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**PROBLEMS OF SAFETY, OCCUPATIONAL
 HYGIENE AND INFECTION CONTROL
 IN THE FIGHT AGAINST OCCUPATIONAL
 DISEASES OF HEALTHCARE WORKERS
 WITH COVID-19 IN TREATMENT
 FACILITIES OF UKRAINE**

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Ключевые слова: *COVID-19, условия труда, профессиональная заболеваемость медицинских работников, риск заражения*

Abstract. *Problems of safety, occupational hygiene and infection control in the fight against occupational diseases of healthcare workers with COVID-19 in treatment facilities of Ukraine. Yavorovsky A.P., Skaletsky Yu.M., Brukhno R.P., Shkurba A.V., Kirichuk I.M., Regan M.M. The objective of the publication was to assess the safety of treatment facilities, occupational health and infection control in Kiev, Zhytomyr and Zhytomyr region to enhance risk management of SARS-CoV-2 infection of healthcare workers and reduce occupational illness and COVID-19 mortality. Bibliosemantic, hygienic, questionnaire, statistical methods and methods of comparative and system analysis have been used. The work of doctors involved in overcoming COVID-19 pandemic is classified as dangerous (extreme). In addition to the SARS-CoV-2 virus, the working conditions of medical workers are influenced by physical, chemical factors and high physical and neuro-emotional stress. Among medical workers of the Zhytomyr*

region who were diagnosed with an acute occupational disease COVID-19, nurses prevailed (38.57%). Nurse assistants (26.1%) ranked the second in COVID-19 incidence, doctor's assistants (5.31%) ranked the third. The doctors' incidence was ranked in the following sequence: doctors of GPFM – 4.85%, surgeons – 4.16%, anesthesiologists – 2.54%, infectious disease doctors – 2.08%, radiologists – 1.85%. Such distribution of medical professions is observed in all Ukraine regions. Chance of becoming infected with SARS CoV 2 for healthcare workers in October was by 3.8 times higher than the general population. Risk of dying from COVID-19 in healthcare workers is greater by 1.5 times than that of the general population. The high level of occupational morbidity of COVID-19 in Ukrainian medical personnel is determined by personal negligence, incomplete staffing of treatment facilities (TF) with medical workers, medical workers with means of individual protection (MIP); nons-use of MIP if available, absence or poor-quality instruction on labor protection; shortage of epidemiologists, hygienists and occupational pathologists.

Реферат. Проблемы безопасности, гигиены труда и инфекционного контроля в борьбе с профессиональными заболеваниями медицинских работников на COVID-19 в лечебных учреждениях Украины. Яворовский А.П., Скалецкий Ю.Н., Брухно Р.П., Шкурба А.В., Киричук И.Н., Рыган М.М. Цель публикации состояла в оценке безопасности, гигиены труда и инфекционного контроля в лечебных учреждениях Киева, Житомира и Житомирской области для улучшения управления рисками заражения медицинского персонала вирусом SARS-CoV-2 и снижения профессиональной заболеваемости и смертности медицинских работников от COVID-19. При проведении исследования были использованы библиосемантический, гигиенический, анкетно-опросный, статистические методы и методы сравнительного и системного анализа. Работа медиков, занятых преодолением пандемии COVID-19, отнесена к опасной (экстремальной). Кроме вируса SARS-CoV-2, на формирование условий труда медицинских работников влияют сопутствующие физические, химические факторы и высокое физическое и нервно-эмоциональное напряжение. Среди медицинских работников Житомирской области, которым поставлен диагноз острого профессионального заболевания COVID-19, преобладали медицинские сестры (38,57%). Второе ранговое место по уровню заболеваемости COVID-19 занимали младшие медицинские сестры (26,1%), третье – фельдшеры (5,31%). Заболеваемость врачей ранжировались в такой последовательности: врачи ОПСМ – 4,85%, врачи-хирурги – 4,16%, врачи-анестезиологи – 2,54%, врачи-инфекционисты – 2,08%, врачи-рентгенологи – 1,85%. Такое распределение по медицинским профессиям в целом наблюдается по всем областям Украины. Риск заразиться SARS CoV 2 для медицинских работников по состоянию на начало октября был выше в 3,8 раза, чем среди общего населения. Риск умереть от COVID 19 у работников здравоохранения выше в 1,5 раза, чем среди общего населения. Главными причинами высоких уровней профессиональной заболеваемости медицинского персонала на COVID-19 в Украине следует определить работу в очаге заболевания, личную неосторожность пострадавших, не полную обеспеченность лечебных учреждений (ЛПУ) кадрами, медицинских работников средствами индивидуальной защиты (СИЗ); неиспользование СИЗ при их наличии, отсутствие или некачественное проведение инструктажа по охране труда; дефицит врачей-эпидемиологов, гигиенистов и профпатологов.

