physiotherapy procedures allowed:

- 1) to prevent the coronavirus disease in 86.7% of COVID-19 close contacts, that is 46.7% higher compared to persons who followed only the current general prevention measures.
- 2) in case of coronavirus disease - to reduce the disease duration to 7-10 days, to reduce the severity of the disease and to prevent complications.

Conclusions: The application of proposed measures can increase the effectiveness of prevention of coronavirus disease. Physiotherapy procedures and decamethoxin eye drops were well tolerated by the subjects, had no side effects, that allows us to recommend them for practical use.

KEY WORDS: portals of entry, decamethoxin, ultraviolet radiation.

THE VALUE OF ISO 9001 SERIES STANDARDS FOR CREATING A QUALITY MANAGEMENT SYSTEM

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Introduction: The current problem in the realization of the right of a citizen to health care is the low quality of medical care and medical services in health care facilities of Ukraine. In the context of the health care reforms initiated by the state, the creation of a quality management system is seen as a guarantee of ensuring the effective functioning of modern medicine.

The aim: Discourse the advisability of implementing the principles of general quality management in accordance with the requirements of ISO 9001 series standards to achieve maximum efficiency of medical institutions.

Materials and methods: The following methods were used in the study: bibliographic, historical, method of system approach and system analysis. International recommendations, legal documents of Ukraine on improving the quality of health care and the experience of implementing quality management systems in the world were processed using these methods.

Results: Problem of ensuring the quality of medical care in Ukraine is solved mainly through the introduction of two management functions "control" and "quality assessment" according to state-defined criteria. At the same time, the experience of other countries, where the health of the population is much better, shows that quality cannot be ensured by its control alone. In accordance with the requirements of the international standards of the ISO 9001 series, quality assurance is planned, implemented and constantly maintained at each stage of the institution. This conceptual approach corresponds to the paradigm of system quality management and provides for systematic and continuous activities aimed at improving the organizational and production areas identified by the organization in the process of its activities. Whereas the control and evaluation of the quality of medical care are only separate links in the complex of many elements of a quality management system.

Conclusions: More than 150 countries around the world, including Ukraine, use the ISO 9001 series standards. These standards are based on customer service orientation. This enables healthcare facilities to continuously and effectively manage the quality of care and provide greater assurance to patients that their needs for strengthening and improving personal health. But today in Ukraine the work on the creation and implementation of a quality management system in the activities of medical institutions is insufficient.

KEY WORDS: Quality of medical care, international standards, medical institution.

STRESS RESISTANCE ASSESSMENT AS A BASIS OF STUDENTS' PRIMARY PREVENTION THAT RECEIVED LEARNING STRESS

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Introduction: Given the recent developments in the world related to the COVID-19 pandemic the preservation of the ability of employees whose work is associated with a risk to life and the primary prevention of violations in their functional status is the key to maintain a staff in the areas of health care. It's associated with extreme working conditions with a risk to both physical and mental health, which causes the occurrence of occupational diseases, the development of occupational deformation, and affects the reduction of professional longevity of the employee. Stress resistance plays an important role as a basic mechanism of protection against stressful situations and their negative effects on human health and human workability. The assessment of stress resistance is the basis of primary prevention for employees it associates whose work with constant psycho-emotional stress.

The aim: Stress resistance assessment of medical students to develop recommendations for primary prevention of extreme acting workers in the detection of disorders in their functional status.

Materials and methods: We conducted the study using the software and hardware complex "Psycholot-1" in which medical students examine by the methods of "Pendulum", "Individual Strategy" and by the test "Adaptability". The study involved 42 medical students from 18 to 27 years, in which the sample size ratio of negative/positive groups is one. The estimated sensitivity and specificity is 70%, error 20%, the level of significant difference $p = 0.05$ at a power of 80 %.

Results: Spearman's rank correlation index was calculated when analyzing the relationship between the values of the number of hits to zero (X_1) in the reaction's study to a moving object (method "Pendulum") and the number of points (X_2) scored during the determination of risk predisposition (method "Individual strategy"). The value of the correlation coefficient is $\rho = 0.339$ (statistically significantly different from zero, $p = 0.0244$). During the analysis of the relationship between X_1 and neuropsychological stability (X_3), Spearman's rank correlation index was calculated. The value of the correlation coefficient is $\rho = -0.385$ (statistically significantly different from zero, $p = 0.0118$).

Conclusion: The results show a positive correlation between the values of the number of hits to zero (X_1) and the number of points (X_2) ($\rho = 0.339$, $p = 0.0244$) an increase in scores is accompanied by an increase in hits to zero in the reaction's study to a moving object. A negative correlation between X_1 and neuropsychological stability (X_3) ($\rho = -0.385$, $p = 0.0118$) was revealed, namely an increase in hits to zero characterizes the decrease in neuropsychological stability of a person for hyper-concentration at tension. The data got to show that to increase a person's stress resistance it's necessary to improve the results of the nervous processes balance which can be achieved by performing physical exercises (for example, CrossFit) and applying coping strategies.

KEY WORDS: stress resistance, professional longevity, functional status, prevention.

HYGIENIC ASPECTS OF SUBSTANTIATION OF CONCEPTUAL BASES OF DEVELOPMENT OF SYSTEM OF PUBLIC HEALTH CARE OF UKRAINE

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Introduction: Having signed in the of 2014 a package of documents on the Association with the EU, Ukraine has undertaken a number of political and socio-economic commitments. Among them, there is one concerning the creation of a new National Healthcare System based on the organization of public health, which is primarily rooted in the principles of preventive medicine and aims at averting diseases, prolonging active life and strengthening human health as a prerequisite of the sustainable development and economic growth.

The aim of the work was to develop a scientific basis for improving the ways of building a national public health system based on the hygienic principles of prevention priority.

Materials and methods: During the observation period (2007-2017), samples of atmospheric air, from Rivne, 4 district centers and 5 rural districts; water supply facilities (centralized and decentralized); industrial facilities were studied to determine the volume and classes of industrial waste and their impact on soil pollution. To study the prevalence and morbidity of the population of Rivne region, medical cards were selected and statistical reports of city and district health departments were analyzed. As a result, in the process of work, the researchers used the following methods: analytical, epidemiological, medico-statistical, hygienic diagnostic, comparative and systematic approach.

