

# Work with Potentially Infectious Samples including Blood, Blood Products, Human Tissues and other Clinical Specimens

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## Guidance

### 1. Summary

This policy and guidance document is intended to assist Principal Investigators, Laboratory Managers and those with responsibilities for Health and Safety to manage the risks associated with handling all potentially infected samples, including clinical materials such as blood and human tissue. The approach of the document is to ask four basic questions:-

1. What are the risks (in this case infection risks)?
2. What is the nature of the work?
3. What are the appropriate procedures to control the risks?
4. How are information, instruction and training best provided?

Answering these 4 questions in some detail will ensure that an adequate risk assessment has been made, which takes into account the procedures involved and the nature and source of the samples to be handled.

One effective method of managing the work is to write a Standard Operating Procedure that supplements the risk assessment and contains detailed step by step instructions of what to do.

This might cover not just basic procedures and issues such as handling waste but also what to do in the event of accidents and emergencies.

### 2. Work with Potentially Infectious Samples including Blood, Blood Products, Human Tissues and other Clinical Specimens

The following provides guidance for work with clinical samples such as blood, blood products, human tissues and other potentially infectious specimens in research laboratories. It does not cover specific work with blood borne viruses (BBV's) such as the human immunodeficiency virus (HIV) or hepatitis viruses where there is deliberate culture involved. It is not aimed at workers carrying out procedures in clinical settings where there is contact with patients or volunteers, or in any health care situation.

A risk assessment should be made for all work involving the handling of blood, blood products, human tissues as well as environmental samples and material from animals that may be contaminated with pathogens. The risk assessment should be specific for the procedures involved and take account of the nature and source of the samples to be handled.

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## 2.1 What are the Risks?

The main issue for work with all clinical material is the potential for infection. The high risk, well known viral agents such as Human Immunodeficiency Virus (HIV), Hepatitis B virus (HBV) and Hepatitis C Virus (HCV) are not the only agents that may be present in clinical samples such as blood and blood products. Other viruses such as HTLV1 and parvovirus B19 as well as various bacterial agents may also be present. Different clinical materials may present increased infection risks, for example *M. tuberculosis* is more likely to be present in lung tissue or sputum samples than in other clinical specimens. In Hong Kong about half of the adult population over 40 has been infected with HBV. Around 8% of the population are carriers and as many as 25% of these will eventually die from diseases caused by the infection. While the seropositivity rates for other blood borne viruses are much lower e.g. 0.2–0.3% for Hepatitis C virus (HCV), the serious nature of the associated diseases warrant stringent infection control measures.

Blood, blood products and clinical specimens are not the only potential source of infection. Environmental samples may be contaminated with zoonotic agents that can cause serious disease. For example, H5N1 influenza can be isolated from live avian species or dead birds, rabies and SARS like viruses can be isolated from bats and *E.coli* O157:H7 can be isolated from sewage and on occasions even from food samples associated with gastroenteritis.

The key control measures when working with any potentially infectious material is maintaining good working practices and avoiding the use of sharps. Paying particular attention to these precautions will protect against the transmission

of all blood borne pathogens via the percutaneous route (i.e. via a breach of the barrier provided by the skin)

**2.1.1** The nature and source of the samples are crucial in assessing the risks of infection. For example the main hazard from bloods and blood products are blood borne viruses (BBVs) such as hepatitis B virus (HBV) and human immunodeficiency virus (HIV). Other specimens such as faeces and urine are not regarded as posing HBV or HIV infection risk as long as they are not contaminated with blood. However, faeces in particular will contain various other pathogens. Sputum samples and specimens of lung tissues may contain *Mycobacterium tuberculosis*. Samples of neurological origin may contain disease-form prion proteins.

**2.1.2** Typical types of samples that may contain infectious agents include:- urine; faeces; genital tract samples; skin and soft tissue samples; respiratory tract samples including nose, throat, eye and ear swabs and sputum; cerebrospinal fluid; pus; other fluids such as pleural, pericardial and joint aspirates; blood; bone marrow; biopsy samples; autopsy samples; forensic samples; environmental samples, e.g. food, water, soil, air, sewage; and archaeological samples.

