ABSTRACT

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OVERVIEW OF THE RISKS AND PREVENTION OF TUBERCULOSIS (TB) AT WORKPLACE

Study by the contract of the International Labour Office

Since 1993 tuberculosis (TB) is a world pandemic. TB is a chronic infectious disease, transmitted by a respiratory way, which can be prevented and treated. 5–10 % individuals infected with micotuberculosis (MTB) (but not infected with HIV), become ill in active type of TB at any period of their life. The risk of TB development in individuals, infected with HIV and TB, is higher. Individuals infected with MTB can infect 10–15 other persons per year through cough. TB is a disease of poor people, which most often, affects young people. The majority of cases of death from TB is recorded in countries with low level of economic development.

In the WHO European Region 23 % all new cases of this disease fall on countries of the European Union (EU), and 73 % – on Kazakhstan, Romania, Russian Federation, Turkey, Ukraine and Uzbekistan. The epidemic of TB in Ukraine started in 1995. Over that time the number of primary patients with TB increased significantly. In the structure of morbidity (2008) Ukraine takes the eight place among other countries of the WHO European Region.

In order to control the TB pandemic the WHO adopted in a strategy 2006 «Stop TB» (for 2006–2015.), which is directed to shortening the prevalence and mortality from TB by 50 % by 2015 in comparison with indices of 1990.

A work place is an ideal place for implementation of measures aimed at prevention and control TB, through involvement of employees and employers. This is because a worker at his/her workplace can receive the necessary information on prophylaxis, qualified diagnostics and treatment of TB, employers can save their potential for production.

The above-mentioned problems turned to be a prerequisite for undertaking a study with the purpose to: identify directions of the scientific research on risk assessment as well as on implementation of occupational TB prevention policy.

Tasks of the investigation
1. To analyze international and national scientific literature on epidemiology, risks and methods of TB prevention at workplace.
2. To study international recommendations and standards on prevention of TB infection at workplace.
3. To make a comparative analysis of the national law of Ukraine on protection of workers at workplace from TB and international recommendations and standards.
4. To analyze the statistical data on TB infection among working population of Ukraine as well as on TB as an occupational disease.
5. To develop recommendations on improvement of the system of TB prevention at workplace and on the decrease of cases of occupational TB.

The study was conducted by leading scientific collaborators of SI “Institute for Occupational Health of AMS of Ukraine” (Professor Y.I. Kundiev, member of National Academy of Sciences and Academy of Medical Sciences of Ukraine, Doctor of Medical
Section 1. Medical and statistical regularities of TB pandemic development (1993–2008). The study revealed that TB pandemic in the WHO European Region had started in 1993. By 2007 the average statistical morbidity rates of this pathology (per 100 000 population) made: for all types – 49,0 (in the world – 139,0); active types – 21,0 (61,0); prevalence – 51,0 (206,0); mortality of non-HIV-infected individuals – 6,3 (20,0); mortality of HIV-infected individuals – 0,9 (6,8); the part of all HIV-infected among all individuals with TB – 9,8 % (15,0 %). Morbidity from all types of tuberculosis for countries of: the WHO European regions – 40,96; CIS countries – 89,45; EU – 15,48. These medical and statistical indices are ones of the best (after American regions) in comparison with other WHO regions according to morbidity rates and are significantly lower than average rates in the world, mostly due to high level of economic development in countries of such region and higher level of the public health system, respectively.

The TB epidemic in Ukraine was recorded in 1995. The morbidity of the population in Ukraine (2007 - 82,44 per 100 tsc. population) is one of the highest in the European Region (average level – 40,96) and takes the eighth place in the structure of morbidity after Kazakhstan (160,01), Republic of Moldova (135,79), Kirgizstan (117,11), Romania (104,89), Georgia (98,21), Tadjikistan (94,25), Russian Federation (89,74).

