

Ministry of Public Health of Ukraine  
“Ukrainian Medical Stomatological Academy”

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METHODICAL INSTRUCTIONS  
FOR INDEPENDENT WORK OF STUDENTS DURING PREPARATION  
TO PRACTICAL (SEMINAR) CLASSES AND IN CLASS

Academic subject	Safety of Vital Functions. Bioethics
Module No 1	Safety of Vital Functions. Bioethics
Topic	Professional harm in professional duties of medical workers
Year of study	I
Faculty	Dental, Medical
Number of academic hours	2

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### 1. Relevance of the topic

Doctors' labor is very complicated, multivarious and hard. It makes high demands to the organism of a doctor. For successful medical and diagnostic work it is necessary to create an optimum work conditions for a doctor. There are many negative factors of the environment influence the organism of doctors of different specialties. These factors are connected with the use of sophisticated medical apparatus, numerous drugs, various working factors, etc. Different types of doctors' labor have a lot of common features.

### 2. The aims of the training course:

To know the basic concepts about safety of doctors.

To seize skills on recognition of threats of factors of an environment.

### 3. Materials for the before-class work and self-preparation work

Names of previous disciplines	Practical skills
1. Chemistry 2. Physics 3. Microbiology 4. Physiology 5. Anatomy	1 .To define main principles of ability to live of the person 2.To analyze and estimate dangerous to a life and health professional activity and independently to make the decision on carrying out of urgent measures.

### 4. Tasks for independent work during preparation for the lesson.

#### 4.1. A list of the main terms, parameters, characteristics that a student should take when preparing for the class

Term	Definition
1. Sharp professional disease (intoxication)	occurs suddenly, after disposable influence concerning high concentration of chemical substances, which is in the air of working zones.
2. Chronic diseases	arise in consequence of long but low influence (not more than MPC, MPL, MPD) concentration, levels, dozes harmful industrial - professional factors.

#### 4.2. Theoretical questions to the class:

1. Concepts about professional harms.
2. Occupational hazards and labour protection of medical personnel of different medical departments (surgical, therapeutic, infectious diseases, psychoneurological and others).
3. Occupational hazards and labour protection of the medical personnel of diagnostic, physiotherapeutic, balneologic and other specific departments, intensive care units and medical institution laboratories.
4. Legislative and organizational measures concerning the medical workers' labour protection.
5. Personal patients' and medical workers' hygiene within the system of health and labour protection, prophylaxis of nosocomial infection and occupational diseases.

### 5. The contents of a theme:

#### *Dangerous and hazard industrial factors*

All dangerous and hazard industrial factors are divided into 4 groups: physical, chemical, biological, psychophysiological.

**Physical factors**, among which most frequent is **unfavorable microclimate**. Surgeons undergo the action of this factor during their work for a long time in the operating room, as well as district therapeutics and pediatricians, doctors of ambulance. Radiologists, roentgenologists, surgeons, traumatic surgeons, therapeutics, undergo the action of **ionizing radiation** during roentgenological examinations of patients. Surgeons undergo the action of **higher atmospheric**

**pressure** during carrying out operations on the heart, large vessels and other operations, connected with high risk in the bar operating rooms. Pressure in bar operating room is about 2-3 atmospheres. Surgeons work in atmosphere, which contains pure oxygen.

**Noise** connected with work of different apparatus and machines (for example, apparatus of mechanical lung ventilation) is a factor of doctors' labor. Sometimes noise reaches 60-70 dB. Psychiatrists undergo the action of **ultra-violet radiation**. **Laser-radiation** is widely used in surgery, ophthalmology and other branches of medicine. **Electro-magnetic fields** influence surgeons, psychiatrists during their work.

**Chemical factors** influence the doctors' organism. Air of hospital rooms is polluted by chemical substances (ozone, nitrogen oxides, antibiotics, narcotic substances). Sixty per cent of all professional diseases of doctors are connected with chemical substances. Chemical substances can cause allergic diseases, bronchial asthma, rhinitis, bronchitis, allergic myocarditis, dermatitis, etc. Surgeons, anesthesiologists, psychiatrists, dentists are very frequently exposed to the action of chemical factors.