Results: On the basis of generalization of data of full-scale experiment on studying of a condition of environment, definition of correlations with indicators of prevalence and morbidity of the population of the Rivne area on the one hand, and theoretical consideration of real administrative decisions on public health, existing normative-methodical documents and legislative acts – on the other hand, the conceptual scheme of development of the domestic system of public health care on hygienic principles of prevention is developed and substantiated.

Through a series of field studies, the work provides an assessment of the risk to public health of the complex impact of the prior environmental factors (air, drinking water). The role of the general system analysis of field experiment data and materials of analytical epidemiology in the introduction and preservation of socio-hygienic monitoring and its generalization in the form of territorial ecological and hygienic passports is substantiated. It is foreseen that the identification of probable risks of these passports should be the basis for forecasting the state and qualitative changes in public health and the formation of clinical pathology, on the one hand, and identifying weaknesses, prevention of which will guarantee good health – on the other. In general, these approaches are the basis for the formation of the public health principles.

Conducted scientific substantiation of conceptual approaches to rebuild a national public health system based on the priority of prevention and application of the principle "Health in all state policies", development of theoretical principles and methodological approaches to justify the development of socio-hygienic (ecological and hygienic) passports of separate settlements as a tool for sustainable development of territories, improvement of living conditions of the population and preservation of its health, establishment of dependence between operating environmental factors; indicators of their danger with the definition of critical organs and systems of the body and the real characteristics of morbidity.

Conclusions: Under the conditions of the settlement passport certification with the definition of environmental, economic and social factors that characterize the living conditions of the population, determining their risks and hazards, conditions are created not only for planned development, but also for predicting positive and negative consequences for further management decisions.

KEY WORDS: monitoring, health, environment, hygienic diagnostic.

EFFICACY OF A FIXED COMBINATION OF BUDESONIDE/FORMOTEROL COMPARED WITH THE COMBINATION OF MONTELUKAST + FORMOTEROL IN IMPROVING OF PULMONARY FUNCTION INDICES IN STEROID-NAIVE PATIENTS WITH BRONCHIAL ASTHMA COMBINED WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE WITH NEUTROPHILIC TYPE OF INFLAMMATION

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Introduction: The combination of bronchial asthma (BA) with chronic obstructive pulmonary disease (COPD) is characterized by symptoms, that are usually characteristic of both asthma and COPD. In the pathogenesis of asthma-COPD overlap neutrophilic type of inflammation plays significant role. It associates with frequent respiratory infections in the anamnesis, more severe course of the disease, worse lung function, greater pulmonary hyperinflation and thickening of the bronchial walls. Therefore, such patients require careful follow-up and the appointment of pathogenetic therapy.

Special attention should be paid to steroid-naïve patients (never treated with glucocorticosteroids) for asthma combined with COPD.

The aim of this study was to evaluate the efficacy and tolerability of two basic treatment regimens and to compare their efficacy: inhalative corticosteroids (ICS)/formoterol vs leukotriene modifiers in combination with formoterol in steroid-naïve patients with asthma combined with COPD with neutrophil inflammation.

Materials and methods: 30 patients with asthma combined with COPD (24 female, 6 male), mean age (59.9 ± 3.5) years, with content of neutrophils in the blood $> 4000 / \mu\text{l}$ were randomized 1: 1. Group 1 (15 patients) - received basic therapy with combination of budesonide/formoterol 160 / 4,5 μg BID. Group 2 (15 patients) received basic therapy with montelukast 1 tab (10 mg) OD and inhalation of formoterol 12 mcg BID. The duration of therapy was 12 weeks.

Pulmonary function indices (PFT) (spirometry, body plethysmography, muscle strength, respiratory drive, impulse oscillometry (IOS)) were studied before and after studied course of treatment.

Patients in both groups did not differ statistically significantly in demographics, disease duration, PFT indices, and smoking status.

Results: The use of a fixed combination of budesonide/formoterol, due to distal penetration into the bronchial tree, led to a significant increase in bronchial patency at all levels, including patency at the level of small bronchi: FVC increased from ($88.0 \pm 4.2\%$) to (97.7 ± 5), 2), $p < 0.05$; FEV1 - from ($66.7 \pm 2.8\%$) to ($75.4 \pm 3.4\%$), $p < 0.05$; PEF from ($72.0 \pm 3.6\%$) to ($80.4 \pm 3.5\%$), $p < 0.05$; MEF75% from ($43.2 \pm 3.7\%$) up to ($52.5 \pm 3.5\%$), $p < 0.05$; MEF50% from ($27.9 \pm 2.6\%$) up to (33.8 ± 2), 3), $p < 0.05$; MEF25% from ($27.3 \pm 2.8\%$) to ($34.4 \pm 3.0\%$), $p < 0.05$, which indicated a significant reduction in PEF significantly increased, while other indicators remained within the reproducibility. The studied treatment regimens did not statistically significantly affect the strength of respiratory muscles, neuro-respiratory drive, impulse oscillometry.

Conclusions: the use of the combined drug budesonide/formoterol (160 / 4.5) μg BID for 3 months, contributed to a more pronounced reduction of bronchoobstruction at the level of large, medium and small bronchi in steroid-naïve patients with asthma combined with COPD than the use of leukotriene modifier with formoterol.

KEY WORDS: asthma, COPD, inhaled corticosteroids, leukotriene modifier, treatment

CHRONIC OBSTRUCTIVE PULMONARY DISEASE EXACERBATION TREATMENT

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Introduction: Nowadays negative impact on human health is increased due to persistent actions of chronic obstructive pulmonary disease (COPD) risk factors associated with an increased frequency of acute respiratory infections events, which are a major cause of COPD exacerbation. In the study of inflammatory processes in patients with COPD exacerbation, special attention is paid to cellular metabolism of an arachidonic fatty acid (FA), which is a substrate for the synthesis of proinflammatory eicosanoids – leukotrienes of the 4th series and prostaglandins of the 2nd series. The key mechanism for the release of this arachidonic FA from phospholipids of the cytoplasmic membrane into a cellular cytoplasm is the activation of the phospholipase A₂ enzyme due to excessive lipoperoxidation and entry into the cellular cytoplasm of Calcium ions.

The aim of the study was to research an efficacy of fenspiride administration in the treatment of COPD exacerbation.