Over the period since 1990 (the start of TB epidemic) till 2007 the number of individuals, which have fallen ill in this disease for the first time in their life, including all types, increased by 134,1 % (in European Regions – by 35,5 %), active types – by 110,2 % (by 37,8 %). The index of morbidity by all types has increased ever more (due to significant decrease of the number of population) – 175,7 % (19,5 %); for active types – 131,6 % (23,5 %). As a result of growing the number of new cases of this disease and some mistakes happened in the treatment of patients, morbidity rates for TB in Ukraine have increased by 52,2 %, whereas in European countries they have decreased by 10,5 %. Mortality rates for TB among HIV-infected individuals in Ukraine demonstrate a tendency to significant increase – by 150,0 % (in Europe – by 40,0 %).

Near 50 000 new cases of TB are recorded in Ukraine annually and near 6,5 000 persons die because of this disease. Morbidity rates for the population with TB increased for the period from 1990 to 2007 by 2,5 and mortality rates because of TB – by 2,8 times. The highest index of morbidity on TB was recorded in 2005 (84,1 per 100 000 population).

The particular feature of TB epidemic in Ukraine are: significant number of neglected cases of TB among patients firstly diagnosed on TB (TB of lungs with distuction – 77,4 per 100 000 population, 45,1 % of all patients), heavy bacillus excretion (71,5 per 100 000 population, 41,6 % of the number of all patients), resulting from the low quality of treatment, increase of the level of chemioresistence to microbial bacteria of TB (MBTB) (primary resistance of MBTB to anti-tuberculosis preparations of the first raw – 23–25 %, two times higher than the average index of the WHO (10,4 %); secondary resistance – 55–56 %, overriding the WHO index 1,5 times (36,0 %); secondary multiresistence – 45–46 %, -- 3,6 time increase of the WHO index (13,0 %)), and increase of the number of death from TB.

During recent years the increase of rates of TB infection for the population of Ukraine has been stated, which increases with age: children of 7–8 years old – 8,5 %, 13–14 years old –
20–25%, adults (40 years old) – 80–90%. TB in Ukraine grows younger, morbidity on TB in children is closely related on the number of cases of TB in adults. People of able-to-work age prevailed among all persons with such pathology and there was a tendency to the increase of their part in 1998 and 2008: men (18–60 years old) – from 80,5 to 85,9 %, women (18–55 years old) – from 67,2 % to 75,3 %. The maximum morbidity rates for men, aged 35 – 54, made in 1998 – 6,2 % of all patients) the increase was recorded on 25–54 years in 2008 (71,5 %), and for women remained for the age of 25–44 (in 1998 – 41,2 %; in 2008 – 46,4 %). Men in Ukraine are more often affected by TB (by 2,4 times) (70,8 %), as compared to women (29,2 %).

Before the start of the present epidemic the morbidity on this pathology prevailed among rural population. The start of the epidemic showed the balance of morbidity rates between urban and rural population in the country with an insignificant tendency to prevalence for the urban population. However, in 2007–2008 a tendency to the decrease of morbidity rates was noted both for urban population (78,2 and 76,4 per 100 000, respectively) and for rural population (83,2 and 80,7).

The morbidity rates for active TB (in 2008) were significantly higher than the average for Ukraine (77,8) in south, eastern and central regions of the country – in Kherson oblast (123,8), Mykolaiv (101,9), Lugansk (101,4), Kryovograd (97,0), Dnipropetrovsk (92,0), Donetsk (91,1), Zhytomyr (89,6), Odesa (87,4), in Autonomic Republic of Crimea 89,9). This can be explained by the availability of a large number of prisons on these territories, where there are more than 10 000 patients as well as by the development of industry, which, in the period of economic difficulties, is followed by a significant level of unemployment and migration of the population.

Among patients, in which TB was diagnosed for the first time in their life (in 2008), near 70,2 % were socially unprotected persons: unemployed (51,3 %), retired (12,7 %), persons without permanent residence (1,9 %), those who returned from prisons (0,8 %), other categories (3,5 %).

