# Safety Guidelines for Handling Human Clinical Specimens

## 1. Introduction

This guideline contains information on the safe handling of human clinical specimens including blood and urine with an aim to prevent possible spread of infectious disease to laboratory users and the general community when conducting different laboratory operations. Every laboratory user has the responsibility to fully understand the safety guidelines when handling specimens and must ensure that all safety procedures are strictly followed for the entire operation. The laboratory supervisor has the responsibility to make sure that all laboratory personnel must complete all necessary training before commencement of any laboratory activity.

## 2. General safety guidelines for handling human clinical specimens

2.1 Specimen collection, transportation and acceptance

2.1.1 All specimen containers should be sterilised and examined to ensure that there are no defects before sample collection.

2.1.2 Laboratory users performing specimen sampling should be trained on specimen collection, labelling, handling and transportation as well as safety and decontamination procedures. All training records should be documented.

2.1.3 All specimens should be considered as biohazard and potentially infectious.

2.1.4 Standard precautionary measures[note 1] should be strictly followed for the entire operation. Hand and respiratory hygienic practices should be included in these precautionary measures.

2.1.5 Specimen collection and transportation procedures that affect the quality of specimens should be clearly defined by the respective laboratory supervisor. All specimens should be clearly labelled for identification.

2.1.6 Food items stored in laboratory for experiment purposes should be labelled properly to avoid contamination of clinical specimens.

2.1.7 Appropriate personal protective equipment (PPE) such as laboratory coat, gloves and goggles/splash shield should be worn during the entire operation. Additional precautionary measures may be necessary in accordance with specific operations in the laboratory.

2.1.8 Breakage-resistant plastic containers for specimen collection should be used and securely capped to prevent leakage and spread of infectious agents.

2.1.9 Secondary containers labelled “Biohazard” should be used when transferring specimens.

2.1.10 Secondary containers containing specimens should be examined for spillage or leakage. Specimens should be rejected if any spillages or leakages are found.

2.1.11 All caps of specimen containers including blood-collection tubes and sample tubes should be securely fastened before proceeding to analysis or storage.

2.1.12 When handling containers of specimens, the body of the container should be firmly held instead of the stoppers or caps of containers in order to prevent spillage or breakage.

note 1 Standard precautionary measures are means to reduce the risk of transmission of blood-borne and other pathogens from both recognised and unrecognised sources including personal hygienic practices, use of PPE, safe disposal of bio-medical wastes, sterilisation of reusable equipment and environmental control. For details, please refer to reference 4.4.

2.1.13 Specimen collection and transportation procedures that affect the quality of specimens should be reviewed regularly by the laboratory supervisor and necessary training for those who involved in the collection and transportation procedures should be provided.

2.2 Laboratory procedures

2.2.1 All specimen preparatory operations should only be processed in a Class II or higher Biological Safety Cabinet (BSC) adhering to relevant level of biological safety practices.

2.2.2 A "dirty zone" for handling specimens should be designated in a laboratory if a separate room is not available; this designated zone should be clearly marked with "Biohazard" warning labels.

2.2.3 Direction of air flow from clean to dirty zone should be utilised when conducting operations in order to reduce the opportunity of contamination.

2.2.4 Instructions for instrument operations, materials handling as well as the procedures of cleaning and disinfection for all working areas and instruments should be available and such information should be clearly indicated.

2.2.5 Non-experimental procedures such as instrument maintenance, emergency response and general housekeeping should also be written clearly.

2.2.6 Training records should be documented and the competency of laboratory users and service providers should be assessed for relevant operations. Training records should be accessible.

2.2.7 The cleanliness of the bench should be regularly inspected by laboratory supervisors.

2.2.8 Appropriate PPE including a minimum of laboratory coat, gloves and goggles/splash shield should be worn for the entire operation. Additional PPE such as mask should be worn according to the basis of documented risk and hazard assessment of the operation or whenever necessary.

2.2.9 Pre-treatment of specimens should be performed to avoid direct specimen introductions to instruments, if required.

2.2.10 Leaked specimens from containers should be considered as contaminated. Any incidences of leakages should be documented and reported to the laboratory supervisor. Such containers should be decontaminated before further processing by instruments. Gloves should be discarded immediately after clean up. A new specimen should be obtained if the container is broken or the content has been spilled.

2.2.11 Leakage of urine should be treated by means of decontamination in order to reduce potential hazards to laboratory users and to maintain the hygienic condition of the laboratory environment.

2.2.12 Visible contamination should be wiped off using 1:10 by volume (v/v) household bleach with a minimum of 0.5% sodium hypochlorite concentration or other laboratory disinfectants. Container labels should be kept intact for easy identification of specimens. Table 1 should be referred for the applications of different types of disinfectants.

