Ministry of Healthcare* of *Ukraine
O. O. Bogomolets National Medical University

department of hygiene and ecology №2

METHODICAL INSTRUCTIONS

for individual work of students
during preparing for practical lesson in the discipline "Occupational safety in the health"
on the topic:

INFECTION RISKS FOR MEDICAL WORKERS

Kiev - 2020

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meeting
from _____ 20___.

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"_____" _____ 20 .

INSTRUCTIONS

FOR STUDENTS' INDEPENDENT STUDIES
IN PREPARING FOR PRACTICAL WORK

Discipline	Occupational (Labor) hygiene
Module № 1	Occupational health in the field
Module № 2	Occupational health issues in the medical field
Topic	Infection risks for medical workers
Course	II, III
Faculties	Medical №1-4, FTDAFU, dentistry, medical-psychology.

Kyiv 2018

1. Introduction

Infectious diseases remain one of the biggest problems worldwide and in the XXI century continue to threaten humanity. Based on the reports of the WHO, patient deaths due to infectious diseases rate second worldwide. There are many different infectious diseases; however, tuberculosis, HIV/AIDS and Hepatitis viruses rank at the top of the list.

Since the epidemic of 1981, 63-89 mln people were infected with HIV worldwide. In the past 10 years, the number of AIDS infected people has become 119.6 times greater, whereas the number of HIV-positive people increased 6.9 times.

There is also a problem caused by the Hepatitis viruses, which are transmitted through blood. There are 257 mln people worldwide infected with Hepatitis B. 887,000 people died in 2015 from the virus.

The WHO reports that 71 mln people have been diagnosed with chronic Hepatitis C worldwide. Nearly 400,000 people die annually from chronic Hepatitis C and its complications. The virus is the primary reason for the need of liver transplantation due to cirrhosis and cancer (hepatocellular carcinoma).

Tuberculosis poses a formidable threat to society worldwide. In Ukraine only it was reported that there were 67,6 cases of tuberculoses per every 100,000 people in 2016. In 2016, 10.4 million people fell ill with TB, and 1.7 million died from the disease (including 0.4 million among people with HIV). Over 95% of TB deaths occur in low- and middle-income countries. Seven countries account for 64% of the total, with India leading the count, followed by Indonesia, China, Philippines, Pakistan, Nigeria, and South Africa.

At the same time, when it comes to occupational diseases, infectious diseases are in the lead. The most dangerous diseases are tuberculosis, Hepatitis viruses and HIV/AIDS. This is why it is important that doctors are provided with all the necessary education in prophylactics and prevention of infectious diseases.

2. Objectives:

1. Safe patient handling for medical and pharmaceutical workers when dealing with HIV, Hepatitis B and C, and TB patients.
2. Encourage safety awareness and provide motivation for medical and pharmaceutical workers to follow the safety rules.

3. Basic training

Discipline	Skills
Human anatomy	Analyze the information about body build, vital systems, organs, and body tissues
Medical biology	Understand the patterns of vital functions of human organism at molecular, biological, and cellular levels

Medical chemistry	Interprete the importance of equilibrium of vital biochemical processes in the organism
Microbiology, virology, and immunology	Study morphology and ultrastructure of bacterial cells and virus structures. Interpret biological properties of pathogenic and nonpathogenic microorganisms and viruses as well as the patterns of their interactions with the macroorganism – a human population and the environment.

4. Tasks for independent work during preparation for the lesson

4.1 List of main terms, parameters, characteristics, which should be taken by the student in preparation for the lesson

Virus	A small infectious agent that can replicate only inside the living cells of organisms.
Hepatitis B	is an infectious illness caused by hepatitis B virus (HBV) which infects the liver of hominoidea, including humans, and causes an inflammation called hepatitis.
Hepatitis C	HCV is a small (50 nm in size), enveloped, single-stranded, positive sense RNA virus.
Chronic hepatitis	It often leads to nonspecific symptoms such as malaise, tiredness and weakness, and often leads to no symptoms at all.
Human immunodeficiency virus (HIV)	It is a lentivirus (a member of the retrovirus family) that causes acquired immunodeficiency syndrome (AIDS), a condition in humans in which the immune system begins to fail, leading to life-threatening opportunistic infections.
Acquired immune deficiency syndrome or acquired immunodeficiency syndrome (AIDS)	A disease of the human immune system caused by the human immunodeficiency virus (HIV).[1][2][3] This condition progressively reduces the effectiveness of the immune system and leaves individuals susceptible to opportunistic infections and tumors.
Tuberculosis , MTB or TB (short for tubercles bacillus)	A common and in some cases deadly infectious disease caused by various strains of mycobacteria, usually Mycobacterium tuberculosis in humans.[1] Tuberculosis usually attacks the lungs but can also affect other parts of the body. It is spread through the air when people who have active MTB infection cough, sneeze, or spit.