Materials and methods: The study included 81 patients with non-severe exacerbation of COPD. The control group consisted of 40 healthy people. Patients were randomized to two groups. The first group included 40 patients receiving standard anti-inflammatory therapy. The second group included 41 patients whom, in addition to standard anti-inflammatory therapy were prescribed fenspiride at a daily dose of 160 mg orally. Background inhalation therapy was continued without changing the dosage. Examination of patients was performed before and after a two-week course of treatment. In addition to routine COPD screening investigations, patients were performed gas chromatographic analysis of phospholipid spectrum of the erythrocyte membrane phospholipid by a Color-500 series chromatograph, as well as hematocrit and blood viscosity measurements with a rotary viscometer. In both groups, an analysis of changes in the fatty acid spectrum in comparison with the dynamics of clinical symptoms and rheological properties of blood was performed.

Results: In patients with COPD in both groups compared to similar values in healthy individuals there was a decrease of arachidonic FA in the spectrum of phospholipids of erythrocyte membranes, along with a shift in the balance between saturated, unsaturated, and polyunsaturated FA towards the predominance of saturated FA. According to the results of gas chromatographic analysis, patients of the second group were stratified into two subgroups: A (26 patients) with low content (less than 8% of all phospholipids) and B (15 patients) with high content (more than 8% of all phospholipids) of arachidonic FA in spectrum of phospholipids of erythrocyte membranes.

Analysis of chromatographic parameters in patients of the first group showed that after treatment the fatty acid spectrum of phospholipids of erythrocyte membranes did not change significantly as well as the rheological properties of blood. The patients of the second group showed more rapid positive changes in the clinical symptoms of exacerbation than the patients of the first group.

The patients of subgroup A showed an improvement in the ratio between saturated, unsaturated, and polyunsaturated fatty acids in phospholipids of the membranes of erythrocytes in the direction of reducing of relative content of saturated fatty acids in the phospholipid spectrum. These changes were combined with rapid regression of clinical symptoms of COPD exacerbation within the first week of treatment and with improvement of the rheological properties of the blood.

In the patients of subgroup B were not observed improvement in the chromatographic spectrum of phospholipids in erythrocyte membranes. The regression of clinical symptoms of COPD exacerbation was slower than in patients of subgroup A – occurring within the second week.

Conclusion: To more effectively using of a fenspiride in the treatment of exacerbations of COPD, should be used the chromatographic criterion for fenspiride administration – low content of arachidonic fatty acid (less than 8% of all phospholipids) in spectrum of phospholipids of erythrocyte membranes.

KEY WORDS: fenspiride, arachidonic acid, fatty acid chromatographic spectrum, blood viscosity

A NEW DIAGNOSTIC PREDICTOR FOR PROPHYLAXIS OF THE DEVELOPMENT OF SEVERE COMPLICATIONS OF ACUTE PANCREATITIS

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Introduction: Acute pancreatitis is one of the most pressing problems of modern medicine due to the development of severe complications that cause mortality in the range of 40 - 70%. The most common causes of death in patients with acute pancreatitis are purulent-septic complications, which in turn cause the development of sepsis, erosive bleeding, pancreatic and gastrointestinal fistulas, mechanical jaundice, etc. At late diagnosis of these complications mortality reaches more than 85% owing to multiorgan insufficiency. There are many rating scales for the severity of acute pancreatitis, but known screening methods are ineffective. Thus, the issue of timely diagnosis of purulent-septic complications of acute pancreatitis, as a method of preventing the development of multiple organ failure, remains relevant today.

The aim: Study of the role of *Helicobacter pylori* (HP) as an etiological factor of acute pancreatitis and a marker of the development of its purulent-septic complications.

Materials and methods: The study involved 124 patients who were divided into the main group (66 patients with moderate severity and severe course) and the

comparison group (58 patients with mild course). There were 71 men (57,3%), women - 53 (42,7%). All patients underwent a screening study of HP in feces and a serological blood test to detect antibodies, namely immunoglobulin M to HP (determination of the phase of the disease - acute or chronic).

Results: The fecal rapid test was positive in 84,7% of patients. During serological examination, a positive result was obtained: 24 hours after hospitalization - in 13,8% of patients in the comparison group, in 34,8% of patients in the main group; after 7 days - in 15,5% of patients and 63,3% of patients, respectively. HP is sensitive to most of the antibiotics used to treat purulent-septic complications of acute pancreatitis. After completing the course of antibiotic therapy, patients underwent a second study of HP (eradication was achieved in 37 (94,9%) patients).

Conclusions: An increase in the number of positive results of serological examination by 28,5% ($P < 0.001$) in patients of the main group 7 days after hospitalization proves that HP is not only one of the etiological factors of acute pancreatitis, but also a possible marker of the development of its purulent-septic complications. The use of this marker makes it possible to quickly, objectively and timely predict the occurrence of purulent-septic complications of acute pancreatitis and prevent the development of multiple organ failure, and thus reduce mortality in this pathology.

KEY WORDS: acute pancreatitis, purulent-septic complications, marker, diagnostics.

MORPHOLOGICAL MANIFESTATIONS OF CRYPTOCOCCOSIS IN THE THORAX ORGANS

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Introduction: Among the representatives of the fungi of the genus *Cryptococcus*, two species are pathogenic for humans – *Cryptococcus neoformans* and *Cryptococcus gattii*, and the former is responsible for most diseases caused in people with immunodeficiency of different etiologies, and the latter can cause disease in individuals with intact immunity. Human infection most often occurs by inhalation of the yeast forms of the fungus, so the lungs are the primary site of injury. HIV infection is a predisposing factor for the development of cryptococcosis. The likelihood of developing mycosis to a certain extent depends on the biological properties of the pathogen – its virulence, the ability to form a capsule. In addition, it was found that the differences between the strains of cryptococci in terms of virulence determine the pathomorphological picture in the tissues, which is characterized by a decrease in the foci of destruction and an increase in the granulomatous reaction.

The aim: To determine the peculiarities of tissue reactions of various organs of the thorax during cryptococcal infection in patients with various changes in immunity.

Materials and methods. We studied 10 cases of cryptococcal lesions of the thorax organs, of which 7 patients were diagnosed with HIV infection, among them 2 patients had terminal stage of HIV infection with a fatal outcome; in the remaining 3 cases there were nonspecific changes in immunity status. A histological study of tissues stained with hematoxylin and eosin, according to Gomori and the PAS reaction with Alcian blue (PAS-AS) was carried out. The histological examination was done on an Olympus BX51 light microscope with an Olympus SP-500 UZ camera attachment and the PROMICRA license "QuickPNOTO MICRO 2.3" was used.