**2.1.3** Several factors regarding the source of the samples should be taken in to account when assessing the likely incidence of a pathogen. These include known medical history of a patient or donor, whether the samples are from individuals showing clinical symptoms of infectious disease, the incidence of the various pathogens that are endemic in the local population or donor group and the type of sample.

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**2.1.4** All human tissues are likely to be contaminated with blood. Therefore they should be regarded as potentially infectious for BBVs. HIV for example has been detected in blood and blood products, in serum, plasma, breast milk, semen, vaginal and cervical secretions, urine, saliva, tears, peritoneal fluid, pleural fluid, pericardial fluid, synovial fluid, amniotic fluid and both cerebrospinal fluid (CSF) and brain tissue. There is also evidence that certain specialised cells lining the gut support the multiplication of HIV. Possible HIV contamination should therefore be taken into account when handling materials of these types in the laboratory.

**2.1.5** It is common practice to take samples, most frequently blood, from laboratory staff. This population is generally a lower risk group for blood borne viruses (BBV) but it should not be taken for granted that they are uninfected. If culture is planned then it is good practice not to carry this out (although not completely prohibited) with blood from the staff who will be handling the cultures. If transformation of cells is planned, with for example, Epstein-Barr virus or SV40, then the blood donors must not handle the cultures.

## 2.2 What is the Nature of the Work?

**2.2.1** In any assessment it is good practice to break down the work being carried out into discrete activities and to ask questions such as:-

a. Where the work will be carried out, e.g. in a separate room within the laboratory or in the main laboratory. This will give you an indication of who could be exposed. The

benches must be easily decontaminated in the event of a spill etc.

b. Whether the work could create airborne particles, e.g. vigorous resuspension of pellets, splashes or aerosols; or will it require the use of sharps. The potential for aerosols to be generated will dictate whether a Biological Safety Cabinet is required for the work or not and the use of sharps will need careful consideration and planning.

c. Who will be carrying out the work? This will help you identify whether they are part of any vulnerable group such as inexperienced/young or pregnant workers. Whilst pregnancy should not necessarily mean exclusion from work with samples (because they are at no greater risk of contracting disease), particular care is taken to ensure that pregnant workers are familiar with procedures and they adhere strictly to these so as to minimise the chances of exposure. Some infections such as chickenpox are more severe in pregnancy and other infections such as Rubella, Listeria and Toxoplasmosis can be serious for the baby. Deliberate culture of these agents should be avoided and handling of some samples e.g. genital secretions, bird faeces and sheep placenta (in lambing season) are higher risk operations and should only be carried out if a risk assessment indicates that it is safe to do so.

d. Whether others (those not actually doing the work) could be affected by the work, e.g. other laboratory staff, visitors, cleaners or maintenance workers.

e. Whether the work is routine or only carried out on an infrequent basis? This will have

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implications for the information, instruction and training given to those carrying out the work.

**2.2.2** In principle the more manipulations carried out the greater the risk. If the ultimate aim is to generate nucleic acid for analysis then the sooner an inactivating agent is applied to the sample the better (both from considerations of the integrity of the nucleic acid and the infection risk). Regardless of these considerations it is prudent to use standard aseptic techniques because blood in particular is a rich medium and will support growth of many different bacterial species.

**2.2.3** As indicated in the previous section culture or transformation of samples may increase risks. Other procedures will also need to be considered carefully for example, centrifugation, blood counts, sections for histology, FACS analysis (see 2.3.5) and the use of cover slips (which should be recognized as potential sources of needlestick injury).