4.2 Questions in theory:

1. Illness rate among medical and pharmaceutical field workers.
2. HIV/AIDS. Definition. Special characteristics of the infection process.
3. Preventive measures.

3.1. AIDS post-exposure prophylaxis.

3.2. AIDS post-exposure first aid.

3.3. Safe handling of AIDS-contaminated materials.

3.4. Safety and protection.

3.5. Precautionary and preventative measures while giving first aid or working with biomaterials.

3.6. Tracking accidents, caring for the victims, and measures for preventing occupational infections.

3.7. Post-contact care for medical workers who have been exposed to HIV in the workplace.

3.8. Emergency protocol for medical workers when exposed to HIV in the workplace.

4. Viral hepatitis types B and C. Definition and epidemic process characteristics.
5. Precautionary and preventative measures for viral hepatitis.
6. TB. Definition and epidemic process characteristics.

6.1. TB epidemics in worldwide and in Ukraine.

7. TB prophylaxis.

5. Practical lesson content

Health workers are exposed to blood and other body fluids in the course of their work. Consequently, they are at risk of infection with bloodborne viruses including human immunodeficiency virus (HIV), hepatitis B virus (HBV) and hepatitis C virus (HCV). The risk of infection for health workers depends on the prevalence of disease in the patient population and the nature and frequency of exposures. Occupational exposure to blood can result from percutaneous injury (needle-stick or other sharps injury), mucocutaneous injury (splash of blood or other body fluids into the eyes, nose or mouth) or blood contact with non-intact skin. The most common form of occupational exposure to blood and the most likely to result in infection is needlestick injury. The most common causes of needle-stick injury are twohanded recapping and the unsafe collection and disposal of sharps waste. Health workers in areas such as operating, delivery and emergency rooms and laboratories have a higher risk of exposure. Cleaners, waste collectors and others whose duties involve handling blood-contaminated items are also at risk.

Biological hazards are infectious agents such as bacteria, viruses, fungi or parasites which may be transmitted via contact with infected patients or contaminated objects, body secretions, tissue, or fluids. Health care workers, particularly those in hospital settings, are regularly exposed to biological or infectious agents.

Most institutions have infection control policies. Although usually developed to prevent the spread of infection to patients, these policies should also cover health care personnel. Such policies could include directives for worker training,

immunization, cleaning, disinfecting, and sterilizing equipment, treatment of infective waste, housekeeping, and processing laundry. Hand washing remains the single most important procedure for preventing the spread of infectious disease in health care settings. Table 1 provides a list of some other infectious agents or diseases to which health care workers may be exposed.

Table 1. Blood-borne Pathogens and Other Infectious Agents and Diseases	
Mode of Transmission	**Infectious Agent/Disease**
Blood and body fluids	Hepatitis B, Non-A, Non-B Hepatitis, Hepatitis C, Acquired Immunodeficiency Syndrome (AIDS), Cytomegalovirus (CMV)
Feces	Hepatitis A, Salmonella, Shigella, Campylobacter.
Virus shedding in urine and stool	Rubella (German measles)
Respiratory secretions	Rubella (German measles), Rubeola (measles), Mumps, influenza, Respiratory syncytial virus (RSV).
Contact with infected skin lesions	Scabies
Airborne droplet nuclei	Pulmonary tuberculosis, Varicella zoster virus (VZV) (chicken pox only)
Saliva	Mumps, Herpes simplex virus (HSV) - Type I, Type II, Herpetic whitlow, Varicella zoster virus (VZC) (chicken pox & shingles)
Secretions of lesions	Herpes simplex virus (HSV) - Type I, Type II, Herpetic whitlow, Varicella zoster virus (VZV) (chicken pox and shingles)

At this time there is an AIDS outbreak in Ukraine. As for the HIV, it is differentiated as follows:

1. ***Low level*** – HIV occurs in no more than 5,0% of any part of the population
2. ***Concentrated level***– HIV occurs in more than 5,0% of any particular population group and in less than 1,0% among the pregnant women in an urban area.
3. ***Generalized epidemics*** – HIV occurrence is regularly higher or it is 1,0% among pregnant women.

At this time, Ukraine is experiencing concentrated levels of HIV infections. Therefore, there is a reasonable chance for any medical worker to be exposed to HIV-infected patients. In recent years, the AIDS Medical Center in Kyiv has seen nearly 100 medical worker applications filed due to accidents in the workplace.