Behind a method of penetration into an organism: through respiratory ways, through digestive system, through a leather(skin) (chemical burns);

By the level of toxic :very high (MPC at air < 0,1 mg/m<sup>3</sup>), highly toxic (MPC 0,1 - 1,0 mg/m<sup>3</sup>), average high (MPC 1,0- 10,0 mg /m<sup>3</sup>), hardly toxic (MPC > 10,0 mg / m<sup>3</sup>).

**Biological factors.** Infectious danger is peculiar to all doctors, especially in-fictionists, phthisiatricians, pediatricians. Diseases of doctors connected with biological factors make up 30 % from total number of diseases; the other diseases make up 10%.

The influence of negative factors causes a specific picture of doctors' morbidity. Very often doctors have diseases of respiratory system, circulatory system, alimentary canal, urogenital system, etc.

#### **The group of psychophysiological factors:**

Physical overstrain: static (keeping of the big cargoes); dynamic (a raising and moving of the big cargoes) hypodynamic, forced position of a body, overstraining organs of body. Nervous - psychological overstrain: mind overstrain, an overstrain of attention, intensive change work processes, monotony of work, emotional pressure.

#### **Separate sharp and chronic professional diseases:**

**Sharp professional disease** (intoxication) occurs suddenly, after disposable influence concerning high concentration of chemical substances, which is in the air of working zones.

**Chronic diseases** arise in consequence of long but low influence (not more than MPC, MPL, MPD) concentration, levels, dozes harmful industrial - professional factors.

In daily professional work of the doctor his organism can undergoes the influence of professional harmful factors of different direction actions:

#### **Physical nature:**

- microclimatic conditions,
- illumination,
- noise,
- ultrasound,
- different kinds electromagnet radiation - ultra-violet, infra-red, ionizing kinds

#### **Chemical nature:**

- medicine of a chemical origin,
- disinfectants,
- solvents and others.

#### **Biological nature:**

- microorganisms,
- medicine of a biological origin.

#### **The psychological nature:**

- The high level of responsibility for consequences of your professional activity,
- Constant contact to the patient and others .

#### **Characteristics of occupational hazards for different medical personnel**

The occupational exercise load and hazards of the surgical specialties doctors include:

-the number of surgical interventions is up to 150 per year in general surgery, 170 – in otorhinolaryngology, 370 – in obstetrics and gynecology. The number and complexity of the operations increase with the raising level of the surgeon's skill;

-the forced body position with the trunk frontal bending and the prolonged static tension of muscles of the shoulder girdle, back and stretched forward arms;

-the hot microclimate of the operating room with high streams of the radioactive heat from the artificial lighting sources (shadow less lamp);

-the ionizing radiation during the X-ray examinations, especially in traumatology, vascular surgery, neurosurgery;

-the toxic effect of the narcosis agents (nitrogen, halothane, chloroform, diethyl ether) and anesthetics;

-high mental and nervous-emotional exertion, connected with the complexity and duration of the surgical intervention, possible post-operative complications and responsibility for patient's life.

Among the diseases afflicting the surgical specialties doctors with temporary disability the diseases of nervous system, cardio-vascular system, digestive system and acute respiratory diseases are the most widespread.

Among chronic diseases of these specialists such diseases, as the diseases of cardio-vascular system, connected with high psycho-emotional and physical load should be mentioned. They are: angina pectoris, hypertension, vegeto-vascular dystonia.

There are frequent diseases due to the prolonged standing at the surgical table: radiculitis, osteochondrosis, dyskinesia, varix dilatation of the lower extremities.

Surgeons' disability or necessity to change their occupation in 60 – 80 % cases can be explained by chronic intoxication with narcotic agents and anesthetics, in 11 – 20 % cases - by the infectious diseases, 9 – 10 % cases - by physical and nervous overexertion.