It is well known that all over the world the first and main category of risk of occupational infection during an epidemic of infectious diseases, regardless of age, immune status, the presence of comorbidities, are medical workers [6, 9].

On March 23, 2019 International Labor Organization (ILO) by the normative document "ILO Standards and COVID-19 (coronavirus) FAQ - Key provisions of international labor standards relevant to the evolving COVID-19 outbreak (23 March 2020, Version 1.2) recognized COVID-19 as a new occupational disease of the last decade and classified medical personnel as occupational group at risk [10].

The document emphasizes that COVID-19 is considered occupational if it develops as a result of occupational contact. In case of disability due to COVID-19, the medical worker is entitled to

monetary compensation, reimbursement of medical and social expenses, and in case of death, family members of the victim receive monetary compensation [6, 10].

In Ukraine, by the resolution of the Cabinet of Ministers № 394 from 13.05.2020 the disease COVID-19 was included in the list of occupational diseases and thus supplemented the list of occupational diseases approved earlier (Resolution of the Cabinet of Ministers of Ukraine № 1664 from 08.11.2000) [6].

The procedure for diagnosing acute occupational disease at COVID-19 is determined by the normative document "Procedure for investigation and accounting of accidents, occupational diseases and accidents at work", approved by the Cabinet of Ministers of Ukraine N 337 from 17.04.2019 [6].

The purpose of the publication was to assess safety, occupational health and infection control in treatment facilities (TF) in Kyiv, Zhytomyr and Zhytomyr region to improve the risk management of medical personnel with SARS-CoV-2 virus and reduce occupational morbidity and death of medical workers from COVID-19.

MATERIALS AND METHODS OF RESEARCH

Bibliosemantic, hygienic, questionnaire, statistical methods and methods of comparative and systematic analysis were used in the study [1, 5, 8].

Data from the TUI, the Cabinet of Ministers of Ukraine, operational information from the State Labor Service, data from the National Health Service of Ukraine, and the Public Health Center of the Ministry of Health of Ukraine were used.

A survey of 135 medical workers of 10 TF in Kyiv and Zhytomyr region was conducted using the questionnaire created by the authors of the article, which contained 54 questions and covered safety and hygienic aspects of medical staff, as well as issues of infection control [8].

The risk of infection with SARS-CoV-2 virus among the population was calculated from the ratio of the number of sick people to the population of the region, and the risk of infection of medical staff - from the ratio of sick medical workers to the number of medical staff [5].

Statistical estimation was performed according to generally accepted methods using the licensed program Microsoft Excel.

The research was conducted as part of the work on research "Scientific justification of the optimal risk management system to ensure a safe hospital environment" (state registration number: 0120U101432), which is being performed at the Department of Hygiene and Ecology №2 of OO Bogomolets NMU by order of the Ministry of Health of Ukraine.

RESULTS AND DISCUSSION

Due to high virulence and contagiousness, long-term survival on surfaces and objects and lack of population immunity, SARS-CoV-2 virus is classified as a causative agent of particularly dangerous infectious diseases (Order of the Ministry of Health of Ukraine dated 25.02.12020 №526). Therefore, the work of medical personnel professionally engaged in overcoming the pandemic COVID-19, according to the current hygienic classification of work is classified as dangerous or extreme (4th class) [3]. The danger in the hospital environment is formed not only by the SARS-CoV-2 virus, but also by concomitant chemical and physical factors, high physical and neuro-emotional stress.

Thus, our survey in Kyiv and Zhytomyr regions showed that the vast majority of medical workers are exposed to increased nervous and emotional stress (89.7% of Kyiv and 74.0% of Zhytomyr doctors). Among the reasons for this stress both Kyiv and Zhytomyr doctors ranked the danger of SARS-CoV-2 virus infection for their own health and the health of family members first, Kyivans ranked second long stay in protective equipment, Zhytomyr doctors – severe condition of patients, own mistakes which negatively affected the health of patients ranked third (Kievans), while a long stay in the means of individual protection (MIP) – Zhytomyr doctors.