Practically every case was connected with medical workers not following safety rules, as well as lack of the required documentation and knowledge in regards to HIV prophylactics and prevention guidelines.

General characteristics of the transmission mechanism of bloodborne diseases (Hepatitis B, C, HIV/AIDS)

Blood-borne infections are transmitted by way of direct blood contact from one individual to another from injured skin or a mucous membrane. Blood-borne infections can also be transmitted through blood doping and drug abuse and through sexual contact.

Exposure to bloodborne pathogens can occur through many mechanisms: needle sticks, being splashed with blood or body fluids on the mucous membranes (the mouth, eyes, and nose), even in some cases human bites (although the risk of transmission via human bites is extremely low). However, contact with bloodborne pathogens falls into two main categories: direct and indirect.

Direct contact is through an open lesion on the skin or mucous membrane.

Indirect contact is through punctures by contaminated sharps or needle

Ways of contamination in the medical field are as follows:

Drawing of blood

Use of artificial blood circulation system

Various injections

Phlebotomy

Various transfusions

Biopsy

Various punctures

Artificial lung ventilation

Intubation

Various surgical manipulations

Various catheterizations

Vaginal examinations

Various examinations (intrusive and semi-intrusive)

Bloodborne disease prevention methods in the medical field:

Microtrauma prevention

Using disposable instruments

Disinfection and sterilization of medical equipment

Using disposable safety equipment during invasive treatments: gloves, goggles, protective garments, etc.

Implementing safety procedures while treating patients

Developing and using vaccines for tuberculosis and Hepititis B.

Discuss creating vaccines to prevent HIV/AIDS, Hepatitis C.

AIDS (Acquired Immunodeficiency Syndrome) is caused by a retrovirus named HIV, the human immunodeficiency virus. The syndrome, characterized by development of complications like opportunistic infections or tumors, was first described in 1981 in the USA. The human race is now hard hit by the pandemic. An estimated total of 15 million people worldwide have already been infected so far. In 2012 over 200 000 people were registered as HIV-infected in Ukraine.

HIV is transmitted largely through three routes: sexual contact with an HIV-infected person, exposure to contaminated blood and needles, and perinatally from an infected mother to her baby.

HIV infection has been reported to occur in health care settings by exposure to contaminated blood through cutaneous injuries or mucous membranes. The estimated risk of contracting the virus after such injuries or exposure to infected blood is 0.4%.

The symptoms of AIDS are primarily the result of conditions that do not normally develop in individuals with healthy immune systems. Most of these conditions are infections caused by bacteria, viruses, fungi and parasites that are normally controlled by the elements of the immune system that HIV damages.

Taken the extremely low risk of HIV transmission in the health care setting, universal precaution in handling blood and other body fluids was generally advocated as the most effective measure in further minimising the chance of infection . HIV has been isolated from blood, semen, saliva, tears, urine, vaginal secretion, cerebrospinal fluid, synovial fluid, breast milk and amniotic fluid of infected individuals. However only blood, blood products, semen, vaginal secretion and breast milk have been linked to HIV transmission.

Risk factors

The risk of HIV transmission after exposure to body fluids from an HIV-infected patient is generally low. Risks associated with the 3 main routes of exposure are as follows: [3, 4]

- Percutaneous exposure - Risk with an HIV-positive source, approximately 0.3%; risk is increased by hollow-bore needles, visibly bloody devices, deep injuries, and source person with terminal illness reflecting higher titer of HIV
- Cutaneous exposure (ie, via nonintact skin) - Risk with an HIV-positive source, less than 0.09%
- Mucous membrane exposure - Risk with an HIV-positive source, approximately 0.09%; risk is increased with a high viral load in the source and large-volume exposure

Prevention

The most effective means of preventing HIV transmission in health care setting is through adherence to universal precautions, thereby decreasing the risk of direct exposure to blood and/or body fluids.

Voluntary instead of mandatory HIV testing is the best way of encouraging people (including health care workers) at risk of infection to seek counselling and appropriate treatment. Health care workers should consider receiving counselling

and HIV antibody testing if they have reason to suspect that they have been infected. Health care workers are generally not required to disclose their HIV status to their patients or employers. Disclosure, if any, should be made on a need-to-know basis and with consent of the worker. Maintaining confidentiality is one way to prevent interference with individual privacy. It is also essential in encouraging the health care workers (either infected or at risk of infection) to receive proper counselling and management. Currently there is no justification for restricting practice of health care workers on the basis of the HIV status alone. Restriction or modification, if any, should be determined on a case-by-case basis.