Hygienic peculiarities of labour conditions and health status of the therapeutic doctors depend on the patient service forms. In case of polyclinic, district service, the leading role belongs to the excess physical load, which depends on the year season (amount of calls), the size of the doctor's district and the type of the buildings (detached houses or many-storied buildings, elevator's presence or absence). These specialists may also suffer from psycho-emotional exertion and different physical factors' unfavorable effect – X-ray, ultrasound, laser and other diagnostic and physiotherapeutic measures, chemical harmful substances – the pharmacological preparations, from which nurses suffer more frequently.

Occupational diseases of therapeutic doctors, first of all of the phthisiatricians, infectiologists, dermatologists, helminthologists, the laboratory assistants at the bacteriological, virological, helminthological laboratories include the corresponding infections; phthisiatricians, X-ray doctors, radiologists suffer from dermatitis, exzemas, toxicodermia, melanomas, leucosis, skin cancer, radiation sickness; psychiatrists from psychoneurosis.

One of the main occupational hazards for dental doctors is their forced standing with the bending and turning trunk position which leads to the prolonged static tension of the corresponding muscles groups; noise and vibration due to drilling machines, sight exertion, blinding effect of the photopolymer lamp, penetration of mercury from the mercury amalgam into the respiratory organs, fumes of the polymer materials solvents, danger of infection from the patient with the upper respiratory tract diseases during the incubation or convalescence stage, while performing the manipulations connected with the patient's mucosal membrane or blood contact.

Abovementioned hazards can result in bearing disorder (34 – 45%), varix dilatation of the lower extremities (19 – 49%), signs of the vibration diseases (paresthesia, loss of hands' temperature sensibility and perceptibility, Dupuytren's contracture).

The visual analyzer exertion can lead to the accommodation spasm, so-called false myopia, and sore eye.

### **Maintenance of radiating safety of the personnel at radiological researches**

Radiological researches as an additional method of diagnostics are widely used in medical practice. Decrease(reductions) in the beam loading received by the personnel at radiological

researches, can be achieved by the rational antiradiation protection. It is organized by system, which base on the following principles.

***Principle of correctness:***

The irradiation should be proved and be appointed exclusively by the doctor for achievement diagnostic and therapeutic effect which cannot be received by other methods of diagnostics and treatment.

***Principle of optimization:***

Collective dozes which are received with the population at carrying out of radiological and radiological procedures, should be so low as far as it is possible with taking into account economical and social factors.

***Principle of not excess:***

Sizes of dozes of an irradiation should be established only by the doctor for each patient individually proceeding from the prevention(warning) of occurrence effects which determine in healthy fabrics and an organism as a whole.

Norms of radiating safety establish such categories of people which can give in to an irradiation:

- **category A** (Personnel) people who work with sources of ionizing radiation constant or temporarily
- **category B** (personnel) - People which don't work with sources of ionizing radiation but location of their working places in premises(rooms) and on industrial platforms of objects with radiation-nuclear technologies can receive additional radiation.
- **category C**- all population.

**Radiating safety of the personnel of radiological departments**

As well as in X-Ray room, a source of harmful factors of radiological branches is ionizing radiation.

As against operating conditions of doctors - radiologists ionizing radiation in radiological branches can create not only the closed sources of ionizing radiation but also open.

«**Closed**» Such sources, which radioactive substance does not get into an environment (X-ray, scale cobalt guns, B - thrones). Principles of radiating protection of the personnel are based on actions of protection against external radiation.

«**Open**» such sources, which radioactive substance get into an environment (using of radioactive iodine - 131). Principles radiation protection of the personnel are based on actions of protection against internal and external radiation.

