



World Health
Organization



WHO best practices for injections and related procedures toolkit



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March 2010



WHO Library Cataloguing-in-Publication Data

WHO best practices for injections and related procedures toolkit.

WHO/EHT/10.02

1.Injections – adverse effects. 2.Injections – standards. 3.Needlestick injuries – prevention and control. 4.Syringes – utilization. 5.Needles – utilization. 6.Cross infection – prevention and control. 7.Guidelines. I.World Health Organization. II.Safe Injection Global Network.

ISBN 978 92 4 159925 2

(NLM classification: WB 354)

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Printed by the WHO Document Production Services, Geneva, Switzerland

Contents

Preface	v
Acknowledgements	vii
Acronyms	ix
1 Background	1
1.1 Unsafe injection	1
1.2 Purpose and scope	1
1.3 Target audience	2
1.4 Bloodborne virus transmission	2
1.4.1 Hepatitis B virus	2
1.4.2 Hepatitis C virus	3
1.4.3 Human immunodeficiency virus	3
1.5 Prevention strategies	4
2 Best practices for injection	5
2.1 General safety practices	5
2.1.1 Hand hygiene	5
2.1.2 Gloves	6
2.1.3 Other single-use personal protective equipment	6
2.1.4 Skin preparation and disinfection	7
2.1.5 Summary of best practice	8
2.2 Injection devices and medications	8
2.2.1 Injection devices	8
2.2.2 Medication	9
2.2.3 Preparing injections	10
2.2.4 Administering injections	11
2.3 Prevention of sharps injuries to health workers	12
2.4 Waste management	12
3 Best practice in phlebotomy and blood collection	13
3.1 Potential effects of unsafe phlebotomy	13
3.2 Background information on best practices in phlebotomy	13
3.2.1 Quality care for patients and health workers	14
3.2.2 Quality of laboratory sampling	15
3.2.3 Blood-sampling systems	15
3.2.4 Blood collection for blood transfusion purposes	17
3.3 Practical guidance on best practices in phlebotomy	19
3.3.1 Provision of an appropriate location	19
3.3.2 Provision of clear instructions	19
3.3.3 Procedure for drawing blood	19
3.3.4 Collecting blood for blood donation	23
3.3.5 After a blood donation	25
3.3.6 Adverse events in blood donation	25
3.4 Illustrations for best practices in phlebotomy	25
4 Occupational risks and management of bloodborne pathogens	29
4.1 Basic occupational health care	29
4.1.1 Immunization against hepatitis B	29
4.1.2 Testing for HBV, HCV and HIV	30
4.2 Prevention of needle-stick injuries and other blood exposures using a hierarchy of controls ..	30
4.3 Overview of management of exposure to blood	31
4.3.1 First aid	32
4.3.2 Notification	33
4.3.3 Risk assessment	33

4.4	Evaluation and management of exposure to HBV	33
4.4.1	Risk of transmission of HBV.....	33
4.4.2	Management of HBV exposure	34
4.4.3	Follow-up of HBV exposure	34
4.5	Evaluation and management of exposure to HCV	34
4.5.1	Risk of transmission of HCV.....	34
4.5.2	Management of exposure to HCV	35
4.5.3	Follow-up of HCV exposure	35
4.6	Management of exposure to HIV	35
4.6.1	Risk of transmission of HIV.....	35
4.6.2	Management of exposure to HIV	35
4.6.3	Follow-up of HIV exposure	38
	References	41
	Annex A: Indications for glove use in health care	47
	Annex B: Disassembly of needle from syringe or other devices	49
	Glossary	51

Tables

Table 1.1	Examples of conditions causing risks in giving injections or collecting blood.....	4
Table 2.1	Indications and precautions for hand hygiene.....	6
Table 2.2	Indications for glove use in injection practice.....	6
Table 2.3	Skin preparation for different types of injection.....	7
Table 2.4	Infection prevention and control practices	8
Table 2.5	Recommendations on medication containers	9
Table 3.1	Elements of quality assurance in phlebotomy	14
Table 3.2	Systems used for blood sampling.....	15
Table 3.3	Recommended needle gauge, length and device for routine injection and phlebotomy procedures for different age groups.....	17
Table 4.1	First-aid care of the exposure site.....	32
Table 4.2	Hepatitis B post-exposure prophylaxis and immunization follow-up in occupational settings	34
Table 4.3	HIV post-exposure prophylaxis following occupational exposure.....	36
Table 4.4	Evaluation of risk of HIV infection.....	36
Table 4.5	WHO recommended two-drug regimens for HIV post-exposure prophylaxis.....	38
Table 4.6	WHO recommended three-drug regimens for HIV post-exposure prophylaxis	38