Results: In HIV-infected patients, cryptococcosis manifested itself in 1 case in the form of foci of necrobiosis in the lymph node with the formation of numerous microcysts, in 2 cases – in the form of cryptococcoma-mycetoma of the lungs, in 2 cases it proceeded in the form of a granulomatous inflammatory process (were amazed lungs and pleura). From 2 autopsy cases, cryptococcosis in 1 case was accompanied by the development of massive necrotic changes in the lung tissue, and in the other there was no obvious tissue reaction. In HIV-negative patients, cryptococcal infection proceeded in 1 case as a solitary organized cryptococcoma, in the other – foci of necrobiosis were revealed in the pleural neoplasm tissue, and in another case, a sarcoid inflammatory cell reaction of the lungs was observed in the lungs in combination with a completely fibrosed cryptococcoma. Cryptococci in the affected tissues were represented by rounded cells with a diameter of 2 to 20 μm . The use of PAS-AS made it possible to visualize cryptococci with their capsules. With a prolonged course of the pathological process, an increase in the number of cells with altered shapes (oval, sickle, biconcave cells) was observed. The ratio of the number of encapsulated cells to non-capsular forms in granulomatous inflammation was significantly higher ($p < 0.05$) than in foci of necrosis or foci of necrobiosis.

Conclusions: The development of cryptococcosis depends both on the state of the patient's immune system, the duration of the pathological process, and on the pathogenicity of cryptococci, their ability to form a capsule. Morphological changes in the tissues of the lungs, pleura, and lymph nodes in patients with cryptococcosis are represented by a wide range of changes: from minimal cellular reaction, predominance of necrobiosis and necrosis of the affected tissue, granulomatous cellular reactions, as well as the formation of cryptococcus mycetoma.

KEY WORDS: *Cryptococcus*, morphology, tissue's reaction

ASSESSING THE MEDICAL CAREER CHOICE FACTORS UNDER THE CONDITION OF COVID 19 EPIDEMICS

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Introduction: The medical career choice motivation is a significant part of the physicians' professional growth, which quite often predisposes for the successful medical career. The motivation of first choice and motivation of staying in the profession may differ, but they define how the person functions as a doctor. The medical career choice motives could be classified into several groups: the social-altruistic (treating people, saving humanity), pragmatic (making a successful career, earning money) and scientific ones. When questioned, many surveyed don't call their real motives of career choice. The questionnaire shows the external motives, which are perceived by the person. The internal career choice motivation sometimes may be even not realized by the person. The challenges of the previous year, the COVID 19 epidemics and necessity to adapt quickly to already existing conditions significantly changed position of doctors and made some people revise their professional prospective. The danger of the COVID 19 infection has affected the career motivation, and it makes obvious not the external, but internal career choice factors.

The aim: The study aim was to detect the medical career choice motivation of already practicing doctors and researchers, distinguishing between the exterior and interior motives.

Materials and methods: The paper represents data of 120 medical PhD students of Bogomolets National medical university, questioned in December 2020-January 2021. The participation in questioning was voluntary, upon receiving consent of the participants. The participants were asked the following questions: the questions on the medical career choice, where they has to choose between "On somebody's advice", "To make a career or earn money", "To help and save the others", "Without any reason" and the career choice question "I support my choice now", "I regret it" or "It's difficult to say". The next question "Are you afraid of working with people now regarding the COVID 19?" could be answered as "Yes, I am", "No, I am not" or "It's difficult to say". The next question was "If you were to work only with the COVID 19, you would" with the options "I accept it", "I refuse it directly", "I'll cheat and refuse, but indirectly" or "I don't know what I would do" option. Then the interviewees were offered to write about the challenges and problems of Ukrainian health service.

Results: Analyzing the career choice factors by the medical PhD students, the majority (70.6%) confirmed altruistic motivation, while 11.8% stated about external motivation (family tradition) and 5.9% chose the career by the advice. Another 5.9% chose the career for pragmatic motives, and 5.9% couldn't define their motives. This altogether makes up 29.59% of externally motivated physicians. 70.6% of the surveyed like their choice, and 29.4% regret it, which almost coincides with the motivation distribution. As for encountering with danger at work during the COVID 19 epidemics, 52.9% don't claim any fear or anxiety related to the disease, while 35.3% are anxious and 11.8% can't define their attitude, which totally represent a half of the surveyed. Despite the motivation and fear, if the surveyed had to work with the COVID 19 patients, nobody chose the option "cheating in order to avoid the work", but 5.9% stated they would refuse. 70.6% stated they would agree to work, which corresponds to conscious career choice data, and 23.5% couldn't define. Concluding on the problems of the Ukrainian HC regarding the COVID 19, the surveyed recalled low salaries, funding, protocols and insurance.

Conclusions: The analysis of the career choice factors by the Bogomolets NMU PhD students showed predominance of the conscious altruistic-social motives (70.6%) against the pragmatic and unconscious choice, which coincides with the number of those who are satisfied and regret their choice respectively. The same number of the surveyed stated they would work with the COVID 19 patients, upon the necessity (70.6%). So, the interior socially stipulated medical career choice predisposes for appropriate performing medical duties.

KEY WORDS: Medical career, motivation, epidemics.

OCCUPATIONAL INJURIES OF HEALTH CARE WORKERS AS A RESULT OF ILLEGAL ACTIONS OF THIRD PERSONS IS AN URGENT GLOBAL HEALTH PROBLEM

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Introduction: Numerous studies conducted by the WHO has shown that health workers are the highest risk group for aggression against them in the workplace, which is associated with constant communication with patients and their relatives. This often leads to unpredictable consequences for both the physical and mental health of healthcare professionals.

The aim: Investigate cases of occupational injuries of medical personnel in health care facilities of Ukraine as a result of illegal actions of third parties.

Materials and methods: researching, statistical analysis.

Results: With the active participation of the WHO and other international health and safety organizations, large-scale studies of cases of aggression against health care workers in the workplace have been conducted in many countries around the world, including Australia, Brazil, Bulgaria, China, Mozambique, Palestine, Portugal, South Africa, Thailand and other. Studies included as registered official appeals to the police or governmental institutions, as well as anonymous answers using a specially designed WHO survey questionnaire "Workplace Violence in the Health Sector. Country case studies research instruments".

