HYGIENIC ASSESSMENT OF RISK FACTORS AND HEALTH OF FORENSIC SCIENTISTS

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The objective of the study was to develop and implement the system of hygienic measures eliminating (mitigating) the impact of risk factors in the work of forensic scientists and to estimate effectiveness of these measures and the program aimed at improvement of employment terms for forensic scientists [1, 2]. Forensic scientists were compared to a control group of other doctors. The following researches were carried out: survey of 303 forensic scientists, analysis of their employment terms based on employment terms special evaluation (2,736 materials of employment terms special evaluation), examination of forensic scientists' health compared to other doctors by analyzing medical examination results (309 health records). Protection and promotion of working population's health is the state priority. Its purpose is to preserve labor potential and create conditions for economic development of the country. Medical workers are exposed to a combined, complex, and associated effect of working environment conditions and parameters [3, 4]. Industrial and social factors can result in a rising incidence, reduction in life expectancy, ill health and medical staff performance increment, and require preventive measures. Those working for forensic expert organizations constitute a special population due to a large number of professional, medical and organizational, and social risk factors [5].

Keywords: forensic scientist, risk factors, occupational hazard

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Compliance with ethical standards: This trial was approved by the National Office of the Chief Medical Examiner of the Republic of Tatarstan (Protocol No. 4 dated 14.03.2019). Consent shall be given voluntarily by every participant. Adults were surveyed on a voluntary basis using questionnaires. The conducted trial doesn't expose participants to danger and corresponds to the requirements of biomedical ethics.

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ГИГИЕНИЧЕСКАЯ ОЦЕНКА ФАКТОРОВ РИСКА И СОСТОЯНИЕ ЗДОРОВЬЯ СУДЕБНО-МЕДИЦИНСКИХ ЭКСПЕРТОВ

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Целью исследования являлась разработка и внедрение системы санитарно-гигиенических мероприятий по устранению (снижению) воздействия факторов риска в работе судебно-медицинского эксперта и оценка их эффективности, а также программы, направленной на совершенствование условий труда специалистов судебно-медицинской экспертизы [1, 2]. Сравнительный анализ проводился с контрольной группой врачей других специальностей. Выполнены исследования: анкетирование 303 судебно-медицинских экспертов, анализ условий труда по данным специальной оценки условий труда (2736 материалов специальной оценки условий труда), изучение состояния здоровья судебно-медицинских экспертов по сравнению с врачами других специальностей путем анализа результатов медицинского осмотра (309 медицинских карт). Приоритетным направлением государственной политики является охрана и укрепление здоровья работающего населения с целью сохранения трудового потенциала и создания условий для экономического развития страны. Медицинские работники подвергаются сочетанному, комплексному, комбинированному воздействию условий и параметров производственной среды [3, 4]. Воздействие производственных, социальных факторов могут привести к росту заболеваемости, сокращению продолжительности жизни, ухудшению состояния здоровья и снижению работоспособности медицинского персонала и требует проведения профилактических мероприятий. Работники судебно-медицинских экспертных учреждений являются особой группой в связи с большим количеством профессиональных, медико-организационных, социальных факторов риска [5].

Ключевые слова: судмедэксперт, факторы риска, профессиональная вредность

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Соблюдение этических стандартов: Данное исследование было одобрено ЛЭК ГАУЗ «Республиканское бюро судебно-медицинской экспертизы Министерства здравоохранения Республики Татарстан (Протокол № 4 от 14.03.2019). Добровольное информированное согласие было получено для каждого участника. Проведение опроса для взрослого населения проводилось на добровольной основе с использованием анкет. Поведенное исследование не подвергает опасности участников и соответствует требованиям биомедицинской этики.

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Currently, we almost lack legal framework for material and technical equipment of buildings and premises which are parts of forensic medical expert institutions. According to par. 11 of Order of the Ministry of Health of the Russian Federation dated 06.06.2013 No. 354н Concerning the Procedure for Post-Mortem Examinations (hereinafter referred to as Order No. 354н), if signs of especially dangerous infectious diseases are found in the dead, stillborn child or fetus, post-mortem examinations are performed in isolated premises of the office (department) of post-mortem examinations, where such postmortem examinations need to be carried out. Based on the requirements of state sanitary and epidemiological rules and hygienic norms, a detailed analysis, search for decisions and measures of adequate and safe activity are required.

Some researches draw our attention to hard work of forensic scientists and non-compliance of their salary to the actually performed volume of work. This is accompanied by low mood, low self-esteem, and emotional lability as important parts of human life quality. According to researchers, forensic scientists reported that they cared of their health, had an active way of life, went in for sports and ate healthy 3.2 and 2.9 times less frequently than therapists and surgeons, respectively.

As cadavers may pose infection hazards to those who handle them, the issues of hygiene, labor protection and sanitary and epidemiological safety of forensic scientists are still the issues of interest.

The measures protecting forensic scientists from a harmful effect of biological hazards associated with cadavers are underdeveloped. This makes the research relevant. Regulatory documents on design of post-mortem examination departments are either not developed or old.