The calculated morbidity rates for selected social groups of the population in Ukraine show that they are the highest among persons who have no permanent residence (2900,0 per 100 000 of the corresponding population; a cohort – 23,0 thousands of persons have been recorded in the country), those who does not work in the able-to age work unemployed (1293,0 per 100 000; a cohort – 1424,0 thousand persons, respectively), prisoners (726,0 per 100 000; a cohort – 145,9 thousand persons), those who have returned from prisons (588,0 per 100 000; a cohort – 49,1 thousands), medical workers of antituberculosis establishments (521,8 per 100 000; a cohort – 20,3 thousands) and workers (107,7 per 100 000; a cohort – 47480,0 thousands). Also, higher levels (higher than background morbidity rates before the start of the epidemic – 31,8 per 100 000 in 1990) have been recorded for rural workers (74,5 per 100 000; a cohort – 698,0 thousand persons) and medical workers of general medical establishments (59,6 per 100 000; a cohort – 809,9 thousand persons, respectively).

In 2008 in anti-tuberculosis (phthisiatric) service of Ukraine 2,900 physicians-phthisiatricians were engaged (0,6 per 10 000 population), the staffed physical persons made only 70,5 %; and near 5.8 000 nurses. The staff (including by-workers) – 94,8 %. Within 1998 - 2008 the number of physicians-phthisiatricians in the country increased insignificantly (by 173 persons per 6,3 %), and the relative increase of the level of provision of the population with physicians-phthhtisiatricians (by 20,0 %) is explained by the decrease of the number of the
population. The index of provision of TB patients, being under examination in dispensaries, with physicians-phthisiatrians over that period tended to the increase (by 46.5%), however, the care of patients diagnosed on TB for the first time, who need maximum working time from medical personnel, including physicians-phthisiatrians, tended to an expressed decrease (by 17.8%).

Because of limitation of resources on phthisiatrian's service and increase of the number of first registered TB patients (by 29.4%) and morbidity rates of active TB (by 43.4%), negative tendencies are noted in the results of treatment and preventive actions for people, being under clinical examination (by 27.4%); morbidity of persons with destructive TB has increased (by 36.6%) and of its bacterial types - 49.8%, for extra-lung types (2.2 times); the index of TB recurrence increases by 53.5%; as well as rates of the number of those who died because of TB (by 29.1%) morality (39.1%) and lethality in hospitals (by 25.5%) from TB, resulting from some mistakes in primary prevention of TB, in diagnostics of early stages of the disease, worsening of a long-term observation and treatment of patients with neglected types of pathology.

However, there are some positive shifts, such as the decrease of morbidity from TB of all contacted people (by 10.9%); increase of rates of closing cavities in patients, diagnosed on destructive TB for the first time (by 16.5%), cessation of bacteria excretion in patients, who earlier demonstrated bacteria excretion (by 8.6%); recovery of people with active TB of lungs after treatment (2.6 times); decreasing the part of patients, who died from TB within the first year of observation (by 5.3%); decrease of cases of disability (by 7.3%) and the index of primary disability because of TB (by 3.4%) of people in able-to-work age, pointing to certain control of TB by medical, diagnostic and rehabilitation actions, concerning, mostly early types of pathology.

**Section 2. Risks of TB development, related to execution of professional duties by workers.** In European Regions TB is caused in a person by a micobacteria of a human type (M. tuberculosis), less often of a bull types (M. bovis) and african (M. africanum). A person can be infected in inhalation of drops, containing M. tuberculosis and depends on the concentration of such drops in the air and on the contact duration. The excretion of M. bovis was recorded mostly in inhabitants of rural areas, where an alimentary way of infection is prevailing.

After being infected with M. tuberculosis within 2–10 weeks the immune system prevents further reproduction and spreading of a pathogene. However, selected bacillus remain in the resting state and preserve their vital activity for many years – a state of a latent period (hidden) of TB infection (such individuals have a positive reaction on skin samples on tuberculin, however they do not demonstrate any symptoms of active TB and are not contagious).