## **2.3 What are the Appropriate Procedures to Control the Risks?**

### **2.3.1 Avoiding risk through the application of standard precautions**

The US Centre for Disease Control (CDC) recommendations for those handling blood or other potentially infected materials has been widely adopted in Hong Kong as an appropriate standard for preventing the transmission of blood borne viruses. (See “Recommendations on Infection Control Practice for HIV Transmission in Health Care Settings” a report from the Scientific

Committee on AIDS co-sponsored by the Hong Kong Advisory Council on AIDS and the Centre for Health Protection, Department of Health January 2005; <http://www.27802211.com/ice/program/program11.htm#2>)

These standards must be adhered to in Hong Kong University laboratories; they are:

- a. All specimens of blood, body fluids and other potentially infected materials must be transported in robust leak-proof containers. Care must be taken when collecting the specimen to avoid contaminating the outside of the container and of any paperwork accompanying the specimen.
- b. All persons processing blood and other potentially infected materials must wear gloves. Gloves must be changed and hands washed after completion of specimen processing.
- c. Hands and other skin surfaces as well as mucocutaneous surfaces should be washed immediately and thoroughly if they come into contact with any clinical material.
- d. A safety cabinet must be used if procedures are conducted that have a high potential for generating droplets or aerosols.
- e. Mechanical pipetting aids should be used. Mouth pipetting must be prohibited.
- f. Use of needles or other sharps (including glass e.g. pipettes or capillary tubes) must be limited to situations in which there is no alternative. It is important therefore to consider and supply satisfactory replacements for any of these items should

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they be required. For example, glass Pasteur pipettes can be replaced with safer alternatives such as plastic pastettes or conventional plastic pipette tips and automatic pipettors. If needles are required then the following precautions must be taken:

1. Needles must not be recapped, purposely bent or broken by hand, removed from disposable syringes or otherwise manipulated by hand.
2. Conventional needles and syringes should be replaced wherever possible with vacuum tube systems preferably fitted with a needle safety device such as the Eclipse (Becton Dickinson), Needle-Pro (SIMS Portex) or Safety-Lok (Becton Dickinson). An executive summary of a comparative evaluation of the efficacy and usability of these and other sharps safety devices (undertaken for the Scottish National Health Trust) is available at <http://www.sehd.scot.nhs.uk/publication/s/DC20050822safesharps.pdf>.
3. After they are used, disposable syringes and needles, scalpel blades and other sharp items must be placed in puncture resistant sharps bins for disposal.

- g. Lab surfaces must be decontaminated with an appropriate chemical disinfectant after a spill of blood or body fluid and when work activities are completed.
- h. Contaminated materials used in the lab must be decontaminated before reuse or must be disposed of correctly via the clinical waste route.

- i. Scientific equipment that has been contaminated must be decontaminated before being repaired in the laboratory or transported to the manufacturer.
- j. All persons must wash their hands after completing laboratory activities and must remove protective clothing before leaving the laboratory.

**2.3.2** Application of standard blood and body-fluid precautions for ALL samples eliminates the need for warning labels on specimens since all such material should be considered infective. For example, in a laboratory handling blood samples, a single biohazard label on the door will suffice.

**2.3.3** Workers with exudative lesions or weeping dermatitis should be excluded from direct handling of human blood or other potentially infected materials.

**2.3.4 Vaccination**

Although vaccination should not be seen as a frontline control procedure it is prudent to ensure staff are appropriately vaccinated. In the case of handling bloods this means ensuring that all staff are vaccinated against Hepatitis B virus with post vaccination antibody monitoring to make sure of an adequate response. It is university policy that all staff and students who are at risk are vaccinated against hepatitis B. A record of those refusing vaccination or advised on medical grounds not to be vaccinated must be kept for 10 years. Other vaccinations may be appropriate depending on the circumstances, for advice please contact the University Health Service.

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### 2.3.5 Specialised equipment

#### a. Fluorescent Activated Cell Sorting (FACS) machines

FACS analysis should also be considered carefully as there is an aerosol risk of infection from sorting unfixed bloods and cells. Some facilities totally enclose their FACS machines in Class 2 cabinet like boxes while others ensure negative airflow in dedicated rooms for increased operator protection. Higher risk operations might include for example the immuno-phenotyping of unfixed blood or cell sorting for viable dendritic cells and in these cases specific protective arrangements to deal with potentially aerosolized infectious agents will be required. (For a detailed safety standard for FACS of unfixed cells see the special report in Cytometry Part A 71:414–437 {2007} by Schmid *et al* “International Society for Analytical Cytology Biosafety Standard for Sorting of Unfixed Cells”)

#### b. Microtomes

The use of microtomes to produce sections for histology is an area of some concern because of repeated reports of accidents both in the University and elsewhere. While blocks are often fixed and paraffin embedded before sectioning, and this presents little infection risk, frozen sections might be more of a hazard and should be assessed more thoroughly.

