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The dangerous infectious diseases in practice of medical and pharmaceutical workers

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Healthcare workers (HCWs) are occupationally exposed to a variety of infectious diseases during the performance of their duties. The delivery of healthcare services requires a broad range of workers, such as physicians, nurses, technicians, clinical laboratory workers, first responders, building maintenance, security and administrative personnel, social workers, food service, housekeeping, and mortuary personnel. Moreover, these workers can be found in a variety of workplace settings, including hospitals, nursing care facilities, outpatient clinics (e.g., medical and dental offices, and occupational health clinics), ambulatory care centers, and emergency response settings. The diversity among HCWs and their workplaces makes occupational exposure to infectious diseases especially challenging. For example, not all workers in the same healthcare facility, not all individuals with the same job title, and not all healthcare facilities will be at equal risk of occupational exposure to infectious agents.

The primary routes of infectious disease transmission in US healthcare settings are: contact, droplet, and airborne.

***Contact*** transmission can be sub-divided into direct and indirect contact. Direct contact transmission involves the transfer of infectious agents to a susceptible individual through physical contact with an infected individual (e.g., direct skin-to-skin contact). Indirect contact transmission occurs when infectious agents are transferred to a susceptible individual when the individual makes physical contact with contaminated items and surfaces (e.g., door knobs, patient-care instruments or equipment, bed rails, examination table). Two examples of contact transmissible infectious agents include Methicillin-resistant *Staphylococcus aureus* (MRSA) and Vancomycin-resistant enterococcus (VRE).

***Droplets*** containing infectious agents are generated when an infected person coughs, sneezes, or talks, or during certain medical procedures, such as suctioning or endotracheal intubation. Transmission occurs when droplets generated in this way come into direct contact with the mucosal surfaces of the eyes, nose, or mouth of a susceptible individual. Droplets are too large to be airborne for long periods of time, and droplet transmission does not occur through the air over long distances. Two examples of droplet transmissible infectious agents are the influenza virus which causes the seasonal flu and *Bordetella pertussis* which causes pertussis (i.e., whooping cough).

***Airborne*** transmission occurs through very small particles or droplet nuclei that contain infectious agents and can remain suspended in air for extended periods of time. When they are inhaled by a susceptible individual, they enter the respiratory tract and can cause infection. Since air currents can disperse these particles or droplet nuclei over long distances, airborne transmission does not require face-to-face contact with an infected individual. Airborne transmission only occurs with infectious agents that are capable of surviving and retaining infectivity for relatively long periods of time in airborne particles or droplet nuclei. Only a limited number of diseases are transmissible via the airborne route. Two examples of airborne transmissible agents include *Mycobacterium tuberculosis* which causes tuberculosis (TB) and the rubella virus which causes measles.

Several OSHA standards and directives are directly applicable to protecting workers against transmission of infectious agents. These include OSHA's [Bloodborne Pathogens standard (29 CFR 1910.1030)](https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10051) which provides protection of workers from exposures to blood and body fluids that may contain bloodborne infectious agents; OSHA's [Personal Protective Equipment standard (29 CFR 1910.132)](https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9777) and [Respiratory Protection standard (29 CFR 1910.134)](https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=12716) which provide protection for workers when exposed to contact, droplet and airborne transmissible infectious agents; and OSHA's *TB compliance directive* which protects workers against exposure to TB through enforcement of existing applicable OSHA standards and the General Duty Clause of the OSH Act.

**CDC Guidelines**

Below is an abbreviated list of CDC resources available to assist HCWs in assessing and reducing their risks for occupational exposure to infectious diseases.