Approximately 30% people, having close contacts with persons infected with M. tuberculosis in common premises, can be infected. After infection TB develops in 3–10% people within 12 months and additionally in 5-10% people TB is developing during the whole life. Persons with long-term and/or intensive contacts of persons with active type of TB, have an additional risk of infection at the level of 22% per year, as compared with the general population. A person with an active TB, which is not treated, is able to infect 10–15 persons, annually.

Such risk factors, which increase probability of transition of a latent TB infection in its active process: are silicosis, work in conditions of exposure to quartz dust and cement, by
increase of the level of development of active TB in lungs by 30 times; for patients with chronic kidney insufficiency, those who undergo hemodialysis, the risk for them increases by 10–25 times; patients with diabetes mellitus - 2–4 times); patients, who have had a surgical intervention – gastroectomy or intestinal anastomosis (followed by the loss of weight and a syndrome of malabsorption), kidney or heart transplantation and who receive immunodepressants. became ill with cancer malformation; those with low index of the body weight (IBW<18.5) increases the risk by 2–3 times; taking psychoactive preparations (narcotics; long-term systemic therapy with corticosteroids and immunodepressants. HIV-infection/AIDS (40–60 % patients with AIDS and the active type of TB take a particular place,. The deficiency of vitamin D; heredity, susceptibility to TB (control through gene IL12B polymorphism); low level of cytokines (factor of alpha tumor necrosis), as a result of a blockade of its synthesis by anti-inflammation preparations is also significant.

Micobacteria are excreted from the human body and domestic animals, which differ by their properties from M. tuberculosis and M. bovis, as well as from saprophytic micobacteria, presented in the environment, are called atypical. Human diseases, caused by atypical micobacteria, have been proposed to call micobacteriosis: M. avium, M. xenopi, M. kansassii, M. malmoense are main microorganisms, which cause about 95 % micobacteriosis in people. Micobacteriosis are found in almost 3 % patients, who are observed by the phthisiatric service, and are most often recorded in individuals with immunodeficiency (in HIV-infected 40–90 %). It is supposed that a patient with micobacteriosis do not present danger to surrounding people, because atypical micobacteriosis are not transmitted from man to man. Most often people with immunodeficiency are infected by atypical micobacteria in inhalation, contaminated food products and penetration of a pathogene unto micro-traumas through the skin and mucouse membranes. By clinical manifestation and roentgenography micobacteria do not differ from TB and antituberculosis preparations do not manifest a therapeutical effect due to medicinal stability of a pathogene.

Occupational diseases, caused by infectious factors are relatively not numerous. The following groups of workers can be referred to occupational groups with higher risk of infection with micobacteria: medical workers; workers of clinical (bacteriological and pathological) laboratories; right protection bodies and prisons; social services, those of the education system, communal services, workers of ritual and rescue services, state administration; transport for passangers; workers of agriculture and forestry, zoos and veterinary services; mining industry; workers exposed to silica dioxide; migration workers; those engaged in the sphere of public nutrition (cookers); military workers.

The danger to be infected with M. tuberculosis can be higher at places, where TB patients receive care, before a diagnosis is stated and before begun the treatment of TB as well as before introduction of quarantine actions (in the halls for waiting in hospitals, deparments of emergency care, etc.). The risk of infection increases significantly, when making some medical manipulations – bronchoscopy, endotrachial intubation, suction, draining of abscesses, inhalation, autopsia, induction of sputum excretion and other interventions, provoking cough, as well as in the process of work in laboratories with biological materials, containing M. Tuberculosis, etc.

The personal of medical establishements have a high risk of infection with M. tuberculosis or M. bovis in such establishments, where patients with active types of TB are cured, where HIV-infected persons are cared for as well as persons with TB, in particular in such
cases when they receive procedures, which can cause cough. Also, people of high risk groups in the process of receiving a medical care.