**According to use of a source of ionizing radiation exist features of radiation protection**

	Kind of a source	
	«Closed» sources (external radiation)	«Open» sources (internal and external radiation)
Principles of radiating protection of the personnel	<ol style="list-style-type: none"> <li>1. Protection by the screen.</li> <li>2. Protection by the distance.</li> <li>3. Protection by time.</li> <li>4. Protection by doze.</li> </ol>	<ol style="list-style-type: none"> <li>1. Use radiating aseptie .</li> <li>2. Protection by the screen.</li> <li>3. Protection by the distance.</li> <li>4. Protection by time.</li> <li>5. Protection by doze.</li> </ol>

Principles of antiradiative protection of the personnel against an internal irradiation first of all include measures for prevention of hit of radio isotopes in an organism of the personnel any of possible way - through respiratory ways, through a gastro enteric tract, through mucous membranes, through skin.

To be protected from the ionizing and non-ionizing electromagnetic radiation, methods based on physical laws of radiation decay, which are stated in the legislative and organization direction are used. They include the protection by means of the radiation sources capacity limitation, distance, time, and shielding.

Thus, the legislation implies limit doses of the ionizing radiation, maximum allowable concentrations of radionuclides in the air of working zone (Norms of radiation safety of Ukraine (NRSU)-97), their maximal allowable activities at the working place and other.

In order to keep health of medical personnel with harmful labour conditions, the legislation establishes the half day are:

- 4-hour-day – for medical workers directly connected with the open sources of radionuclides;
- 5-hour-day – for personnel connected with closed sources of the ionizing radiation (gamma-, X-ray), also for morbid anatomists, prosectors, forensic medical experts, anatomists;
- 5.5-hour-day – for doctors of the tuberculosis, psycho-neurological centers, physiotherapists, dentists;
- 6-hour-day – at the infectious, tuberculosis, psychiatric, narcological, balneal, radon, laboratory departments.

### **Inadmissible influence of ultrasound and maintenance of protection of the doctor of ultrasonic diagnostics.**

At the present stage of development of medicine ultrasonic diagnostics are widely used in various in the direction: in therapy, neurology, urology, obstetrics, stomatology. But the ultrasound is not absolutely safe for the person, therefore its professional using demands methods of protection of the personnel from its harmful influence.

Ultrasound is the sound fluctuations from 20000 up to  $10^9$  Hz. Ultrasound is absorbed fabrics of a human body with allocation thermal energy. Can cause by damage the central nervous system, defeat of ears, the vestibular organs.

Protection against negative influence of ultrasonic fluctuations passes by hermetic sealing sources, using absorbed materials, reduction of contact of the personnel with ultrasound.

### **Self-control material:**

#### **1. Professional harm is-**

- A) Adverse factors for health of working (industrial) process or unsatisfactory sanitary-and-hygienic conditions;
- B) Harm which do not allow to carry out the worker the duties;
- C) Harmful habits, which occurrence it is caused by factors of production;
- D) Factors which create optimum conditions on a workplace.

#### **2. Who are supposed to work on operation of the x-ray device**

- A) Persons not grown-ups of 35 years;
- B) Men who have passed specialization on radiology;
- C) Persons not younger 18 years which have passed specialization on radiology, precautionary medical survey and have no contra-indications;
- D) Persons not younger 16 years which have passed precautionary medical survey and have no contra-indications.

#### **3. What sources of ionizing radiations are "closed"?**

- A) Natural sources ionizing radiations;
- B) Such sources, which radioactive substance get into an environment (using of radioactive iodine - 131);
- C) Such sources, which radioactive substance does not get into an environment (x-ray devices, scale cobalt guns, B - thrones);
- D) Artificial sources ionizing radiations.

#### **4. The category A of population includes or belongs to:**

- A) Persons who directly are not borrowed(occupied) with work with sources of ionizing radiations but can receive an additional irradiation;
- B) All population;
- C) Patients with oncological diseases who receive radiation therapy;
- D) Persons who constantly or temporarily work directly with sources ionizing radiations.

#### **5. Name main principles of antiradiation protection of the personnel at work on "Open" sources ionizing radiations (an external irradiation)**

- A) Use radiating aseptic.
- D) Protection by time, by doze.

- C) Use of means collective and an individual protection.
- D) Protection by the distance, by time, by doze, by the screen and use radiating aseptic.

## **7. Literature**

Basic:

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