2.2.13 Instruments for specimen analyses should be inspected regularly for cleanliness and contamination. Decontamination should be carried out when necessary.

2.2.14 Contaminated instruments should be treated before servicing or shipping. The manufacturer should be consulted for detailed decontamination procedures.

2.2.15 The following procedures should be performed if decontamination of the equipment or portions of such equipment is not feasible:

2.2.15.1 The equipment should be labelled with "Biohazard" and the affected area should be clearly marked.

2.2.15.2 All related personnel such as laboratory users and the servicing representative should be alerted before handling, servicing or shipping in order to implement appropriate precautionary measures.

2.2.16 All PPE including laboratory coat should only be kept in the laboratory area. Cleaning and disinfections of laboratory coats should be regularly arranged by laboratory supervisors. Hands and forearms should be washed thoroughly with laboratory grade hand disinfectants when necessary and after work.

2.3 Disinfection and sterilisation

2.3.1 Disinfection should be carried out for the purpose of protecting relevant users and laboratory environment. It should be carried out by using an appropriate disinfectant which has sufficient contact time. Contact time and instructions are indicated on individual disinfectants. The following table provides a comparison on the use of different types of disinfectants:

Table 1. Comparison of different types of disinfectants

| Type of disinfectant | Use | Hazards | Example and contact time |
|---|---|---|---|
| Alcohol | • Cleaning instruments | • Flammable<br>• Eye Irritant<br>• Toxic | 70% Ethanol or isopropanol<br>10 – 30 mins |
| Chlorine compounds | • Spill of human body fluids<br>• Bactericidal<br>• Fungicidal<br>• Sporicidal (at >1000ppm sodium) | • Eye, skin and respiratory irritant | 1:10 (v/v) Household bleach<br>10 – 30 mins |
| Glutaraldehyde | • Bactericidal<br>• Fungicidal<br>• Tuberculocidal<br>• Virucidal<br>• Sporicidal | • Eye, skin and respiratory irritant<br>• Sensitiser<br>• Toxic | 2% Cidex<br>10 – 30 mins |
| Iodophors | • Disinfecting some semicritical medical equipment<br>• Bactericidal<br>• Fungicidal<br>• Virucidal | • Skin and eye irritant<br>• Corrosive<br>• Toxic | Wescodyne<br>10 – 30 mins |
| Phenolic compounds | • Bactericidal<br>• Fungicidal<br>• Tuberculodial<br>• Virucidal | • Skin and eye irritant<br>• Sensitiser<br>• Corrosive<br>• Toxic | Hil-Phene<br>10 – 30 mins |
| Quaternary ammonium compounds | • Bactericidal<br>• Fungicidal<br>• Virucidal | • Skin and eye irritant<br>• Toxic | Hi-Tor or Lysol I. C.<br>10 – 30 mins |

2.3.2 Working environment such as bench should be cleaned when necessary as well as before and after work.
2.3.3 Spilled area should be cleaned immediately with disinfectant.
2.3.4 Items such as thermometer, stirrer plate and spatula that have been contaminated by used gloves should be decontaminated accordingly.
2.3.5 Diluted household bleach of 1:10 (v/v) should be used for effective disinfection against highly infectious agents such as hepatitis B virus.
2.3.6 If disposable bench top liners were used, the underlying bench should also be disinfected after the removal of top liners.
2.3.7 All disposable liners should be discarded as bio-medical waste.
2.3.8 Dried blood or body fluids should be soaked with relevant disinfectant. A contact time of at least 20 minutes should be allowed for thorough disinfection.
2.3.9 All used containers and laboratory tools should be sterilised by means of autoclaving after use.

2.4 Waste disposal

2.4.1 Bio-medical wastes should be segregated, labelled, stored and disposed of in accordance with the requirements stipulated in "Code of Practice for the Management of Clinical Waste for Waste Producers" published by the Environmental Protection Department as specified in Part III Section 5 of the Laboratory Safety Manual of HKBU.
2.4.2 Bio-medical waste bags should be stored inside a covered waste receptacle and securely fastened when reaching the warning line on the bags.
2.4.3 Liquid bio-medical wastes should be autoclaved or sterilised by 1:10 (v/v) household bleach for 30-60 minutes. Afterwards, the wastes can then be poured into the drain (connected to the sanitary sewage system). Note: Sodium hypochlorite solution should not be autoclaved.
2.4.4 Uncontaminated or autoclaved solid bio-medical wastes including centrifuge tubes, culture plates, PCR tubes and pipette tips can be disposed of as general waste.
2.4.5 Liquid bio-medical wastes related to free-flowing blood and other solid bio-medical wastes should be disposed of as stated in 2.4.1.