Nurses, physicians, pathologists, medical and legal specialists are mostly often fall ill with TB as well as the personnel of bacteriological laboratories. The infection with TB of medical workers can occur more often in anti-tuberculosis establishments (72.0 % workers of all found patients with TB) most often with strains, stable to main anti-tuberculosis chemical preparations.

The following are the factors which determine risks of occupational infection with M. tuberculosis: late diagnostics and not timely isolation and treatment of patients with active TB; insufficient ventilation and air condensation in premises, where there are persons with active TB (high rate of air re-circulation); insufficient precautions when making procedures causing cough; lack of corresponding respiratory protection; insufficient use of ultraviolet radiation in premises where there are patients with active TB; low work safety when making such manipulations as dressing, bronchoscopy, autopsy; failure to keep to anti-tuberculosis actions in laboratories, morgues, hospitals.

Agricultural and zoo workers are faced to high risks of occupational infection with M. bovis (when breeding cattle, pigs, horses, sheeps, goats) and with M. avium, M. balnei (in poultry breeding). High risks of occupational infection with M. bovis can also happen with workers of zoos in the period of care, research and treatment of TB in these animals (horses, bulls, buffaloes, bizons, yaks, elephants, camels, northern deers, birds, cold-blooded animals). Also, high risks of infection with TB from animals are recorded in veterinary workers, when they study and cure animals with this disease, when study in laboratories, biological materials, taken from ill animals. Forestry workers and fishers have risks of infection with TB through inhalation, when they use animals with such pathology in their work as well as during contacts with wild animals infected with TB (mountain goats, deers, badgers, rabbits, fish) or with wounded animals, or in contacts with the skin and mucous membranes of the biological materials, infected from ill animals.

Since 1976 an unfavourable epizootic situation is observed in Ukraine, concerning morbidity of the cattle on TB in agriculture in collective and private farms. In 2004-2005 the cattle with the reaction on tuberculin was recorded in 24 of 25 administration regions: in 6 oblasts – more than in 20 % farms; in eight – in 10–20 %, in ten – near 10 % farms. The studies revealed that a relation between the intensive development of farms, where cattle was found to react on tuberculin and people infected with TB, except for the Crimea Republic, indicating the influence of epidemiological situation with TB on the intensity of manifestation of epizootic process of micobacterial infection (in 7.9 % farms the cause of morbidity in the cattle were people infected with TB).

Among miners and other workers involved in mining process the increase of morbidity rates of TB is recorded, caused by M. tuberculosis. This can be explained, first of all, by that workers stay in the closed premises for a long time with limited air exchange, being in close contact with each other. The studies revealed that the presence of a progressive heavy fibrosis in lungs, caused by the exposure to dust, containing silica dioxide in quantities exceeding 30%, is a risk factor for developing a secondary TB with the availability of pneumoconiosis (silicosis) in miners.

The morbidity rates of TB of lungs significantly increase under occupational exposures to crystal silica dioxide (кремнеземом) and in the case of availability of pneumoconiosis (silicosis)
in miners, respectively. The number of persons with TB among workers with silicosis can exceed 20% (in large prevalence of TB). It is supposed that occurrence of the secondary TB in patients with silicosis is probably related to toxic effect of silica into macrophages of the lungs. Workers of the mining industry have the highest risk, when they are exposed to dust, containing silica (ground and underground mining, underground extraction of stone, ore, minerals, coal); in the construction industry (in cutting, drilling, explosion works); foundry production (those working with a sand-blower, chippers, drive off workers, those working in tunnels and others), when using a sand-cluster for metal cleaning, in welding and abrading works. Main risk factors in development of coniotuberculosis are as follows: endogenous (age; sex; presence of antigens by HLA system – A25, B15, A1A9; decrease of the immunity – decrease of the functional activity of T-lymphocytes; astenic type of the body; unfavourable heredity on TB; pneumoconiosis); exogenic factors (profession, length of employment in dust exposure, place of work). The latest scientific data show that for workers, exposed to silica dust, TB can be initiated by atypical micobacteria (Mycobacterium spp. – M. kanssastii, M. malmoense), where the soil is the source for such bacteria.