In the medical field, certain professions have greater exposure to HIV. They are:

nursing staff - treatment nurses who work in hospitals and serve HIV infected patients;
surgeons who operate and surgical nurses; mid-wives-gynecologists, autopsists;
laboratory workers who examine blood, biological fluid, and other biomaterials that contain HIV.

Research implemented by the EU showed that out of 23,212 HIV-positive workers in the medical field 196 (0.8%) stated that they had been infected on the job. However, only 41% of these claims were documented. The medical staff at highest risk included surgeons (4.9%), paramedics (policemen, rescue workers) (2.5%), dentists (12%), allied health professionals (1.2%) and medical nurses (1.1%), general practitioners (1%).

HIV post-exposure prophylaxis

PEP (post-exposure prophylaxis) means taking antiretroviral medicines (ART) after being potentially exposed to HIV to prevent becoming infected. PEP is a way to prevent HIV infection after a recent possible exposure to the virus.

PEP should be used only in emergency situations and must be started within 72 hours after a recent possible exposure to HIV. Occupational transmission of HIV to health care workers is extremely rare, and the proper use of safety devices and barriers can help minimize the risk of exposure while caring for patients with HIV. A health care worker who has a possible exposure should see a doctor or visit an emergency room immediately. PEP must be started within 72 hours after a recent possible exposure to HIV. The sooner, the better; every hour counts.

- Primary prevention strategies are emphasized, along with prompt reporting and management of occupational exposures.
- The HIV status of the source of the exposure should be determined to guide the need for HIV PEP; if the HIV status of the source is unknown, it should be determined, usually with a rapid and reliable test such as the fourth-generation HIV test. If there is a concern about a false-negative result (eg, result is negative but there has been a risk for HIV transmission to the source prior to test detection, about 4-10 days for tests that detect Ag and/or Ab, including

the fourth-generation test), plasma HIV RNA (HIV viral load) testing of the source is recommended.

- PEP should be initiated as soon as possible, ideally within 2 hours of exposure; a first dose of PEP should be offered to the exposed worker while the evaluation is underway if HIV transmission is considered credible.
- A PEP supply for 3-5 days is available for urgent use, and the exposed worker obtains a continuous supply to complete the 28-day course.
- Follow-up appointments should begin within 72 hours of HIV exposure and should include follow-up HIV testing, monitoring for drug toxicity, and counseling.
- Repeat HIV testing should be obtained at 6 weeks and 4 months postexposure. Testing should also be performed using the fourth-generation assay or HIV viral load if the injured healthcare worker has symptoms of the acute retroviral syndrome.

HIV – management of exposure

First aid when dealing with spilt blood or other biological fluids:

Percutaneous or cutaneous exposure: washing of the area with soap and water

  - DO NOT use strong disinfectants such as ethanol, chlorous solutions and iodine, because they may cause irritation of the damaged skin and worsen the condition
  - DO NOT apply pressure or rub the wound
  - DO NOT try to suck the blood that is coming out of the wound out

- **Mucous membrane exposure**: copious irrigation of the area with water or sterile saline;
- **Puncture wounds:** cleanse with alcohol-based hand wipes
- **Eye exposure**: irrigation with copious amounts of sterile water or saline; sit down, throw your head back and ask a colleague to carefully pour water or saline on the eye so that water would come out of the lower lid, hence you pull on the lid the entire time. Do not remove lenses the entire time you rinse, because they create a protective barrier. Once you finish rinsing, take out your lenses and clean them as usual. They are now ready to be used again.
  - DO NOT clean your eyes with soap or a disinfecting solution

- **Spilling onto the undamaged skin:**

Immediately rinse off the spilt fluid

If clean water is not available, use gel or hand-washing liquid

  - DO NOT use strong desifectants such as ethanol, chlorous solutions and iodine, because they may cause irritation of the damaged skin and worsen the condition
  - DO NOT use weak disinfecting sollutions, such as 2-4% chlorhexidine gluconate
  - DO NOT rub the exposed area
  - DO NOT apply a band aid

Mouth cavity exposure
Immediately spit out the fluid that got into your mouth cavity. Thoroughly rinse out your mouth with water or saline and spit it out again. Repeat several times.