Upgrade of hygienic approaches during production environment assessment would take control of many factors that constitute a risk for the health of forensic scientists to a new level.

The factors associated with a way of life and influencing one's health include as follows: leisure organization, emotional microclimate in the family, nutrition, sleep, general state of mind, physical activity, smoking and alcohol consumption. It is established that 47.5% and 32.7% of those responded reported such harmful habits as smoking and alcohol consumption, respectively. Assessment of alcohol consumption frequency has shown that 89.17% drink alcohol on official days off, and 10.83% have it every weekend. 37.1% take strong alcoholic beverages (spirit, vodka, cognac, whiskey, rum), 45.7% have other beverages (beer, wine), 17.1% take energy drinks. According to smoking intensity, all smokers were divided into the following groups: 23% of those smoking up to 5 cigarettes a day, 22% of those with 5–10 cigarettes, 50% of those with 10–20 cigarettes, and 5% of those with high smoking intensity (over 20 cigarettes a day). Thus, high prevalence of tobacco dependence and alcohol consumption can be noted [6].

Working environmental factors (temperature of air, noise, etc.) also produce an unfavorable effect on labor process conditions. Intensity of work with frequent attendance on weekends and holidays is the factor of the labor process, which influences a worker's health.

Hygienic measures that must be used to weaken unfavorable factors of the industrial process and preserve health include as follows: installation of mobile devices (pneumatic tubes) at the Chief Medical Examiner department to transport the sample taken there to the laboratory (the devices prevent transition of the infection into other structural subdivisions of the office); installation of the laminar flow system in the room where especially dangerous infections are handled. The system inactivates any microorganisms present in the treated air; develops and applies cadaveric special markings (the marking denotes possible cadaveric contamination, including contamination with especially dangerous infections, which require sanitary protection measures for the area); develops and applies on-site special bags containing hygienic means (when mobile teams are engaged).

Medical and organizational measures must embrace as follows: preliminary and periodic medical examinations to reveal people with contraindications to work for health reasons and to detect initial signs of diseases in employees, educative activity intended to eliminate bad habits and use personal protective equipment.

The objective of the study was to develop and implement the system of hygienic measures eliminating (mitigating) the impact of risk factors in the work of forensic scientists and to estimate effectiveness of these measures and the program aimed at improvement of employment conditions for forensic scientists.

MATERIALS AND METHODS

Social and hygienic assessment of a way of life and working conditions for forensic scientists from offices of the Chief Medical Examiner was done by analyzing survey data. A questionary specially developed by the author was used. The tool took into account the specific scope of work at offices of the Chief Medical Examiner. Work of forensic scientists underwent a special assessment in accordance with the legislation in place.

The specific weight was 49% for the surveyed men (and 51% for women). After distribution of those surveyed into age groups it was found out that the preferential age of doctors was 50–59 years (23%) for the National Office of the Chief Medical Examiner of the Republic of Tatarstan, and 25–30 years (20.9%) for the Voronezh Regional Office of the Chief Medical Examiner. 37 doctors (17.1%) have less than 5 years of service, 24 (11.1%) have 5 to 10 years of service, 36 (16.6%) have 10 to 15 years of service, 21 (9.7%) have 15 to 20 years of service, 41 (18.9%) have 20 to 25 years of service, 29 (13.4%) have 25 to 30 years of service, 22 (10.1%) have 30 to 35 years of service. The years of service underwent a comparative analysis. During the analysis, it was found out that the preferential length of doctors' service was 20 to 25 years (18.9%) for the National Office of the Chief Medical Examiner of the Republic of Tatarstan, and 5 to 10 years (20.9%) for the Voronezh Regional Office of the Chief Medical Examiner.

The results of regular medical check-ups were used when assessing health of forensic scientists. They were comparatively compared with the control group of other doctors. Statistical analysis was done using the R computing environment (v. 3.5.2).

This trial was approved by the National Office of the Chief Medical Examiner of the Republic of Tatarstan (Protocol No. 4 dated 14.03.2019). Voluntary informed consent was provided by every participant. The conducted study doesn't expose participants to danger and corresponds to the requirements of biomedical ethics.

TRIAL RESULTS

The trial results were implemented into organizational and practical work of the National Office of the Chief Medical Examiner of the Republic of Tatarstan. The trial results are used to educate students from the department of general hygiene

of the Kazan State Medical University and students from the pediatric hygiene department of Pirogov Russian National Research Medical University (students specializing in Hygiene and surgery residents specializing in Hygiene and Epidemiology in Emergencies).

Study records were obtained during a sociological study using a developed questionnaire, which considers the specifics of work in the Office of the Chief Medical Examiner.

Factors related to the way of life and influencing health have been assessed. They include as follows: organization of leisure time, emotional microclimate in the family, nutrition, sleep, general state of mind, physical activity, smoking and alcohol consumption.

A very insignificant number of people who regularly go in for sports has been established. According to the analysis of physical activity, 21% of those requested don't go in for sports at all.