In 22.9% of cases Zhytomyr doctors feel tired in the middle of the work shift, 66.7% – at the end of the work shift, and 28.2% of Kyiv doctors note the state of fatigue in the middle of the work shift and 79.5% – at the end of the work shift.

94.9% of doctors in Kyiv hospitals are sufficiently provided with MIP, while in Zhytomyr hospitals – only 62.5% of respondents.

Tests for COVID-19 by PCR were performed in 74.5% of Kyiv and 56.5% of Zhytomyr doctors, although all Kyiv and Zhytomyr doctors were involved in the reception, examination and treatment of COVID-19 patients.

Vaccination of Zhytomyr doctors against infectious diseases at the expense of the state is carried out in 68.8% of respondents, and of Kyivans - in 18.0% of respondents.

Among the physical factors, Zhytomyr doctors most often note the effect of ultraviolet radiation (22.9%), in second place – noise from equipment (20.8%) and in third place (16.7%) – ionizing radiation. Their Kyiv colleagues also rank ultraviolet (48.7%) and noise (20.51%) in first and second place, and electromagnetic radiation – in the third (18.0%).

Adequate lighting in the workplace and sufficient ventilation efficiency are noted by 90.6% and 50.0% of Zhytomyr doctors and 51.3% and 30.8% of Kyiv ones, respectively.

It should be noted that the lack of lighting increases the frequency of accidents (prick of a needle, cuts by a scalpel, etc.), injuries from falls.

One should also pay attention to the presence of special requirements for ventilation systems in infectious diseases units. For example, the WHO in order to ensure the safe and comfortable stay of medical staff in intensive care units with patients with COVID-19 recommends the supply of clean air in the room at a rate of at least 160 l/sec. per one patient [2]. In Ukraine, at the moment there is a re-profiling of general somatic units for the admission of patients with suspected or diagnosed COVID-19

without taking into account the requirements for ventilation systems of infectious departments.

Among harmful chemical occupational factors, Kyiv (71.8%) and Zhytomyr (57.3%) doctors most often mention the presence of biocides and drugs – 46.2% and 39.6%, respectively. Interviewed Kyiv doctors noted offensive odor – 41.0%, irritation of mucous membranes or skin – 35.9% and allergic reactions – 18.0%, as a manifestation of the influence of chemical factors and their Zhytomyr colleagues noted the importance of these manifestations at the level of 51.0%, 45.0% and 33.3%, respectively.

During 2019-2020 almost every 5th of Zhytomyr doctors noted that he/she was injured from 1 to 10 times because of a slippery floor, 11 doctors – because of slippery paths in the territory of the TF, 8 doctors – because of foreign objects underfoot and lack of handrails on ascents and descents, and 6 ones - high doorsteps. Approximately at the same level, the problem of injuries was noted by Kyiv doctors.

The similar were rates of injuries of Kyiv and Zhytomyr doctors resulted from pricks or scratches of an injection needle or broken glass when opening ampoules, as well as from burns. The number of cases of musculoskeletal injuries, recorded mainly during the movement of patients did not differ significantly in the surveyed groups of physicians.

According to the analytical panels of the Cabinet of Ministers of Ukraine [4], the provision of TF of Ukraine with medical staff providing care to patients with COVID-19 at the end of September 2020 averaged 83.5%. The lowest indicator was in Kharkiv region (72.8%), and the highest – in Rivne region (91.88%). In Kyiv, the staffing of TF was at the level of 83.69%, and in the Zhytomyr region – 78.53%. Understaffing of treatment facilities with medical staff leads to increased physical and emotional stress of their work, faster development and accumulation of fatigue.

Low levels of provision of medical staff with MIP also attract attention [4]. The highest figure in Ukraine was in mid-August 2020 and amounted to 76.1% of Ukraine's real demand. Since then, there has been a clear tendency to reduce the provision of medical staff with MIP. Within a month and a half, this figure decreased by more than 7% and as of early October it was only 69%. The lowest figure was in Khmelnytsky region (53.89%) and the highest – in Kirovohrad region (95.22%). In Kyiv, the provision of medical staff with MIP was at the level of 67.84%, and in Zhytomyr region – 69.49%.