DO NOT use soap or a disinfecting solution

Safety procedures for working with HIV infected materials

Universal safety procedures should be followed when working with blood and other biological fluids, such as:

Sperm
Vaginal discharge
Any fluid containing blood
Cultures and media that contain HIV contact with which resulted in HIV infection
Synovial fluid
Cerebral fluid
Pleural fluid
Peritoneal fluid
Pericardial fluid
Amniotic fluids, whose level of HIV transmission is not yet determined

Universal safety procedures are NOT used for:

Fecal masses
Urine
Nasal discharge
Flegm
Sweat
Tears
Vomit
Saliva (except for dental procedures in which saliva may contain blood)

It is recommended that medical workers avoid exposures in the workplace. The following should be avoided:

Accidental traumas caused by needles or other sharps
Mucous mouth cavity, eyes or the nose, damaged skin (cuts, scratches, dermatitis, acne) coming in contact with infected blood and other biological fluids
Touching surfaces contaminated with infected materials
Touching the area of damaged skin or mucous membranes of the eye, nose or mouth

It is recommended that medical workers abide to occupational safety rules, specifically using various safety devices and barriers, such as:

Routinely use barriers (such as gloves and/or goggles) when anticipating contact with blood or body fluids.

Immediately wash hands and other skin surfaces after contact with blood or body fluids.

Carefully handle and dispose of sharp instruments during and after use.

Safety devices have been developed to help prevent needlestick injuries. If used properly, these types of devices may reduce the risk of exposure to HIV. Many percutaneous injuries, such as needlesticks and cuts, are related to the disposal of sharp-ended medical devices. All used syringes or other sharp instruments should be routinely placed in "sharps" containers for proper disposal to prevent accidental injuries and risk of HIV transmission.

Tuberculosis, MTB or TB (short for tubercles bacillus) is a common and in some cases deadly infectious disease caused by various strains of mycobacteria, usually Mycobacterium tuberculosis in humans. Tuberculosis usually attacks the lungs but can also affect other parts of the body.

In 2016, as in 2015, an estimated 10.4 million people fell ill with TB and TB remains the leading cause of death worldwide from a single infectious agent. The report highlights the continuing threat of drug-resistant TB: in 2016, there were 600,000 new cases with resistance to rifampicin (RRTB), the most effective first-line drug, of which 490 000 had multidrug-resistant TB (MDR-TB) – up from 480,000 in 2015. Almost half (47%) of these cases were in India, China and the Russian Federation.

Table 1

Reporting of data in the 2017 round of global TB data collection

	COUNTRIES AND TERRITORIES		WHO MEMBER STATES	
WHO REGION OR SET OF COUNTRIES	NUMBER	NUMBER THAT REPORTED DATA	NUMBER	NUMBER THAT REPORTED DATA
African Region	47	47	47	47
Region of the Americas	46	45	35	34
Eastern Mediterranean Region	22	21	21	21
European Region	54	46	53	45
South-East Asia Region	11	11	11	11
Western Pacific Region	36	31	27	24
GLOBAL	216	201	194	182

The cause of TB, Mycobacterium tuberculosis (MTB), is a small aerobic non-motile bacillus.

Symptoms include chest pain, coughing up blood, and a productive, prolonged cough for more than three weeks. Systemic symptoms include fever, chills, night sweats, appetite loss, weight loss, pallor, and fatigue.

Risk factors

Persons with silicosis have an approximately 30-fold greater risk for developing TB. Silica particles irritate the respiratory system, causing immunogenic responses such as phagocytosis, which, as a consequence, results in high lymphatic vessel deposits. It is this interference and blockage of macrophage function that increases

the risk of tuberculosis. Persons with chronic renal failure and also on hemodialysis have an increased risk: 10–26 times greater than the general population.

Persons with diabetes mellitus have a risk for developing active TB that is two to four times greater than persons without diabetes mellitus, and this risk is likely greater in persons with insulin-dependent or poorly controlled diabetes. Other clinical conditions that have been associated with active TB include gastrectomy with attendant weight loss and malabsorption, jejunoileal bypass, renal and cardiac transplantation, carcinoma of the head or neck, and other neoplasms (e.g., lung cancer, lymphoma, and leukemia).

Given that silicosis greatly increases the risk of tuberculosis, more research about the effect of various indoor or outdoor air pollutants on the disease would be necessary. Some possible indoor sources of silica include paint, concrete and Portland cement. Crystalline silica is found in concrete, masonry, sandstone, rock, paint, and other abrasives. The cutting, breaking, crushing, drilling, grinding, or abrasive blasting of these materials may produce fine silica dust. It can also be in soil, mortar, plaster, and shingles. When you wear dusty clothing at home or in your car, you may be carrying silica dust that your family will breathe.

Low body weight is associated with risk of tuberculosis as well. A body mass index (BMI) below 18.5 increases the risk by 2–3 times. On the other hand, an increase in body weight lowers the risk. Patients with diabetes mellitus are at increased risk of contracting tuberculosis, and they have a poorer response to treatment, possibly due to poorer drug absorption.