* [Hand Hygiene in Healthcare Settings](http://www.cdc.gov/handhygiene/). This web page provides HCWs and patients with a variety of resources including guidelines for providers, patient empowerment materials, the latest technological advances in hand hygiene adherence measurement, frequently asked questions, and links to promotional and educational tools published by the World Health Organization (WHO), universities, and health departments.
* [Guide to Infection Prevention for Outpatient Settings: Minimum Expectations for Safe Care](http://www.cdc.gov/HAI/settings/outpatient/outpatient-care-guidelines.html). This document is a summary guide of infection prevention recommendations for outpatient (ambulatory care) settings.
* [Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008](http://www.cdc.gov/hicpac/pdf/guidelines/Disinfection_Nov_2008.pdf)\*. This document presents evidence-based recommendations on the preferred methods for cleaning, disinfection and sterilization of patient-care medical devices and for cleaning and disinfecting the healthcare environment. This document supersedes the relevant sections contained in the 1985 Centers for Disease Control and Prevention (CDC) Guideline for Handwashing and Environmental Control.
* [2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings](http://www.cdc.gov/hicpac/2007IP/2007isolationPrecautions.html). This document is intended for use by infection control (IC) staff, healthcare epidemiologists, healthcare administrators, nurses, other healthcare providers, and persons responsible for developing, implementing, and evaluating IC programs for healthcare settings across the continuum of care.
* [Management of Multidrug-Resistant Organisms In Healthcare Settings, 2006](http://www.cdc.gov/hicpac/pdf/MDRO/MDROGuideline2006.pdf)\*. All healthcare settings are affected by the emergence and transmission of antimicrobial-resistant microbes. These guidelines provide information for the prevention of transmission of Multidrug Resistant Organisms (MDROs).
* [Guidelines for Environmental Infection Control in Health-Care Facilities](http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5210a1.htm), (June 6, 2003). This web page provides guidelines, recommendations and strategies for preventing environment-associated infections in healthcare facilities.
* [Healthcare Workers](http://www.cdc.gov/niosh/topics/healthcare/). National Institute for Occupational Safety and Health (NIOSH) Workplace Safety and Health Topic. Healthcare is the fastest-growing sector of the U.S. economy, employing over 18 million workers. Women represent nearly 80% of this work force. Healthcare workers face a wide range of hazards on the job, including needlestick injuries, back injuries, latex allergy, violence, and stress.
* [Eye Safety – Eye Protection for Infection Control](http://www.cdc.gov/niosh/topics/eye/eye-infectious.html). National Institute for Occupational Safety and Health (NIOSH) Workplace Safety and Health Topic. NIOSH recommends eye protection for a variety of potential exposure settings where workers may be at risk of acquiring infectious diseases via ocular exposure.



**Concept about dangerous diseases in practice of the medical worker.**

The HIV is a human immunodeficiency virus. Coming across in an organism of the person it causes the fatal infectious disease named accepted in international practice for “HIV –infection”. Illness proceeds long, has some stages, last one with different clinical displays is designate for “acquired immunodeficiency syndrome” (AIDS). The term "syndrome" designates set of illness symptoms.

It is necessary to ascertain, that at all persons who have caught a human immunodeficiency virus, AIDS, and fatal result already will develop sooner or later. Behind modern representations 5 years after infection AIDS develops at each third infected person.

Sharp displays are observed approximately in 30-70 % of infected people. The most often symptoms are rises in a body temperature of, increase in lymph nodes, quinsy, on the person, a trunk as pink or red spots, dissonance of digestion, a headache, vomiting and a photophobia.

**HIV and AIDS іn practice of the doctor**

Danger of infection of a HIV of medical workers is possible at the carrying out medical - diagnostic manipulations at using needles, syringes and systems of single application. As all fabrics and fluids of the patient, especially blood and sperm, bear (carry) in itself danger of infection, their fence and is necessary for carrying out (for spending) researches in rubber gloves and special clothes. After performance of work wash personal hands. Tests of blood and other biologicalmaterials for research designate words “CAREFULLY – AIDS”. Materials keep are only in special capacities with the same mark.

Any damage of a skin and mucous membranes of the medical personnel, pollution by a biological material from patients during granting of medical service and work on HIV- infected material are qualified by it as medical accident. Right after contact to blood and other biological liquids it is necessary to wash out the polluted sites of skin water with the soap, the polluted mucous membranes pure (clean) water. Not later than 24-36 hours the prophylaxis must be by preparations
during 4 weeks. The fact of medical failure is registered in special magazine, then the victim (behind its consent) during the nearest 5 days survey on presence of antibodies to a HIV. If result is negative, the following testing carry out in 1, 3 and 6 months. In case of revealing at medical worker HIV -Infection, the special commission solves the problem on definition of infection by professional.