Investigation showed South Africa has the highest level of physical violence in the health care area. Up to 71.1% of public sector respondents and 51.6% of private-sector respondents said that they had experienced physical violence at least once by patients or hospital visitors during their work in the medical field. Respondents suffered from physical violence in Thailand with 10.5%, Bulgaria with 7.5%, Brazil with 6.4%, the lowest level was registered in Lebanon with 5.8%.

In Ukraine, no special large-scale surveys were conducted on aggressive actions directed against medical workers in health care facilities of different regions by hospitals, gender, age, etc. Information about violence against health workers comes only in isolated cases.

While in Ukraine, according to the police and the judiciary data, approximately 2.2×10^{-4} to 0.001% health care professionals of the total number of medical workers suffered from physical violence shown by patients or their relatives from 2006 to 2018, in all over the world according to WHO studies these figures are much higher from 8% to 38% in different countries, that could be explained the concealment of cases of physical violence against personal in medical institutions of Ukraine.

Conclusions: The experience of Ukraine and the countries of the world in the direction of research of outsiders aggressive actions concerning medical workers in the workplace has shown:

While in Ukraine, according to the police and the judiciary data, approximately 2.2×10^{-4} to 0.001% of health workers suffered from physical violence against health care workers, the number of medical professionals who reported physical violence in the workplace against them are much higher more than 8% to 38% all over the world. Such a difference in the number of cases may indicate the understatement and underestimation of cases of physical aggression against medical workers in health care institutions of Ukraine.

Thus, research, analysis of cases of violence against health care workers in Ukraine and assessment of the risks of aggression against health care workers in health care facilities is relevant. Such research can be a powerful tool for developing effective measures to prevent and reduce the risk of violence and aggression against health care workers in the workplace, as well as to develop effective medical legislation to protect health workers.

KEY WORDS: Health workers, workplace violence, aggressive actions, medical legislation.

ONLINE CHATBOT ELOMIA AS A TOOL FOR THE PREVENTION OF DEPRESSIVE DISORDERS

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Introduction: In times of global pandemic, the problems of prevention of mental disorders become especially important. There are two main factors that have exacerbated the mental health crisis around the world: 1) quarantine restrictions that have led to significant changes in the normal rhythm of life (job loss, social isolation, lack of support, distance job, refusal to rest, etc.); 2) destructive effect of coronavirus on the patient's nervous system, which shows itself in prolonged periods of low mood, depressive and suicidal manifestations. Despite the general consensus of the medical community on the catastrophic effects of COVID-19 on the mental health of people around the world, national systems simply cannot invest large resources in mental and psychological care programs that are accessible to the general public. In this light, online services aimed at providing first aid can play a special role. One such service is the Elomia application, created on the basis of artificial intelligence and based on the principles of cognitive-behavioral therapy. The application allows users to: 1) receive round-the-clock support in English; 2) share their own experiences; 3) perform exercises aimed at reducing the level of general anxiety.

The aim of the thesis is to present the results of a control study of the effectiveness of Elomia in reducing the tendency to depression.

Materials and methods: In order to conduct the study, two groups of respondents aged 19 to 23 years were formed – experimental (n = 42) and control (n = 40). Criteria for inclusion in the study groups were: 1) the presence of a predisposition to depression; 2) fluency in English (at a level not lower than Upper-Intermediate). Patient Health Questionnaire-9 (PHQ-9) was used to diagnose the tendency to depression.

The subjects of the experimental group had to use the chatbot Elomia for 4 weeks after first testing. There were no restrictions or requirements on the amount of time spent communicating with the chatbot.

Respondents of control group were asked to seek psychological help from the Depression self-help guide developed by The National Health Service of the United Kingdom for 4 weeks.

Results: At the beginning, the respondents of the experimental and control groups were characterized by a moderate level of predisposition to depression. None of the participants suffered from depression during the experiment. Comparison of data distributions by levels of predisposition to depression in the experimental and control groups did not show statistically significant differences.

After four weeks, retesting revealed that in the experimental group there was a decrease in the average predisposition to depression by 28%, while in the control group this decrease reached only 4%.

Conclusions: The present study demonstrates that the online chatbot Elomia can be used to prevent depression in people who show a moderate predisposition to depression and for various reasons can not seek medical help. The advantages of the service are: easy and round-the-clock availability, the ability to use from a mobile phone, a wide range of exercises to combat various aspects of low mood and predisposition to depression.

KEY WORDS: depressive disorders, depression, communication,

THE RELATIONSHIP BETWEEN VITAMIN D STATUS, METABOLIC PARAMETERS AND ADIPOKINE LEVELS IN OVERWEIGHT AND OBESE ADOLESCENTS

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Introduction: Overweight and obesity affect vitamin D status in the body by additional depositing vitamin D in adipose tissue, which contributes to a decrease in its active metabolites due to a violation of hydroxylation processes. Increases in adipose tissue affect the serum adipokine levels, which affects metabolic processes and general condition of the body.

The aim of the study was to determine the relationship between vitamin D status and parameters of lipid and carbohydrate metabolism with adipokine levels in overweight and obese adolescents.

Materials and methods: 136 adolescents with overweight and obesity (60 overweight and 76 obese adolescents) were examined. The mean age of children was 15.5 ± 2.3 years. Anthropometric measurements and body mass index (BMI) were established in all adolescents. BMI was determined according for world health organization recommendation. To determine vitamin D status using the immune-enzyme method, blood serum levels of calcidiol (25(OH)D) were determined. The leptin and adiponectin levels, basal insulin levels were measured in all adolescents by using the immune-enzyme method. The blood glucose level, total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C) and triglycerides (TG) by were measured by enzymatic methods. Based on the obtained research results homeostasis model assessment of insulin resistance (HOMA-IR) index, atherogenic index of plasma (AIP), very low-density lipoprotein cholesterol (VLDL-C) and non-HDL-C were calculated in all adolescents with overweight and obesity. All research results were processed statistically. The relationship level was established using correlation analysis.