The correlation between diabetes mellitus and TB is concerning for public health because it shows a distinct connection between a contagious disease and a chronic disease. TB is a highly contagious air-born bacteria, therefore contracting tuberculosis depends on whether the patent comes into contact with the bacteria or not. Diabetics do not have an increased risk of contracting latent tuberculosis but studies have shown that patients with diabetes mellitus are more likely to move from a latent form of TB to an active form of TB. This is where the public concern comes from, because when TB is active it is contagious and potentially fatal. (Fig. 5B)
Other conditions that increase risk include:

the sharing of needles among IV drug users;

recent TB infection or a history of inadequately treated TB;

chest X-ray suggestive of previous TB, showing fibrotic lesions and nodules;

prolonged corticosteroid therapy and other immunosuppressive therapy;

immunocompromised patients (30-40% of AIDS patients in the world also have TB) hematologic and reticuloendothelial diseases, such as leukemia and Hodgkin's disease;

end-stage kidney disease;

intestinal bypass;

chronic malabsorption syndromes;

vitamin D deficiency;

and low body weight.

Twin studies in the 1940s showed that susceptibility to TB was heritable. If one of a pair of twins got TB, then the other was more likely to get TB if he was identical

than if he was not. These findings were more recently confirmed by a series of studies in South Africa. Specific gene polymorphisms in IL12B have been linked to tuberculosis susceptibility.

Some drugs, including rheumatoid arthritis drugs that work by blocking tumor necrosis factor-alpha (an inflammation-causing cytokine), raise the risk of activating a latent infection due to the importance of this cytokine in the immune defense against TB.

Prevention

TB prevention and control takes two parallel approaches. To begin with, people with TB and their contacts are to be identified and then treated. Identification of infections often involves testing high-risk groups for TB. Furthermore, children are vaccinated to protect them from TB. No vaccine is available that provides reliable protection for adults. However, in tropical areas where levels of other species of mycobacteria are high, exposure to nontuberculous mycobacteria gives some protection against TB.

Vaccines

Healthcare workers were considered on an individual basis in settings in which a high percentage of MDR-TB patients was identified, transmission of MDR-TB was likely. TB control precautions were implemented and were not successful.

Risk groups among medical workers:

A. Medical staff at TB clinics and centers – high risk

Tuberculotherapist and other occupations, nurses and caretakers, social workers, etc. who work at health centers, TB clinics, TB health retreats are primarily exposed to the active form of TB. This group is also at high risk of being infected with chemically resistant forms of TB from patients undergoing treatment.

B. Medical staff at HIV/AIDS clinics – high risk

Healthcare workers at HIV/AIDS clinics are at high risk of being infected with TB. What is more, danger also comes from patients with extrapulmonary and atypical diseases, especially during their asymptomatic period.

C. Medical staff at clinical laboratories.

Clinical laboratory staff are exposed to increased risk contaminating air-born TB in the workplace. M. tuberculosis is often transmitted during primary manipulation of data samples from patients whose TB was not yet diagnosed.

D. Medial staff at general hospitals.

All medical workers are exposed to occupational risk of MTB infection. Considering increased instances of TB among the general public and ways of transmission, the following are listed healthcare professions at highest risk:

- General practitioners/family doctors, local physicians, emergency room (ER) doctors and nurses, who are first to contact patients on the early stages of TB even before the diagnostics process
- Doctors and medical nurses at hospitals, where patients with undiagnosed TB may be present for prolongued periods of time (during diagnostics of pathologic inflammation of the lung), in case of extrapulmonary TB (skin, kidneys, brain, eyes, bones and joints, lymph nodes, etc.)
- Forensic doctors and pathologists during autopsy of persons with undiagnosed TB, primarily the homeless, unemployed, ex-convicts, etc.

Main preventive measures in the workplace for TB are the following:

- Timely isolation of the person infected with TB or suspected to have TB
- Respiratory safety measures: a face mask for the patient who has cough, face masks with filters for medical staff involved in giving first aid to the patient.
- Using a protective shield when administering first aid to the patient
- Limiting time that medical staff is in contact with the patient
- Using ventilation system in the premises where patients are treated, using negative air pressure
- Using bacteriological cleansing system for disinfecting air in the treatment facilities
- UV lighting and disinfection of the premises
- Placing signs to mark the facilities and objects that may cause TB infection
- Training medical staff in occupational safety
- Implementing medical examinations of all staff on the premises

Epidemiological features of different types of the hepatitis virus.

Hepatitis (plural hepatitides) is an inflammation of the liver characterized by the presence of inflammatory cells in the tissue of the organ. The condition can be self-limiting (healing on its own) or can progress to fibrosis (scarring) and cirrhosis.

Hepatitis may occur with limited or no symptoms, but often leads to jaundice, anorexia (poor appetite) and malaise. Hepatitis is acute when it lasts less than six months and chronic when it persists longer.