Physicians and all health care workers have the right to a safe work environment. Especially in developing countries, the problem of occupational exposure to HIV has contributed to high attrition rates of the health labour force. In some cases, employees become infected with HIV, and in other cases fear of infection causes health care workers to leave their jobs voluntarily. Fear of infection among health workers can also lead to refusal to treat HIV/AIDS patients.

Patients have the right to be protected to the greatest degree possible from transmission of HIV from health professionals and in health care institutions:

a) Proper infection control procedures and universal precautions consistent with the most current national or international standards, as appropriate, should be implemented in all health care facilities. This includes procedures for the use of preventive ART for health professionals who have been exposed to HIV.

b) If the appropriate safeguards for protecting physicians or patients against infection are not in place, physicians and National Medical Associations should take action to correct the situation.

c) Physicians who are infected with HIV should not engage in any activity that creates a risk of transmission of the disease to others. In the context of possible exposure to HIV, the activity in which the physician wishes to engage will be the determining factor. Whether or not an activity is acceptable should be determined by a panel or committee of health care workers with specific expertise in infectious diseases.

d) In the provision of medical care, if a risk of transmission of an infectious disease from a physician to a patient exists, disclosure of that risk to patients is not enough; patients are entitled to expect that their physicians will not increase their exposure to the risk of contracting an infectious disease.

e) If no risk exists, disclosure of the physician's medical condition to his or her patients will serve no rational purpose.

**Virus hepatitis and possible one of its activators in an organism of the doctor**

Virus hepatitis is serious problem of public health services considering their wide circulation. Now in the world more 500 million carriers of virus hepatitis with parenteral are totaled byinfection which in most cases get a chronic course with formation of difficult results - cirrhosis of a liver and a cancer of a liver. At present allocate seven types of virus hepatitis: A, B, C, D, E, F, G.

Viral hepatitis has emerged as a major public health problem throughout the world affecting several hundreds of millions of people. Viral hepatitis is a cause of considerable morbidity and mortality in the human population, both from acute infection and chronic sequelae which include, in the case of hepatitis B, C and D, chronic active hepatitis and cirrhosis. Hepatocellular carcinoma which is one of the ten most common cancers worldwide, is closely associated with hepatitis B, andat least in some regions of the world with hepatitis C virus.

The hepatitis viruses include a range of unrelated and often highly unusual human pathogens.

**Hepatitis A virus**

Hepatitis A virus (HAV), classified as hepatovirus, is a small, unenveloped symmetrical RNA virus which shares many of the characteristics of the picornavirus family, and is the cause of infectious or epidemic hepatitis transmitted by the fecal-oral route.

**Hepatitis B virus**

Hepatitis B virus (HBV), a member of the hepadnavirus group, double-stranded DNA viruses which replicate, unusually, by reverse transcription. Hepatitis B virus is endemic in the human population and hyperendemic in many parts of the world. A number of variants of this virus have been described. Natural hepadnavirus infections also occur in other mammals including woodchucks, beechy ground squirrels and ducks.

**Hepatitis C virus**

Hepatitis C virus (HCV), is an enveloped single-stranded RNA virus which appears to be distantly related (possibly in its evolution) to flaviviruses, although hepatitis C is not transmitted by arthropod vectors. Several genotypes have been identified. Infection with this more recently identified virus is common in many countries. Hepatitis C virus is associated with chronic liver disease and also with primary liver cancer in some countries.

**Hepatitis D virus**

Hepatitis D virus (HDV) is an unusual, single-stranded, circular RNA virus with a number of similarities to certain plant viral satellites and viroids. This virus requires hepadnavirus helper functions for propagation in hepatocytes, and is an important cause of acute and severe chronic liver damage in many regions of the world.

**Hepatitis E virus**

Hepatitis E virus (HEV), the cause of enterically-transmitted non-A, non-B hepatitis, is another non-enveloped, single-stranded RNA virus, which shares many biophysical and biochemical features with caliciviruses. The most similar genome to HEV is found in a plant virus, beet necrotic yellow vein virus, and there are similarities in the functional domains to rubella virus. Final taxonomic classification is yet to be agreed upon. Hepatitis E virus is an important cause of large epidemics of acute hepatitis in the subcontinent of India, Central and Southeast Asia, the Middle East, parts of Africa and elsewhere. This virus is responsible for high mortality (15–20%), during pregnancy particularly during the third trimester.