## 3. Specific precautionary measures for conducting different operations

3.1 Slide preparations

3.1.1 Slides drying should be performed using an exhaust system such as fume cupboard.
3.1.2 Slides drying by waving action or using electric fans should be avoided as this may generate aerosols and facilitate the spread of infectious agents.

3.2 Microscopes

3.2.1 As different parts of the microscope might have come into contact with specimens, the microscope should be disinfected daily.
3.2.2 Non-corrosive disinfectants should be used. Selection of appropriate disinfectants should also be effective for killing potential infectious agents.

3.3 Hemacytometers

3.3.1 Plastic hemacytometers could be used to replace glass hemacytometers in order to avoid bodily injury from broken glass shards.

3.4 Automated hematology analysers and chromatographic analysers

3.4.1 Each specimen should be registered using a logbook system in order to alert the operator about the presence of specimens such as blood or urine.

3.4.2 Safety shield and containment device should be installed to minimise exposure to aerosols and droplets generated from fast moving instrument sample probes.

3.4.3 Hand movement should be minimised near the sample probe area in order to reduce aerosols generation.

3.4.4 Gloves should be worn when wiping sample probes after sampling.

3.4.5 Sample trays should be handled with caution and covered during transfer to avoid spillage.

3.4.6 Mechanical devices such as auto-pipettes should be used to fill sample cups or aliquots tubes. Decanting should be avoided to reduce the formation of aerosols.

3.4.7 Effluents from analysers should be considered as bio-medical wastes and should be collected in waste containers filled with sufficient quantity of concentrated household bleach to achieve at least 0.5% sodium hypochlorite concentration when full.

3.4.8 Instruments should be cleaned immediately after the completion of experiments involving clinical specimens to avoid spread of infectious agents.

3.5 Flow cytometers

3.5.1 All unfixed specimens such as peripheral leukocytes, bone marrow and various body fluids should be considered as biohazardous materials.

3.5.2 Laboratory users should be trained in order to perform cell sorting operation which is considered to be potentially biohazardous.

3.5.3 Access to flow cytometry should be restricted to authorised laboratory users during cell sorting operation; a notice should be posted at the entrance to alert such process. Observing personnel should be protected with the same level of PPE as the operator during cell sorting on flow cytometers.

3.5.4 Instructions from manufacturer should be strictly followed when operating flow cytometers. Any instrumental failures such as a clogged sort nozzle or the presence of air in the fluidic system can drastically increase the generation of aerosols.

3.5.5 Sample tubes should be securely placed into the sample introduction ports to avoid blown-off or splashing during pressurisation.

3.5.6 Daily decontamination of fluidic system and samplers should be performed in accordance with the instructions from the manufacturer.

3.5.7 Waste should be collected in waste containers filled with sufficient quantity of concentrated household bleach to achieve at least 0.5% sodium hypochlorite concentration when full.

3.6 PCR/DNA sequencer

3.6.1 The direct contact of specimens with the sequencer should be avoided. Pre-treatment of specimens is recommended.

3.7 Centrifuge

3.7.1 Specimens should be contained in securely capped centrifuge tubes before spinning down. The outside of specimen containers should be disinfected before coming in contact with the centrifuge so as to avoid contamination by specimens.

3.8 Handling of buffy coat smears

3.8.1 Disposable Wintrobe tubes should be used to replace capillary tubes in order to avoid cutting glass tube in which shards of glass may be produced.

3.9 Handling of urine

3.9.1 Leakage-resistant cups should be used as the primary container during collection of urine.

3.9.2 All procedures involving preparation and handling of collected urine should be conducted in Class II BSC or fume cupboard.

3.9.3 Specimens should be contained inside a securely sealed or capped secondary container during sample transfer and before analysis.

3.9.4 Injection of samples for analysis should be carried out under a local exhaust system.

3.9.5 Prolonged operation with urine specimens should be handled inside a fume cupboard in order to reduce health hazards and odour nuisance that could affect other laboratory users.

## 4. References


4.1 *Guidelines for Safety Work Practices in Human and Animal medical Diagnostic Laboratories*, Centres for Disease Control and Prevention, US Department of Health and Human Services, USA, 2012.

4.2 *Guideline for Disinfection and Sterilisation in Healthcare Facilities*, Centres for Disease Control and Prevention, US Department of Health and Human Services, USA, 2008.

4.3 *Laboratory Biosafety Manual*, World Health Organisation, Geneva, Switzerland, 2004.

4.4 *Standard Precautions in Health Care*, World Health Organisation, Geneva, Switzerland, 2007.