### 2.4 How are Information, Instruction and Training best provided?

#### 2.4.1 An important element of the risk assessment is consideration of how to

provide information, instruction and training to those carrying out the work and those that may be affected by the work. i.e. information on the risks, instruction on what to do and training in order to be able carry out the instructions.

**2.4.2** All those handling clinical specimens need to be aware of the potential risk for infection from the samples they are working with. This can be achieved by providing staff with an appropriate source of information and making sure they have understood what they read. For example [www.aids.gov.hk](http://www.aids.gov.hk) or [www.hepatitis.gov.hk](http://www.hepatitis.gov.hk) are useful WEB sites with a significant amount of information relevant to Hong Kong. The government website on aids <http://www.info.gov.hk/aids> contains useful information such as incidence of HIV in the general population (<http://www.info.gov.hk/aids/pdf/g192.pdf>). <http://www.info.gov.hk/aids/pdf/g152.pdf> also provides useful background information on sero-prevalence of blood borne viruses in Hong Kong.

**2.4.3** The instruction on what to do can be provided effectively by writing a standard operating procedure (SOP) tailored to work in the laboratory but based on the measures outlined above in section 2.3. Training on how to handle the samples can be given by demonstration of the SOP and close supervision of staff while they familiarize themselves with the procedures. Information, instruction and training on what to do in the event of a spill and on what to do with potentially infected clinical waste will also need to be given. Both of these issues can be detailed in the SOP.

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**2.4.4** Consideration should be given on how to document any information, instruction and training provided by the department. Formal written training records are the preferred option.

**2.5 Accidents, Incidents and Near Misses**

ALL accidents incidents or near misses involving suspected exposure to infectious agents, including direct skin or mucous membrane contact with clinical material, must carry out the actions detailed below in the abbreviated University policy. The full policy on the “Management of Needle Stick Injury, Bites, Scratches, Splashes or Mucosal Contact with Blood, Body Fluids or other Clinical Material” can be found on the safety office website at <http://www.hku.hk/safety/pdf/NSP.pdf>.

**2.5.1 First aid**

- a. Wash the site of exposure liberally with soap and water but without scrubbing. Free bleeding of puncture wounds should be encouraged gently but wounds should not be sucked. Antiseptics and skin washes should not be used - there is no evidence of their efficacy, and their effect on local defences is unknown. Disinfectant may be used and the wound dressed.
- b. In the case of exposed mucous membranes, such as splash in the eyes, wash immediately and liberally with running water. If the eyes are exposed this should be carried out before and after removing any contact lenses.

**2.5.2 Immediate actions**

- a. Make the site of the incident safe for others (particularly if a spill is involved). Care should be taken to ensure that others do not help with the clear up of an accidental spillage if they are not aware of the potential risks and trained in safe working practices.
- b. Inform the Head of Department and the workers supervisor/PI of the incident as soon as possible.
- c. Seek competent medical advice immediately. Normally the injured person should attend the Accident and Emergency (A&E) department of a nearby Hospital Authority hospital. Any delay in attendance may compromise treatment.

Any decision not to attend A&E will be in consultation with the Head of Department or PI and will depend on the nature of the incident. All individuals bitten by bats or dogs/cats (or having contact with their saliva) **must** attend A&E. Similarly individuals with any exposure to materials known to be infected with HIV, Hepatitis C or other BSL3 agent would normally be expected to attend A&E.

- d. Identify and retain for testing, if necessary, the source of any contamination (specimen, sample, material etc).
- e. Make every effort to ensure the confidentiality of persons potentially exposed to blood borne viruses, such as HIV, as a result of an accident.

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### 2.5.2 Reporting of the incident or accident

Fill out the standard incident/accident report forms after the individual has attended accident and emergency. See the Safety Office website and page 5 of the accident reporting policy found at the following URL <http://www.hku.hk/safety/pdf/ACCR.pdf>.

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### 2.5.3 Remedial actions

Record and implement any remedial actions identified as soon as reasonably practical.

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