**The GB hepatitis viruses**

The GB hepatitis viruses (GBV-A, GBV-B and GBV-C). The GB hepatitis viruses were cloned recently and preliminary genomic characterization shows that they are related to other positive-stranded RNA viruses with local regions of sequence identity with various flaviviruses. Phylogenetic analysis of genomic sequences showed that these viruses are not genotypes of the hepatitis C virus.

In the majority of regions of the world hepatitis B and C are prevail. Widely spreading of virus hepatitis be explained ease of infection. The virus hepatitis in 1000 times is more infectious than AIDS!!! Even traces of blood it appears enough for infection. The usual devices for shaving, manicure accessories, drawing tattoo, visiting of the dentist, the gynecologist, the transferred operation - all this can be a risk factor for infection. The hepatitis B is transferred the same as also a HIV, at direct contact to fluids of an organism of the infected person, through syringes or other tools which prick and cut, at blood transfusion, from mother to the child. It is similar up to a HIV,this virus is not transferred at household contact, through a food, a water and air - droplet way. The main difference of a hepatitis B from a HIV is its higher infection.

**Prophylaxis infection viruses of a hepatitis and immunoprophylaxis at contact to biological materials of the patient with a hepatitis**

With the purpose of the prevention of infection with hepatitis in all healthcare facilities it is necessary using as much as possible medical and laboratory toolkit of disposable; severely to be observed rules of use, disinfection, and sterilization of medical and laboratory toolkit, the equipment.

Prophylaxis of professional infections of healthcare workers reduced to the maximal prevention of pollution of blood which contains virus hepatitis, in an organism of the doctor in a working time. All manipulations at which can take place pollution of hands by blood or fluid, a trace to carry out in rubber gloves.

In case of pollution of hands by blood it is immediately to process them tampon moistened with a disinfectant solution (1 % a solution chloramines) and to wash up them twice warm flowing water with soap, dry to wipe an individual towel or a napkin of disposable using.

Surfaces of working tables at the end of each working day, and in case of pollution by blood it is immediately to process 3 % solution chloramines.

*Medical personal* who work contact to blood and its components are subject to inspection on presence of virus (НBs Ag) in an effective date for work, and is farther not less often than a once in year.

***Prophylaxis of post-transfusion hepatitis (PTH)***:

а) Careful medical and biochemical inspection of all categories of donors;

b) The maximal restriction of donors number concerning one recipient of blood or its preparations;

c) Regular epidemiological investigation of cases PTH;

d) Revealing of donors of sources PTH and their alienation from a donor service.

All categories of donors at everyone are subject to complex laboratory inspection with obligatory research of blood on presence НBs Ag with use of high-sensitivity methods of its indication.

***The person is not supposed to a donor service, in which as a result of inspection is established:***

•transferred in past VH, irrespective of prescription of disease;

•presence НBs Ag in whey of blood;

•presence of chronic diseases of a liver;

•Presence of clinical and laboratory attributes of a pathology of a liver;

•contact in family or in an apartment with patient VH for the period of 6 months from the moment of his hospitalization;

The person which had transfusion of blood and its components for last 6 months.

**Tuberculosis and its distribution in Ukraine and the world.**

The beginning of a new millennium is accompanied by menacing situation about that tuberculosis which always was the indicator of social well-being in public. Every year in the world from 7 up to 10 million patients with tuberculosis reveal are from which 2,5-3 million persons died. The total of patients on this illness makes 50-60 millions. ALL OVER THE WORLD death from tuberculosis wins first place among other infectious and parasitic illnesses.

The distribution of a tuberculosis leads to reductions to life expectancy, growth of a death rate, temporary and stable capacity for work.

Epidemic of a tuberculosis in our country is declared since 1995, since it continues to progress. Each hour per Ukraine register four new cases of tuberculosis and one case of death from this illness. Every year it appears 37 - 39 thousand persons and 11 thousand patients with tuberculosis died. Since 2001 disease a tuberculosis has increased in 2,2 times and has made a level 80,9 on 100 thousand population, and mortality has increased in 2,7 times and makes 22,6 on 100 thousand population.Radiologists in the tropics or, indeed, anywhere else, should consider tuberculosis in almost every differential diagnosis: its manifestations, like its sufferers, are legion.