Results: The mean serum level of 25(OH)D was 14.69 (10.27–20.30) ng/mL in overweight adolescents and 12.71 (9.36–17.37) ng/mL in obese adolescents. The study has determined vitamin D deficiency among overweight adolescents with BMI 85–97th percentiles – in 70.0 % and obese adolescents with BMI over 97th percentile – in 77.6 %. Serum 25(OH)D levels in overweight and obese adolescents have a positive significant correlation with adiponectin ($r=0.592$, $p=0.000$) and inverse significant correlation with leptin ($r=-0.498$, $p=0.000$), were defined. The effect of adipokines on metabolic processes in the body was confirmed by their relationships with the main parameters of lipid and carbohydrate metabolism. It has been established that leptin levels have significant inverse correlation with HDL-C ($r=-0.631$, $p=0.000$) and positive significant correlation with LDL-C ($r=0.189$, $p=0.028$), TG ($r=0.384$, $p=0.000$), non-HDL-C ($r=0.261$, $p=0.002$), basal insulin level ($r=0.788$, $p=0.000$), HOMA-IR ($r=0.743$, $p=0.000$). Adiponectin levels have positive significant correlation with HDL-C ($r=0.587$, $p=0.000$) and inverse significant correlation with LDL-C ($r=-0.244$, $p=0.004$), TG ($r=-0.359$, $p=0.000$), non-HDL-C ($r=-0.306$, $p=0.000$), basal insulin level ($r=-0.755$, $p=0.000$), HOMA-IR ($r=-0.709$, $p=0.000$).

Conclusions: The vitamin D status in overweight and obese adolescents have a relationship with the serum adipokine levels. The severity of lipid and carbohydrate metabolism metabolic disorders in overweight and obese adolescents have a relationship with the adipokine levels.

KEY WORDS: vitamin D, adipokines, metabolic syndrome.

CAD PATIENTS WITH HYPERTENSION AND SOMATOFORM DISORDERS REHABILITATION STRATEGIES

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Introduction: In the COVID-19 pandemic improvement of blood oxygen transport function and stabilization of the psychoemotional sphere is a priority for rehabilitation of CAD patients with hypertension, especially at anxiety-depressive disorders.

The aim: Investigated the functional activity of erythrocytes (ER) and hemoglobin (Hb), cardiohemodynamics and psychological status at landscape imagi-native kinesiotherapy, holographic modeling and correction with mildronate.

Materials and methods: In 50 patients (men aged 47.8 ± 1.8 years) with stable exertional angina pectoris II-III FC, stage II hypertension, anxiety-depressive disorders under traditional treatment (β -blockers, calcium channel blockers, nitro drugs, tranquilizers), conventional rehabilitation exercises (1 gr.) and in 50 patients (men aged 46.7 ± 1.6 years) with mildronate combination - the metabolic drug, 10% -5ml intravenous bolus under holographic modeling (2 gr.) before and after 10 days of rehabilitation were studied ER resistance, its glycolytic enzyme activity and antioxidant protection, the level of 2,3-diphosphoglycerate (2,3-DPhG), hydroxy-, deoxy-, methemoglobin (MetHb), Hb fractions - HbA₀, HbA₁, HbF, cardiohemodynamics.

Coronary artery angiography, bicycle test, Holter ECG, 24-h our blood pressure monitoring, disc electrophoresis, EchoCG, "Test self-identification system", "Self-assessment of the level of psychoemotional exertion", holographic modeling - the spatial unfolding of the internal holo-gram of our state (engram) created by the unfolding of an integrative image with its subsequent reflection in external objects with positive feedback to stabilize and restore cardiovascular sys-tem and psychoemotional sphere.

Results: After a 10-day rehabilitation cardiohemodynamics and psychological status improved more significantly in the 2gr. than in the 1gr. patients: an increase in the minute volume of blood circulation, cardiac and stroke indices, a decrease in pressure in the pulmonary artery, and a reduction in the phase of tension in the right ventricle ($P < .0.05$). After rehabilitation in the 1gr. systolic blood pressure decreased from 177 ± 2 to 148 ± 1 mm Hg ($P < .0,05$), diastolic – from 107 ± 2 to 94 ± 1 mm Hg, in the 2 gr respectively - from 178 ± 1 to 132 ± 1 mm Hg ($P < .0,05$) and from 109 ± 2 to 82 ± 1 mm Hg ($P < .0,05$). In 84% of patients of 2gr. and 21% – 1 gr. decreased the frequency and duration of ischemic episodes.

After rehabilitation in patients 2 gr. favorable changes in the ER state were revealed: the con-tent of MetHb and HbA1 significantly decreased, the level of HbA0 increased ($P < .0.05$). At the same time, the number of ER with increased resistance and the content of 2,3-DPhG in them in-creased, which optimizes the supply of O₂ to tissues and its utilization. In patients of 1gr there was a tendency to an increase in the levels of MetHb, HbA1, maximum hemolysis of ER and a shift to the left of the peak of the phase of the maximum hemolysis rate.

Psychoemotional exertion indices (PEI) prior to the start of rehabilitation in the 1gr. and 2gr. were respectively: anxiety – 8.77-8.79, aggressiveness – 4.67-4.64, fear of death – 8.14-8.13, feeling of loneliness – 8.52 -8.53; suicide – 4.38–4.36. After rehabilitation in the 2gr. and 1gr. PEI were: anxiety – 3.52 and 7,33, aggressiveness – 2.32 and 3,98, fear of death – 3.72 and 7,21, feeling of loneliness – 4.27 and 7,35; suicide rates – 2.18 and 3,78 respectively. Before the rehabilitation start 79% of patients 2 gr. and 77% of the 1gr. rated their condition as bad, 12% and 13% – very bad. After rehabilitation in 1gr. 5% of patients indicated poor condition, 51% –satisfactory, 44% – good, in 2gr. 34% of patients reported satisfactory condition, 57% – good and 9% – excellent. In 67% of patients of the 2gr. the doses of β -blockers and calcium channel blockers drugs are reduced while maintaining stable parameters of cardiohemodynamics, 54% of patients stopped taking psychotropic drugs.

Conclusions: Holographic modeling at landscape imaginative kinesiotherapy in combination with mildronate improve cardiohemodynamics, psychological status and blood oxygentransport function in CAD patients with hypertension and anxiety-depressive disorders.