65.3% of those responded reported chronic diseases; 34.7% had no chronic diseases at all. Diseases of the digestive system, respiratory diseases and allergic disorders prevail among chronic diseases. No significant differences were found during a comparative analysis of chronic morbidity in doctors from the National Office of the Chief Medical Examiner of the Republic of Tatarstan, and the Voronezh Regional Office of the Chief Medical Examiner (Pearson χ^2 criterion = 2.64, p level 0.104).

Those surveyed were asked about the working environmental factors (air temperature, noise, etc.), emergency situations, availability of first-aid kits (anti-AIDS, antishock), availability of personal protective equipment, occupational health and safety compliance/non-compliance. Based on questionnaire screening, 58.9% are satisfied with on-site air temperature, whereas 41.1% don't like it. 38.7% of those requested reported occupational noise. 81.9% liked the light environment, whereas 18.1% didn't. 50% of all surveyed employees weren't satisfied with ventilation quality. Thus, we need to develop a plan of measures to improve the ventilation regimen in the office. 57.9% of those surveyed mentioned enough available first aid kits, 35.3% said that the kits were not enough and unavailable, 6.8% reported enough but unavailable kits. 82.3% of employees pointed at a sufficient number of individual protective devices, whereas 17.7% reported the opposite. Intensity of work was one of labor process factors influencing a worker's health. When answering the question 'Do you feel tired when processing information (while working with the documents)?' 65.7% gave a positive answer, and 34.3% provided a negative response.

Other questions were used to examine the emotional microclimate in the office. The employees estimated the level of their comfort as rather high ('good' for 34.1% and 'excellent' for 56.2%). The level of comfort during business communication with direct supervisors was lower: 'good' for 22.7% and 'excellent' for 66.2%. During communication with the senior management of the office the level of comfort is also lower as compared to communication with colleagues ('good' for 28.4% and 'excellent' for 54.8%). There were single cases of 'bad' and 'very bad' responses. Half of the employees provided a positive answer to the following question: 'Do you feel the symptoms of emotional burn-out (fatigue, unwillingness to communicate, apathy, physical distress, insomnia, anxiety, inability to restore strength after weekends)?' [7]. Moreover, 26.3% of the employees stated that they needed professional psychological aid in case of negative emotions during communication with colleagues, severe circumstances, accumulation of stress leading to psychological breakdown, depression, and acute conflict with others.

Labor conditions of forensic scientists were analyzed based on labor condition special assessment data.

Parameters of biological, chemical and physical working environmental factors were examined on-site, and the workload and intensity parameters were determined [8].

Labor conditions assessed by harmful factors are presented in the table.

DISCUSSION OF RESULTS

The trials conducted showed that forensic scientists' labor conditions can be characterized as follows: the category of occupational risk relates to the average (significant) risk with the index of occupational diseases (IOD) being equal to 0.12–0.24 (according to P 2.2.1766–03 Guideline Assessing the Professional Risk for Worker's Health. Organizational and Methodological Basis, Principles and Criteria of Estimation). The parameter is determined according to the following formula: IOD=1/(RC*SC), where RC is a risk category and SC is a severity category. Measures to decrease the risk are required under the given conditions.

A forensic scientist must carry out labor functions associated with a biological danger such as forensic examinations of cadavers and other types of expert work; attendance as part of crime scene investigation team comprising necroscopy protocols; visits to examine cadavers in case of emergencies associated with mass fatality incidence.

The total specific gravity of forensic scientists operating under harmful conditions was 100%.

CONCLUSION

On-site labor conditions for forensic scientists can be characterized as harmful according to the biological factor, chemical factor and labor process severity parameters (class 3.1–3.2). Indoor climate (average air temperature in the working area) (41.0%), noise (38.7%), high risk of infection while working with the sources of especially dangerous infections are subjectively considered by employees as the most unfavorable ones. A high percentage of people with cuts by medical

Table. Characteristics of labor conditions for forensic scientists

Working environmental and labor process factors	Class (subclass) of labor conditions
Chemical	3.1 (substance-formaldehyde)
Biological	3.2
Light environment parameters	2
Labor process workload	3.1
Labor process intensity	1
Final class (subclass) of labor conditions	3.2

instruments during forensic examinations (37.7%) is associated with not enough and/or unavailable first-aid kits (anti-AIDS, antishock) (42.0%). 17.7% lack individual protection means. The majority of forensic experts have II and III health groups (94.8%) with 2.8 diseases per one medical worker in average. Eye disorders are ranked first and followed by respiratory diseases, circulatory diseases, locomotor disorders, diseases of the digestive system, and infectious disorders. Female forensic scientists (over 70% of workers) often suffer from the diseases of the genitourinary system due to the contact with formaldehyde. The experts' blood chemical values show an increased level of GGT, cholesterol, and high and low levels of glucose (valid differences, $p \leq 0.001$). High level of professional burnout is typical of 50.3% of forensic scientists. Social risk factors influencing health of forensic scientists such as high prevalence of tobacco dependence and alcohol consumption are found out.

A program aimed at improvement of forensic scientists' employment conditions, educative activities decreasing the spread of bad habits and preventing professional burnout, initiating promotion events to strengthen responsibility for employees' health (encouraging those who lead a healthy way of life, stopped smoking, underwent profound medical exams) has been suggested.

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