Risks of occupational TB infection of other groups of workers are underestimated in Ukraine, whose occupational activity is related on long-term contacts with a large number of persons, who can be referred to social risk groups on TB development: workers of social services, passanger transport, communal services, state administration, law bodies, prisons, emergency service, etc., when hunting for ill animals or eating their meat. Also, they can be infected with atypical types of micobacteria (Mycobacterium spp.) when drinking water, contaminated with wild animals, when inhaling dust of the contaminated soil.

**Section 3. Morbidity from occupational tuberculosis and coniotuberculosis in Ukraine (1993–2008).** The study revealed that morbidity on occupational TB in Ukraine made 0,95% of the total occupational pathology and on coniotuberculosis – 1,4% (among patients with pneumoconiosis – 5,0%).

Annually 55 cases of occupational TB is recorded in Ukraine (cumulation number of patients for 1993–2008 – 880) and 105 cases of coniotuberculosis (cumulation number - 1673). The correlation relation has been found between records of cases of occupational TB (r =0,96, p<0,05) and negative – for coniotuberculosis (r=-0,70, p<0,05) and the number of new cases of TB in the total population. However, the part of patients with occupational TB and coniotuberculosis is insignificant (1,71% and 10,97% respectively), which can be explained by of the hypodiagnostics of occupational genesis of TB against the increase of the population morbidity of TB.

Among patients with occupational TB of lungs women are prevailing (82,9%), whereas for coniotuberculosis – men (92,9%).

The highest morbidity rates on occupational TB (r =0,70, p<0,05) and coniotuberculosis (r =0,80, p<0,05) were recorded in oblasts with high morbidity rates of TB for the population. The following are the largest number of cases for occupational TB by branches of the national economy: in public health system (94,3% of all cases); for coniotuberculosis – in mining industry (coalmining) (70,8%), in metallurgical production (12,3%), production of machines and equipment (8,3%). Annual average morbidity rates are higher than average rates for the country (per 100 000 man-years, respectively of the corresponding workers in the staff): occupational TB of lungs – public health system (6,40), metallurgical production (0,77);
occupational TB of the skin – public health system (0,03); coniotuberculosis – coalmining (25,08), metallurgical production (3,16).

The maximum cumulation number of patients with occupational TB is recorded in persons of able-to-work age – from 20 to 49 (80,1 % of all patients) with the same tendency as for patients with TB in the population, however morbidity rates in the age of 25–34 are higher than population risks (1,2–1,3 times); for TB patients of more than 50 years old (79,4 % of all patients), which is significantly differed from existing population regularities.

Occupational TB is recorded mostly when the length of experience is from 1 до 24 years (83,2 % of all cases), with the maximum – 5–14 years (40,4 %), for coniotuberculosis – 5–29 years (78,4 % of all cases).

94,3 % of all cases of occupational TB has been recorded among public health workers. The largest number of patients with TB by occupational groups was recorded for nurses (40,6 %), physicians (23,9 %), young nurses (20,8 %) and other medical workers (physicians-bacteroelogsists, assistants, desinfectors, laundresses, preparators, etc. (14,7 %).

When analyzing the dynamic of morbidity on TB among medical workers (for 2000–2008) it was found that occupational TB over that period was higher -10,2 % patients (from 5,3 to 12,9 %). In this, TB development was recorded only in 16,5 % workers in anti-tuberculosis establishments (from 14,0 to 19,2 %), indicating a very low activity in determination of occupational type of TB among medical workers of not only anti-tuberculosis establishments but other public health institutions as well.

Section 4. International principles and approaches to prevention of TB at workplace.
Preventive programs for a workplace, concerning the control of TB, should be included in other medical programs, related to HIV/AIDS prevention at workplace, in particular. The following are main principles in the control of TB at workplace: refuse from discrimination, confidentiality, provision with healthy work environment and care of workers, social control. The realization of preventive programs on TB at workplace is integrated, with due account of the WHO strategy «DOTS».