Hepatitis B is an infectious illness caused by hepatitis B virus (HBV) which infects the liver of hominoidea, including humans, and causes an inflammation called hepatitis

Prevention

Several vaccines have been developed by Maurice Hilleman for the prevention of hepatitis B virus infection. These rely on the use of one of the viral envelope proteins (hepatitis B surface antigen or HBsAg). The vaccine was originally prepared from plasma obtained from patients who had long-standing hepatitis B virus infection. However, currently, it is made using a synthetic recombinant DNA technology that does not contain blood products. One cannot be infected with hepatitis B from this vaccine.

Following vaccination, hepatitis B surface antigen may be detected in serum for several days; this is known as vaccine antigenaemia. The vaccine is administered in either two-, three-, or four-dose schedules into infants and adults, which provides protection for 85 – 90% of individuals. Protection has been observed to last 12 years in individuals who show adequate initial response to the primary course of vaccinations, and that immunity is predicted to last at least 25 years.

Unlike hepatitis A, hepatitis B does not generally spread through water and food. Instead, it is transmitted through body fluids; prevention is thus the avoidance of such transmission:

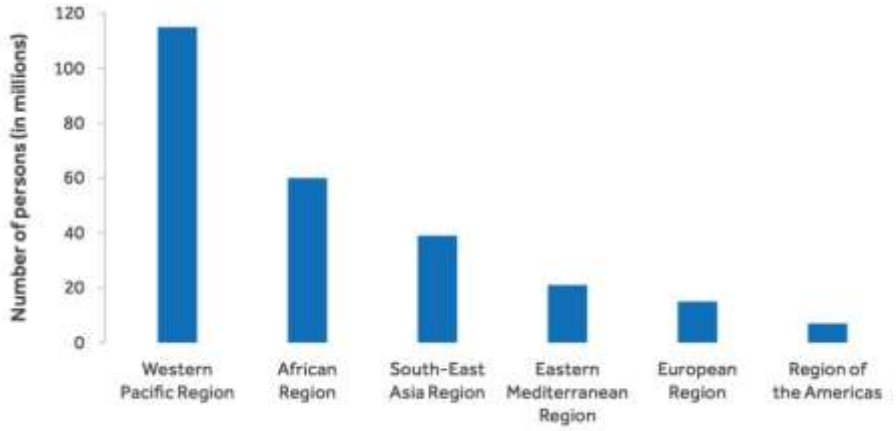
- unprotected sexual contact,
- blood transfusions,
- re-use of contaminated needles and syringes, and
- vertical transmission during child birth.

Infants may be vaccinated at birth.

Shi, et al. showed that besides the WHO recommended joint immunoprophylaxis starting from the newborn, multiple injections of small doses of hepatitis B immune globulin (HBIg, 200–400 IU per month), or oral lamivudine (100 mg per day) in HBV carrier mothers with a high degree of infectiousness (>106 copies/ml) in late pregnancy (the last three months of pregnancy), effectively and safely prevent HBV intrauterine transmission, which provide new insight into prevention of HBV at the earliest stage.

Table 2 (with graph). Prevalence of HBV infection (HBsAg) in the general population by WHO region, 2015: the WHO African and Western Pacific regions have the highest prevalence and the largest number of persons living with HBV.

Table 2



	Estimates of the prevalence of HBV infection (%)			Estimated number of persons living with HBV (millions)		
		Uncertainty interval (95%)			Uncertainty interval (95%)	
WHO region	Best	Lower	Higher	Best	Lower	Higher
African Region	6.1	4.6	8.5	60	45	84
Region of the Americas	0.7	0.4	1.6	7*	4	16
Eastern Mediterranean Region	3.3	2.6	4.3	21	17	28
European Region	1.6	1.2	2.6	15	11	23
South-East Asia Region	2.0	1.5	4.0	39	29	77
Western Pacific Region	6.2	5.1	7.6	115	93	140
Total	**3.5**	**2.7**	**5.0**	**257**	**199**	**368**

Hepatitis C is an infectious disease affecting the liver, caused by the hepatitis C virus (HCV). The infection is often asymptomatic, but once established, chronic infection can progress to scarring of the liver (fibrosis), and advanced scarring (cirrhosis) which is generally apparent after many years. In some cases, those with cirrhosis will go on to develop liver failure or other complications of cirrhosis, including liver cancer or life threatening esophageal varices and gastric varices.

People can be exposed to HCV through accidental exposure to blood through needle sticks or blood spatter to the eyes or open wounds at work. Universal precautions to protect against such accidental exposures significantly reduce the risk of exposure to HCV.