At the same time, the level of provision of TF with MIP such as reusable medical masks and bio-seal suits was lower than 50% (48.1% and 43.3%, respectively), the provision with disposable insulating gowns was 55.3%.

Characterizing the impact of the above factors on the health of medical workers, it should be noted that the disease incidence of medical staff, as well as of the general population has been steadily increasing since the beginning of the epidemic (Fig.).

As can be seen from the figure, as of the end of September 2020, 14,492 confirmed cases of COVID-19 in medical personnel were registered in Ukraine (the population with a confirmed diagnosis of COVID-19 was 208,959 people). The proportion of sick medical workers in the structure of sick population in total was 6.94%. It is worth noting that this figure decreased almost three times compared to the highest officially recorded during quarantine in Ukraine (19.43%, as of May 2020).

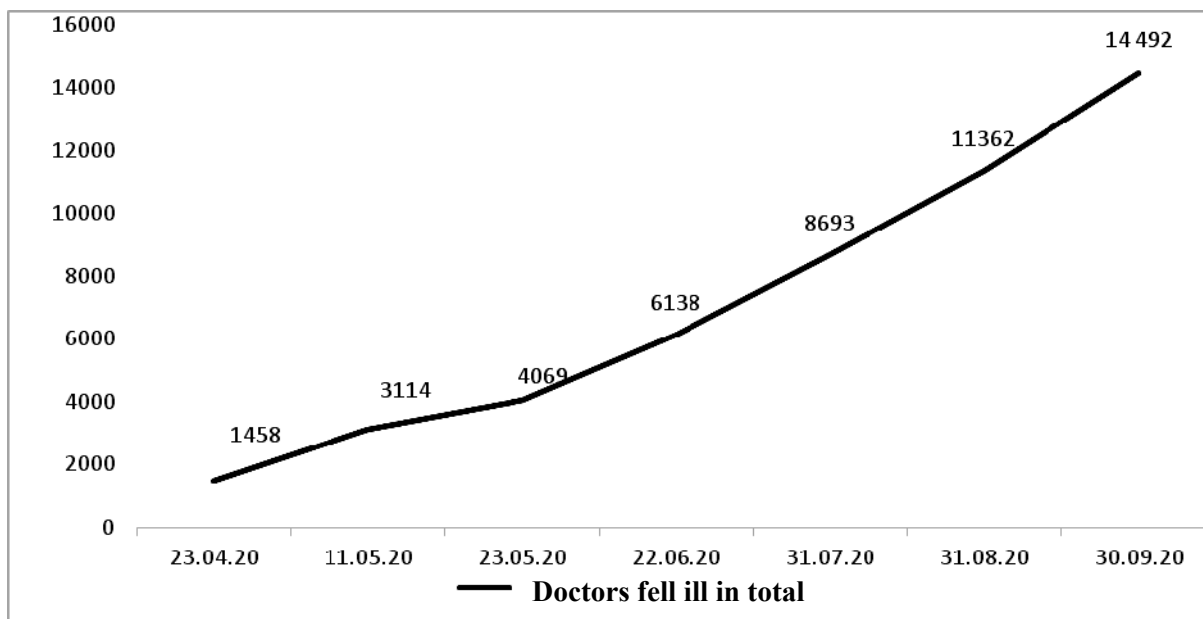
Data of Prof. D.V. Varyvonchuk [11] indicate that the average growth rate of new cases of SARS-COV-2 virus infection by the indicator "persons/day" (i.e. "the number of persons infected per day") on the relevant 7 dates, among medical workers was: 18.3; 93.6; 80.6; 78.6; 85.9; 59.9; 114.7; 187.7 (Figure 1). The indicator "persons/day" increased by 10.3 times among medical workers during the observation period.

According to Prof. D.V. Varyvonchuk, as of October 2, 2020, the cumulative mortality among medical workers made up 131 people, being 0.8%. Mortality from COVID-19 among population in this period was registered at the level of 2% [11].

The analysis of the distribution of new cases of SARS-CoV-2 virus infection among healthcare workers by days of the week showed that the highest number of infections among medical personnel occurs on Friday and Saturday. The least number of new cases was registered on Monday. This pattern of increasing number of infections with SARS-CoV-2 virus at the end of the working week can be explained by the accumulation and development of fatigue in medical staff during the working week, which leads to physiological changes in CNS structures responsible for acute perception of danger [2, 7, 9].