***Tuberculosis*** is an infection with the *Mycobacterium tuberculosis* or *Mycobacterium bovis*. Both are gram-positive, acid and alcohol fast, aerobic, non-spore forming rods, classified with the actinomycetes. *M. tuberculosis* is a facultative intracellular parasite, which, many believe, is capable also of extracellular growth and can remain dormant for years or even decades.

Tuberculosis is a worldwide infection from which some three million people die annually, more than from any other single infectious disease. It is probable that, because of AIDS, drug resistance, and population stresses, the epidemic will increase in the future unless brought under control. The countries with the largest number of patients with tuberculosis are Bangladesh, Brazil, China, India, Indonesia, Nigeria, Pakistan, the Philippines, and Vietnam. The rate of disease ishighest in sub-Saharan Africa. In some parts of the world, 80% of the population react positively to a tuberculin skin test by the age of 25 years and many react much earlier (unless they are HIV positive). In developing countries tuberculosis accounts for 26% of avoidable deaths.

The reported incidence, however, may not be accurate: it is often a reflection of the efficiency and methods used to detect the disease rather than a true indication of its actual prevalence. Public health facilities vary greatly, but, for example, it was estimated in East Africa (1971) that half a million persons were newly infected each year and that 75,000 would develop clinical tuberculosis, of whom only 25,000 would be diagnosed and 16,000 treated. Such figures have improved in some countries, but not in all. A person, once infected, is likely to harbor the tubercle bacillus for the rest of his or her life and it may remain dormant unless there is a change in general health or immunity, as occurs with AIDS, diabetes, leukemia, or malnutrition. Much lesscommonly, there may be reinfection.

***Professional danger of the doctor of the phthisiatrician and the use of preventive measures***

Doctors - phthisiatricians are persons who communicate with patients with tuberculosis because they are constant supervision of experts of a tubercular clinic. They have primary task the prevention of cases of disease by tuberculosis among the medical personnel.

With this purpose in a tubercular hospital persons employed are not younger than 18 years which have passed obligatory medical examination. The following prophylaxis examinations on tuberculosis are carried out every 6 months.

The rules of disinfection at work with tubercular patients are practically same as at work on HIV-AIDS patients and patients with hepatitis. It first of all works of medical personals in rubber gloves, using disposable toolkit, strict performance of rules of the current and final disinfection.

Observance even such simple safety rules at work with infected patients will help medical workers of the specialized establishments to keep the health.

**Needlestick injuries**

Needlesticks are a common occurrence in the health care profession. It is estimated that 600 000 to 800 000 needlestick injuries occur per year in the United States. Of these, many, if not most, go unreported. In response to the risk of exposure, institutions have focused on primary prevention as a means of reducing the incidence of needlesticks and thereby decreasing the number of bloodborne pathogen transmissions. Needlestick injuries still occur, however, and it is important that individuals in the health care field become well informed about the exposure risks and educated regarding the appropriate response.

***What are the primary pathogens transmitted?***

*1. Human Immunodeficiency Virus (HIV):* The average risk of seroconversion after a needlestick injury from a confirmed HIV source is approximately 0.3 % without post-exposure therapy .Certain factors contribute to elevated risk :

* Increased depth of the puncture wound
* Visible blood on the needle
* Needle used in the vein or artery of the patient
* Patient with terminal HIV as source of the fluid

*2. Hepatitis B Virus (HBV):* The risk of acquiring hepatitis secondary to HBV percutaneous exposure varies based on the serological status of the patient. In the worst case scenario, if the patient has active replication of the virus (indicated by HBe Ag-positive blood ) then the risk of developing clinical hepatitis is as high as 31 %. When the patient has HBsAg-positive blood but is HBe Ag-negative (indicating a less infective state), the risk is significantly lower, about 1 to 6 %.

*3. Hepatitis C Virus (HCV):* The risk of HCV seroconversion after a needlestick injury from a patient infected with HCV is approximately 1.8 %. Unfortunately, there is little evidence to support postexposure treatment as a means to decrease the risk of infection.