The program on prevention of TB infection should be based on mutually subordinated actions in the control. The first level of the control covering the majority of people is implementation of administrative measures, aimed at the decrease of the danger in the contact of non-infected individuals with those infected.

The second level of the control assumes the use of the technical control for preventing prevalence and decrease of the concentration of infected drops.

The third level of the control includes the use of special actions on the decrease of the dangerous transmission of M. tuberculosis.

The development and realization of typical programs on the TB control at workplace is also expedient, with due account of occupational risks of infection and development of active types of pathology:
1. In public health system – in clinics (departments) for patients with TB, centres for treatment of HIV-infected/patients with AIDS, in emergency services and departments of intensive therapy, in roentgenological departments, in out-patient and in-patient departments, where there can be patients with TB, which have not been diagnosed, in bactereological and clinical laboratories, in pathological departments and divisions of medical and legal expertise.
II. In the system of social provision - in shelters for unemployed, geriatric homes, rehabilitation centres for persons who have discharged from prisons, communal services, administration management.

III. At enterprises: mining and processing industries, where there are recorded high morbidity rates of pneumoconiosis, as well as among workers of agriculture and forestry, when hunting and fishering.

IV. In the system of supervision in prisons (observation, medical and social provision).

V. In agriculture.

- isolation of a patient with TB or a patient suspected for TB;
- respiratory protection (protective masks - for a patient with cough; respirators - for the personnel, who care of patients);
- use of protective screens for medical care;
- minimization of the period of staying of the personnel with an infected person;
- use of the ventilation system for creation of appropriate air tension in premises, where a patient stay;
- use of the system of bacteriological cleaning (disinfection) of the air in premises, where there are patients;
- ultraviolet radiation and disinfection of premises;
- marking premises and places, which can present danger due to TB infection for the personnel;
- training in work safety for persons, who take care of a patient;
- medical observation of the personnel.

It is expedient to undertake measures for finding individuals with latent TB, by taking a skin sample with tuberkulin and using modern serological methods, in order to reveal the presence and rates of antibodies to micobacteria and to determine sensitisation of cells in vitro to tuberculin (by specific IgE) through synthesis of interferon in cells, etc.

The microscopic study of sputum on the presence of acid-stable micobacteria are most effective and safe in finding patients with active TB (painting by Ziel-Nilson) and studying the availability of the micobacteria DNA in biological media.

It is supposed that the use of roentgeographic (fluorographic) studies in the total screening for TB is not necessary. This can be recommended only for diagnostics of the TB process.

Vaccination of the adult population with BCG for prevention of TB infection is considered not expedient.

Section 5. Provision of TB prevention at workplace in Ukraine. Favorable conditions have been created in Ukraine following legislation and regulation requirements for prevention and control of TB at workplace, which, in general, correspond to requirements of the WHO and ILO.

adoption of the general national program on the contraction against TB morbidity in 2007–2011 (2007)" and provision with corresponding standard and sub-legal documents of Ukraine (laws, instructions, methods recommendations, sheets, etc).

However, when considering specific aspects on prevention and control of TB at workplace, a number of problems have been found in Ukraine (related to WHO and ILO recommendations), such as:

- The assessment of conditions, related to risks of MTB transmission at workplace is not conducted in full extent, it has not been determined and regulated for occupational groups of high risk (except for selected groups of medical workers).
- A plan of actions for the control of infection has been developed and implemented only for the public health system; such plans are not developed for other occupational groups of high risk.
- Education and training of occupational groups in preventive measures for TB is systematically carried out only for medical workers (by different levels of access and efficiency), such training for other groups remained almost inaccessible (they are carried out only locally in the framework of projects, which are supported financially from foreign sources – for medical workers of the Donetsk railway, for those working in prisons).
- Earlier detection and diagnostics of patients with TB at workplace are made only for medical workers, workers of the sphere of education, public nutrition, commerce, etc.
- Training in work safety for patients with TB and those suspected of TB infection is carried out only in establishments of anti-tuberculosis service.
- There are no conditions for taking sputum sampling at enterprises.
- The separation of patients and examination of persons suspected of TB in out-patient conditions is not carried out.
- Measures for decreasing contacts with the infection in laboratories are followed.
- Isolation of patients having multiple stability to medicines is conducted mostly in anti-tuberculosis establishments. There are no specialized departments and centers. The policy concerning isolation of patients is used in all medical anti-tuberculosis establishments. These actions are stricter than the WHO recommends.
- The period of isolation for patient is ended after obtaining negative results of bacterioscopic study of the sputum. So, the duration of staying patients in in-patient department is rather long: average number of days for a patient for being on the bed (2008) is 86,38 (from 47,91 to 115,32).
- The assessment of preventive actions on the control of the infection, according to WHO indices is not made. The epidemiological supervision over the morbidity of TB/MTB infected workers is carried out only for social groups and some occupational groups. (medical workers, agricultural workers, service workers, etc.).
- The decrease of concentrations of weighted particles in the working zone air, containing an infected agent (MBT), is reached by ventilation of premises and rational architectural planning in medical establishments; providing a ventilation system is hardly accessible and non affective, because of the poor engineering and technical system; the use of highly effective dry filters is not possible; bactericidal (ultraviolet) lamps are widely use. The technical control of efficiency of the work of ventilation and power of ultraviolet lamps is conducted not systematically.
The use of personal protective equipment for respiration system is insufficient. The disposed masks and serviettes for patients of medical establishments are not available. The provision of medical personnel with respirators (with the diameter of pores by 1.0 mkm) is low. The respirators of positive resistance (PAPR) in medical establishments are not available.

Aiming to improve the system of prevention of TB infection at workplace and to decrease the occupation TB morbidity it is **recommended**:

1. To develop a system of epidemiological monitoring of TB morbidity for the population of Ukraine with due account of branches of the economic activity (by UN classification – ISIC-2) with due account of occupational groups, employment (ISCO) of the population.

2. To develop target programs of TB prevention for individuals with high occupational risk of TB development (except for medical workers) – workers of: employment service, social services and education, state administration, public transport, rescue services, etc.

3. To provide exchange of personified information on TB patients taken from the Automatic information system “Occupational morbidity” and the database “Electronic registry of TB patients” in All-Ukraine centre for TB control (Ministry of Health of Ukraine).

4. To develop unified scientifically grounded criteria and instructions for organization for an expert’s diagnosis of “occupational tuberculosis”. To improve the work of phthisiatrian’s service and the service of occupational pathology for detection of occupational pathology among TB patients. The work of occupational pathology in order to detect patients with TB of lungs among patients with pneumoconiosis should be strengthen. The work of phthisiatrian’s and veterinary services on detection of TB in agricultural workers in case of outbreak of TB morbidity should be improve.

5. To provide medical establishments with marking of premises which can be dangerous for the personnel in respect of MTB infection; to use engineering equipment for protection of the personal from aerosols of a patient (protection screens, glass barrier, etc.); to separate streams of patients (separate patients suspected of TB); to provide patients who has cough with disposed serviettes and masks; to renew the functioning of the ventilation system, to strengthen the technical control over the work of the ventilation system and ultraviolet lamps; to provide workers with respirators of 1.0 mkm diameter of pores; to provide anti-tuberculosis establishments with highly effective air filters (HEPA) and respirators of positive resistance (PAPR).

6. To conduct scientific studies on the expediency to change a fluorographic screening of the working population on TB into the use of clinical screening, serological (express) tests and research of biological fluids on micobacteria (microscopic and DNA-investigation).

To scientifically ground medical contraindications in order to permit workers from occupational groups of high risk of TB infection to perform their professional duties.