The analysis of COVID-19 incidence rate of medical workers by professions showed that the highest ranks in the number of occupational diseases are among nurses (38.57%), nurse assistants (26.1%), doctor's assistants (5.31%) and administrative staff. Among specialists GPFM doctors (4.85%), surgeons – 4.16%, anesthesiologists (2.54%), infectious disease doctors (2.08%), radiologists (1.85%) predominate.

According to our calculations, the risk of contracting SARS CoV 2 by health care workers at the beginning of October was 3.8 times higher than in the general population. Healthcare workers are 1.5 times more likely to die from COVID-19 than the general population.



Dynamics of confirmed cases of COVID-19 in medical workers over the period from 23.04 to 30.09.2020 (according to the State Labor Service)

At the end of September 2020, the part of completed investigations of COVID-19 occupational disease among healthcare workers was 24.6% nationwide. In Volyn, Odesa, Rivne, Zaporizhia, Chernivtsi, Sumy regions and the city of Kyiv, this figure did not exceed 20%; in the Zakarpattia region only 3.4% of cases have been investigated at that time.

Commissions that worked in Kiev and Zhytomyr region among the causes of COVID-19 occupational infectious disease in medical workers noted the following: personal negligence, the absence or non-use of MIP if available; use of MIP that do not correspond to the degree of existing risks to the life and health; lack of instruction on labor protection, which is especially important for nurses and nurse assistants; work in the focus of the disease; other causes (for example, violation of the distinction between clean and virus-contaminated areas in the TF).

In our opinion, the causes of COVID-19 occupational disease among medical workers include the shortage of medical staff in the TF of Ukraine and the shortage of MIP. The shortage of medical staff leads to an increase in the duration of work of existing staff in the medical institution and an increase in the level of nervous and emotional stress, and the shortage of MIP in such working conditions significantly increases the risk of SARS-CoV-2 virus infection.

The lack of objective possibility in TF to timely and fully perform commission investigations on the circumstances and causes of occupational diseases and deaths among health workers according to the

Resolution of the Cabinet of Ministers from 17.09.2019 N 337 "On Approval of the Procedure for Investigation and Accounting of Accidents, Occupational Diseases and Accidents at Work" should also be considered the cause of the high level of COVID-19 sick rate of health workers. Due to the acute shortage or complete absence of hygienists, epidemiologists and occupational pathologists in the relevant staff structures instead of 5 days attempted to the investigation of the occupational disease provided by the Cabinet of Ministers, the work is delayed for a weeks and a months.

CONCLUSIONS

1. From a safety, hygienic and epidemiological point of view, the work of medical staff is associated with possible professional contact with the SARS-CoV-2 virus, which is classified as a pathogen of particularly dangerous infections. According to the Hygienic Classification, such work is characterized by the highest hazard class – 4.

2. In addition to the highly pathogenic SARS-CoV-2 virus, working conditions are influenced by concomitant physical, chemical factors and high physical and neuro-emotional stress. In combination, they enhance each other's effects and cause the functional accumulation of fatigue in health care workers, which in turn increases the risk of COVID-19 occupational disease.

3. The analysis of COVID-19 occupational sick rate in medical workers by profession showed that more than a third of sick medical workers in the

Zhytomyr region (38.57%) were nurses, nurse assistants ranked second (26.1%), doctor's assistants – the third (5.31%). The sick rate among physicians was ranked as follows: GPFM doctors – 4.85%, surgeons – 4.16%, anesthesiologists – 2.54%, infectious disease doctors – 2.08%, radiologists – 1.85%. Such a distribution by medical professions is generally observed in all regions of Ukraine.

4. The main reasons for high levels of occupational sick rate in medical workers are: personal negligence, non-use of MIP if available, work in the focus of the disease, lack or poor quality of occupational safety training at work in harmful and dangerous conditions; incomplete provision of health care facilities with health care workers (79.4% available) and adequate MIP (68.3%);

shortage or complete absence of epidemiologists, hygienists and occupational pathologists, which not only makes it impossible to timely investigate cases of COVID-19 occupational disease in health workers and death from it, this does not allow carrying out the necessary anti-epidemic and sanitary measures at the state level in full.

5. The risk of contracting SARS-CoV-2 in healthcare at the beginning of October was 3.8 times higher than in the general population. Healthcare workers are 1.5 times more likely to die from COVID-19 than the general population.

Conflict of interest. The authors declare no conflict of interest.

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