Prevention According to Centers for Disease Control, hepatitis C virus is spread by exposure to large quantities of blood, either through the skin or by injection:

Injection drug use (currently the most common means of HCV transmission.

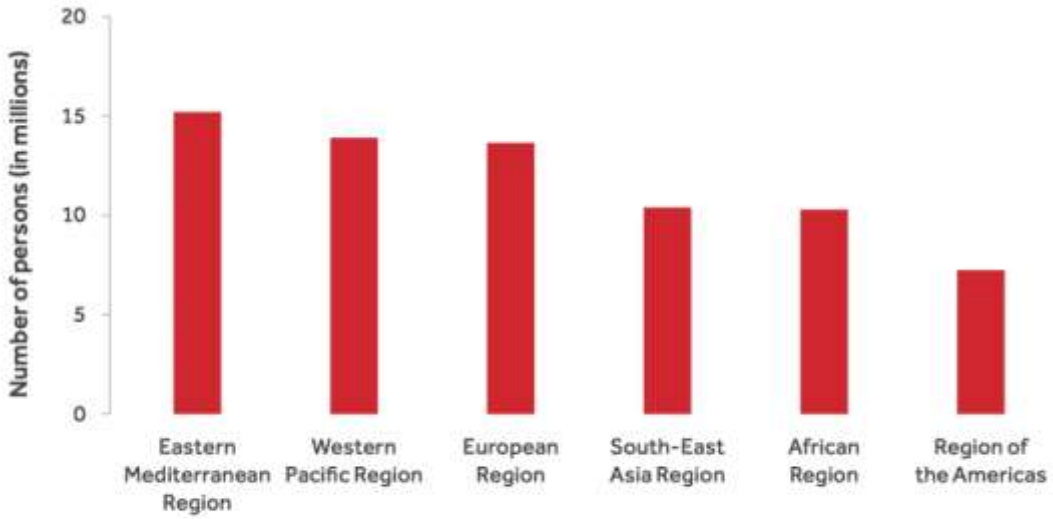
Receipt of donated blood, blood products, and organs.

Needle stick injuries in healthcare settings. Birth to an HCV-infected mother.

Strategies such as the provision of new needles and syringes, and education about safer drug injection procedures, greatly decrease the risk of hepatitis C spreading between injecting drug users.

No vaccine protects against contracting hepatitis C, or helps to treat it. Vaccines are under development and some have shown encouraging results. Table 3 (with graph) shows prevalence of HCV infection (HCV RNA positive) in the general population, by WHO region, with uncertainty intervals, 2015: 71 million persons living with HCV worldwide.

Table 3



	Estimates of the prevalence of HCV infection (%)			Estimated number of persons living with HCV (millions)		
		Uncertainty interval			Uncertainty interval	
WHO region	Best	Lower	Higher	Best	Lower	Higher
African Region	1.0	0.7	1.6	11	7	16
Region of the Americas	0.7	0.6	0.8	7	6	8
Eastern Mediterranean Region	2.3	1.9	2.4	15	13	15
European Region	1.5	1.2	1.5	14	11	14
South-East Asia Region	0.5	0.4	0.9	10	8	18
Western Pacific Region	0.7	0.6	0.8	14	10	15
Total	**1.0**	**0.8**	**1.1**	**71**	**62**	**79**

Source: WHO, work conducted by the Center for Disease Analysis. *See* Annex 2.

In Ukraine as of August 2016, 44,000 people are registered to be Hepatitis C positive.

Transmission mechanisms: bloodborne, rarely natal. The virus is present in various biological fluids:

Blood
Saliva
Urine
Tears
Mothers' milk
Sperm
Bile, etc.

However, only bood, sperm, and possibly saliva pose real epidemiological threat, because all other fluids contain small amounts of the virus.

Concentrations of the HCV in the blood of an infected person is on average 10^3- 10^4 of viral parts per 1 ml. At the same time, the transmittable amount of a virus may be present 0,01-0,001 ml of blood.

3.6% risk is of the HCV being transmitted sexually. Transmission index among persons at risk of contracting HCV sexually is 16-17%

Mechanical ways of transmission: various medical parenteral manipulations, tattoos, piercings, intravenous administration of drugs.

6. Test yourself

A. Describe the main methods used to prevent TB.

B. Problem 1.

A 56 year old female patient was diagnosed with hepatitis C based on clinical data and laboratory tests. It is known that 4 months prior to becoming ill the patient had undergone a surgery on her stomach. The patient had blood transfusion twice, as well as intravenous and intramuscular injections. Could she have been infected with hepatitis C while being in post operative care after the surgery? How could she become infected?

7. References

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