***Role of Vaccination***

Of these 3 infections, vaccination is available only for HBV. In the 1970s, the risk of acquiring HBV was 10 times greater in health care workers than in the general population. This risk has significantly declined, due in part to an aggressive vaccination campaign geared toward hospital staff.

Facts about the vaccine:

* A series of 3 shots made from HBs Ag is administered.
* Vaccination response can be confirmed by assessing for anti-HBs 2-3 months after completion of the series.
* Efficacy is approximately 95 % in healthy adults.
* Protection lasts at least 10 years after vaccination, but may last much longer.
* Currently, no booster is recommended.

***What protocol should be followed after any needlestick?***

First, *do not panic*. Protocols are in place to minimize the risk of infection after exposure. Second, do not ignore the exposure. Acting within outlined timeframes can lead to a significant decrease in the transmission rate of certain infections. The following measures also should be taken:

* The site should be immediately washed with soap and water.
* The incident should be reported and an exposure report sheet completed.
* The exposure should be assessed (type of fluid, type of needle, amount of blood on the needle, etc).
* The exposure source should be evaluated:
	1. HIV, HBV, and HCV status of the patient;
	2. Consent and testing of the patient for these diseases if the status is unknown;
	3. Likelihood of infection based on the community served by the hospital if the patient is not available to be tested.
* Appropriate management of any positive exposure is necessary

***Virus-specific Post-exposure Management***

*1. HIV:* Use of post-exposure prophylaxis can help to reduce the risk of contracting HIV. Maximal benefit can be obtained by initiating treatment within hours of exposure. Guidelines include the following:

* Start post-exposure prophylaxis as soon as possible.
* Reevaluate the exposed individual within 72 hours, particularly focusing on new information regarding the source and the exposure.
* If the source is determined to be HIV-negative, post-exposure prophylaxis can be discontinued.
* If the source is determined to be HIV-positive, continue treatment for 4 weeks if tolerated.
* All workers exposed to HIV should undergo HIV antibody testing at 6 weeks, 12 weeks, and 6 months.

A few additional considerations regarding HIV exposure management:

There is the possibility of toxicity with antiretrovirals, so use should be restricted to exposures in which reasonable risk of transmission is present.

* 2-drug therapy (with 2 nucleoside analogues) is recommended, although 3-drug therapy may be warranted under certain circumstances (a source with a high viral load or known drug resistance).
* One should inform the treating physician about pregnancy status and current medications because these can influence the selection of a treatment regimen.

*2. HBV*: The treatment after exposure varies based on the vaccination status of the exposed individual and the HBV status of the patient:

* Regardless of the status of the patient, if an individual suffers a needlestick and is unvaccinated, the vaccination series should be initiated.
* If an individual has been vaccinated and has a documented response to the vaccine, then no treatment is required after an exposure.
* If the vaccination status of the exposed individual is unknown, he or she should be tested for anti-HBs before deciding on treatment.

*3. HCV:* No treatment has been shown to prevent infection for workers exposed to HCV. Recommendations center on following workers after the injury and monitoring for HCV RNA in the serum. Recommendations include:

* Begin testing for HCV antibodies, HCV RNA levels, and alanine aminotranferase (ALT) levels immediately after the event.
* Repeat testing 2-8 weeks later.
* If infection occurs, the health care worker should be referred to a specialist for management.

Some people, such as health care workers are at increased risk of needlestick injury, which occurs when the skin is accidentally punctured by a used needle. Blood-borne diseases that could be transmitted by such an injury include human immunodeficiency virus (HIV), hepatitis B (HBV) and hepatitis C (HCV).

***Ways of reducing the risk of needlestick injuries include:***

* Health workers who may come in contact with blood or body fluids should receive hepatitis B vaccinations.
* Follow all safety procedures in the workplace.
* Regularly undertake safety refresher courses.
* Minimise your use of needles.
* Remember that latex gloves don’t protect you against needlestick injuries.
* Don’t bend or snap used needles.
* **Never** re-cap a used needle.
* Place used needles into a clearly labelled and puncture-proof sharps approved container.