KEY WORDS: CAD, Hemoglobin, Hologram

CHRONIC INFLAMMATION AND ITS ASSOCIATION WITH PLASMA OXALIC ACID IN END-STAGE RENAL DISEASE PATIENTS

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Introduction: Chronic inflammation is considered a characteristic feature of end-stage renal disease (ESRD) and a strong risk factor for both cardiovascular and all-cause mortality in the dialysis population. Unfortunately, although oxalate balance disorders are a common feature in ESRD patients, clinical studies on the relationship between the concentration of oxalic acid and blood cytokines in ESRD patients have not been conducted before.

We hypothesized that xalate imbalances might be involved in chronic inflammation and thus increase the risk of cardiovascular disease (CVD) in ESRD patients.

The aim: Our study aimed to analyze the association between chronic inflammation and oxalate homeostasis metrics in ESRD patients.

Materials and methods: A total of 50 ESRD patients and 23 healthy volunteers were included in this cross-sectional observational study. Among the patients there were 29 hemodialysis and 21 peritoneal dialysis patients.

The study protocol was approved by the local ethics committee of the Institute of Nephrology of the National Academy of Medical Sciences of Ukraine and registered in the international database of clinical trials ClinicalTrials.gov under identification number NCT04399915.

Concentrations of interleukin 6 (IL-6), tumor necrosis factor- α (TNF- α) and monocyte chemoattractant protein-1 (MCP-1) were determined in serum using STAT FAX-303 PLUS and commercially available test kits for enzyme-linked immunosorbent assay (ELISA) (Diaclon, France; DRG, Germany; Ukrmedservice, Ukraine) according to the manufacturer's protocols.

The plasma oxalic acid (POx) concentration of oxalate in the blood was determined spectrophotometrically using the reagent Oxalate Assay Kit (MAC-315) (Sigma-Adrich, Spain). Data are presented as median (Me) and interquartile range [Q25-Q75]; nonparametric (U-test) Mann-Whitney was used for comparative analysis. The correlation was determined by the Spearman method.

Results: POx concentration in the examined patients varied from 15.7–116.2 $\mu\text{mol/L}$ and was significantly higher in the ESRD patients compared with the healthy volunteers: 44.05 [27.7-116.2] vs 27.2 [24.1-37.7] $\mu\text{mol/L}$, $p = 0.003$. The analysis demonstrated a gradually increasing trend in the majority of the examined inflammatory mediators according to the tertiles of POx. The dialysis patients in the upper tertile of POx concentration had higher levels of IL-6, TNF- α and MCP-1 compared with those in the middle and the low tertiles of Pox. The correlation analysis indicated a direct association between POx concentration and blood IL-6 ($r = 0.49$, $p < 0.0001$) and MCP-1 levels ($r = 0.55$, $p < 0.0001$).

Conclusions: Elevated POx concentration is associated with chronic inflammation in ESRD patients.

KEY WORDS: Oxalic acid, chronic inflammation, cytokines.

SOME FIBRINOLYTIC FACTORS FOR DIFFERENTIATION ISCHEMIC CHEST PAIN FROM NON-CARDIOGENIC ONE IN PATIENTS WITH ISCHEMIC HEART DISEASE HISTORY

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Introduction: Chest pain (CP) ranks second place among all emergency department visits. The physicians focus on ruling out acute coronary syndrome (ACS), including unstable angina (UA) as the most life-threatening CP reasons. However, this diagnosis confirms only in 25-40% of hospitalized patients. Musculoskeletal (MS) disorders are another widely-spread but less dangerous reason for CP. The role of fibrinolytic factors, namely tissue plasminogen activator (tPA) and plasminogen activator inhibitor, type 1 (PAI-1) have been discussing regarding both above-mentioned conditions.

The aim was to evaluate the utility of tPA and PAI-1 as diagnostic markers for distinguishing UA and MSD in patients with ischemic heart disease history (IHD).

Materials and methods: In this cross-sectional study, we recruited 72 patients with CP who were hospitalized in the cardiology department with the provisional diagnosis "UA" and IHD history. We followed the guidelines (European Society of Cardiology 2020) for the preliminary diagnosis establishment and management of the patients. However, some patients were continuing complaining of CP despite basic treatment with no dynamic on ECG. For those, we have performed a stress ECG test. Though it was positive, the patients described another character of CP on the peak of exertion. The osteodegenerative changes of the thoracic spine region were registered in all patients of this group on chest X-ray. As the non-steroid anti-inflammatory drugs were helpful for this group of patients and no dynamic on ECG at rest were noted, we discontinued the specific treatment of UA. In general, the full set of investigations included anamnesis taking, physical examination, two-dimensional transthoracic echocardiography, ECG at rest in dynamic, 24-hour Holter monitoring, stress ECG, routine laboratory analysis (complete blood count, basic metabolic panel, troponin I).

Consequently, we defined 2 groups of patients: Group 1 – patients with crescendo UA (n=50), and Group 2 – patients with MS CP and angina history (n=22). The groups were comparable by baseline characteristics.

The whole blood samples for tPA and PAI-1 were collected in sodium citrate and centrifugated. Plasma samples were aliquoted and frozen at -80°C until use. We analyzed the concentrations of tPA and PAI-1 by ELISA (Santa Cruz Biotechnology, CA, USA), calculated tPA/PAI-1 and PAI-1/tPA ratios.

We assessed binary logistic models, receiver operating characteristic curves, calculated sensitivity (Se), specificity (Sp), and positive likelihood ratio (LR+) of each indicator.

Results: No diagnostic utility of tPA concentration alone was revealed (P=0.68). PAI-1 concentration and PAI-1/tPA ratio demonstrated a moderate increase (by 15.0% and 14.0%) in UA probability (LR+ 2.30 (1.38, 3.82) and 2.2 (1.39, 3.39), Se 94.0% and 100.0%, Sp 59.1% and 54.5% at cut-off point 0.345 rel.units/ml and 1.596, respectively). TPA/PAI-1 raised MS disorders probability by 69.0% (LR+ Inf (3.43, 897), Se 54.5%, Sp 100.0% at cut-off point 0.654).

Conclusions: PAI-1 concentration alone and tPA/PAI-1 ratio, but not tPA alone demonstrated promising results for differentiation ischemic and non-ischemic CP in patients with IHD.

KEY WORDS: musculoskeletal disorders, crescendo unstable angina, plasminogen activator inhibitor, tissue plasminogen activator.

FROM MEDIZINISCHE POLIZEI TO PUBLIC HEALTH: TEACHING AT THE HIGHER MEDICAL SCHOOL

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Introduction: There are disciplines in medical science that have not changed their name for centuries, but the opposite is also observed.

The aim is to trace how the name of the discipline that is now called "public health" in the Ukrainian higher medical school changed in Ukraine.

Materials and methods: Materials – published historical sources; method – historical.

Results: The term Medical police (Medizinische Polizei) began to be used in German-speaking states in the second half of the 18th century. The Medical police is the empirical science of the forms of state activity in the field of health care. Throughout the 19th century, the Medical police was the subject of teaching in the higher medical school in the Russian Empire, including Ukraine. With the establishment of Soviet power in Ukraine, the Medical police ceased to be taught in medical universities. Instead of it, Social Hygiene appeared in the then programs of Ukrainian universities. This combination of words, as well as the Medical police, was borrowed from the German language - Soziale Hygiene. The change in the name of science was natural. For over 100 years, the Medical police have been enriched by the statistical method. In addition, a theoretical part of this science has appeared, i.e. population health studies at the population level. Thus, it is necessary to distinguish two main periods in the formation and development of the discipline, the name of which is in the title: 1) empirical (medical police); 2) scientific (social hygiene and subsequent changes in the name in Ukraine). In Soviet Ukraine, the departments

of social hygiene appeared in 1923. In 1941, in Ukraine, as well as in the USSR as a whole, the departments of social hygiene were renamed into the departments of healthcare organizations. Here it is important for us to pay attention to the fact that the new name indicated the old content of science, taken from the 18th century, i.e. health system study (health care system). In 1966, in the Soviet Union (and hence in Ukraine), the departments of healthcare organization were renamed to the departments of social hygiene and healthcare organization. In the context of this message, it is important to emphasize that thus the name of the discipline indicated that although it studied health systems (healthcare system), it also had a theoretical component as it studied public health at the population level to create an effective system for providing public healthcare systems. At the same time, in modern science, not only in medicine, English dominates, where the term "Public Health" is used. This term "Public Health" has two meanings: 1) population health; 2) health care (state; public). Therefore, the departments that were once called departments of «social hygiene» in the USSR in the German manner, in a number of post-Soviet countries began to be called departments of «public health and healthcare organizations», but not in Ukraine, where since 2018 they have been renamed into the departments of «громадського здоров'я», which is not a complete translation of the phrase Public Health into Ukrainian, only partially conveying the content of the discipline as a science and subject of teaching. In other words, population health study is not an end in itself of our science. We are engaged in the healthcare system to maintain and improve public health, and therefore it is desirable to emphasize this in the title of our science in Ukrainian. Vocabulary of the world's languages are significantly different from each other. Therefore, in the Ukrainian language one word can be used to designate something, in English two words and vice versa. It seems that the last circumstance must be taken into account when using foreign language terms in the Ukrainian scientific literature and in the names of departments.

Conclusions: Thus, in our opinion, the name of our discipline as a science and subject of teaching in Ukraine requires further clarification.

KEY WORDS: teaching in medical universities, Ukraine, 19-21 centuries.

DYNAMICS OF THE NUMBER AND DENSITY OF PEDIATRICIANS IN UKRAINE, 1993 – 2019

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Introduction: Recent research shows that children's health depends on the number of pediatricians and shows that the regions with the highest infant mortality and morbidity have the lowest number of pediatricians (Beth D. Harper et al., 2019). In this regard, the WHO (World Health Organization) recommends monitoring and to plan the number of pediatricians in accordance with the expected epidemiological changes (prevalence and mortality from infectious diseases among children under 5 years of age), neonatal mortality and chronic morbidity (Kyu HH. et al., 2016; Kanyuka M. et al., 2016).

The aim of the study. To study the dynamics of the number of pediatricians and the density of pediatricians in Ukraine.

Materials and methods: The density of pediatricians was calculated on the basis of the analysis of reporting forms for the period 1993-2019 (forms № 17 "Report about medical personnel") (<http://medstat.gov.ua>) and data on the of children's number in Ukraine (<http://www.ukrstat.gov.ua>). Predictive trends are constructed by regression analysis.

Results: From 1993 to 2019, the number of children in Ukraine decreased by 42% – from 13101056 people to 7579703 people. During this period, the number of pediatricians decreased by 58% from 19,400 people (1993) to 8,133 people (2019). The density of pediatricians per 100,000 children during this period decreased by 27.5% (148.1 in 1993 to 107.3 in 2019), but this figure in Ukraine exceeds the world average (32 (IQR 5 – 74) per 100,000) in 2018 (Beth D. Harper et al., 2019).

In 1993, 45% of pediatricians provided primary care (8,786 people) and 55% of pediatricians provided hospital care (10,614 people). In 2019, 69.6% (2,474 people) of pediatricians provided primary care and 30.4% (5,659 people) of pediatricians provided medical care in hospitals (hospital pediatricians).

The density of pediatricians in hospitals decreased by 7.85% (from 81.02 to 74.66 per 100,000), and the density of pediatricians in primary care – decreased by 51.3% (from 67.6 per 100,000 to 32.64 per 100,000) by serving children by family doctors.

The number and density of pediatricians in Ukraine during 1993 – 2019 has a negative trend. The regression analysis method was used to calculate a density prediction model per 100,000 pediatric population in 2030 for each group of pediatricians. The regression coefficient for the group of pediatricians was $R = 0.7$ ($p < 0.0001$), for the group of primary pediatricians – $R = 0.8$ ($p < 0.0001$), for the group of hospital pediatricians – $R = 0.46$ ($p < 0.01$). If this trend continues, according to the regression analysis in 2030, the density of pediatricians per 100,000 will be 108.95 (–12.4%), of which hospital pediatricians – 72.9 (–5.3%), primary care pediatricians – 36.01 (–23.8%).

Conclusions: In Ukraine, the density of pediatricians during 1993 – 2019 y. has tendency to decrease (–27.5%) on the background of decreasing of children's number (–42%). By 2030, according to forecasts the density of pediatricians will decrease to 12.4%. When planning the number of pediatricians in Ukraine, the prevalence of pediatric morbidity, the provision of primary health care to children by family physicians, and the optimization of communication between primary care physicians and hospital physicians should be considered.

KEY WORDS: number of pediatricians, density of pediatricians.