Preface

A safe injection is one that does not harm the recipient, does not expose the provider to any avoidable risks and does not result in waste that is dangerous for the community. Unsafe injection practices can lead to transmission of bloodborne pathogens, with their associated burden of disease.

To ensure rational and safe use of injections globally, better injection safety practices are needed. The responsibility for ensuring injection safety rests with national governments, prescribers, administrators, receivers of injections and the wider community. The World Health Organization (WHO) acknowledges this responsibility of its member states and the challenges they face. Through the WHO Injection Safety programme and the Safe Injection Global Network (SIGN – whose secretariat is hosted by WHO), the organization demonstrates its commitment to preventing injection-related disease transmission for patients, health workers and the community at large, through the rational and safe use of injections. WHO and SIGN recognize the importance of infection prevention and control in injection safety.

The WHO strategy for the safe and appropriate use of injections worldwide has four objectives:

- formulating national policies and plans for the safe and appropriate use of injections;
- ensuring quality and safety of injection equipment;
- facilitating equitable access to safe injection practices and equipment;
- achieving appropriate, rational and cost-effective use of injections.

In keeping with these objectives, SIGN has developed this toolkit for injection safety and related procedures.

The toolkit covers elements of standard precautions relevant to the transmission of bloodborne pathogens through unsafe injection practices in health-care settings. The document will help to increase health workers' awareness of the importance of standard precautions relevant to injection safety. Its main target is health workers actively engaged in the administration of the various types of injections in all health and related care services, particularly at the peripheral level. However, other people administering injections may find the toolkit useful.

The main areas covered by the toolkit are:

- bloodborne pathogens transmitted through unsafe injection practices;
- relevant elements of standard precautions and associated barrier protection;
- best injection and related infection prevention and control practices;
- occupational risk factors and their management.

The toolkit is illustrated with practical designs that make it an easy source of reference for the user, and can be used to produce posters, flash cards and spreadsheets. WHO has also produced an aide-memoire, to introduce the reader to the subject.

Compliance with the toolkit is recommended, as it is expected to improve the safety of injections for both patients and health workers.

Selma Khamassi, MD, MSc

Injection Safety & Related Infection Control

Safe Injection Global Network (SIGN) Secretariat

Health Systems and Services/Department of Essential Health Technologies/Diagnostic Imaging and Medical Devices

WHO, Geneva, Switzerland



Acknowledgements

The World Health Organization/Safe Injection Global Network (WHO/SIGN) thanks Dr Una V Reid, Human Resource Development Consultant, for the development and writing of this toolkit.

Expert review group meeting (31 March to 2 April 2008)

The document was reviewed and further developed by a group of experts during a technical meeting held at WHO Headquarters (WHO/HQ), Geneva, from 31 March to 2 April 2008.

Consultants

Dr Patricia K Bertsche

Manager, Global Occupational Health Services
Abbott Laboratories
Abbott Park, IL, USA

Dr Nizam Darmani

International Federation for Infection Control
Northern Ireland

Professor Shaheen Mehtar

Head of Academic Unit for Infection Prevention and Control
Tygerberg Hospital and University of Stellenbosch
Cape Town, South Africa

Representatives of international and national organizations

Dr Lawrence Marum

Team Leader Medical Transmission
Global AIDS Program, HIV Prevention Branch
Centers for Disease Control and Prevention (CDC)
Atlanta, GA, USA

Dr Joseph Perz

Acting Team Leader, Research and Field Investigations
Division of Healthcare Quality Promotion (DHQP)
CDC, Atlanta, GA, USA

Dr Christie Reed

Medical Transmission
Global AIDS Program, HIV Prevention Branch
CDC, Atlanta, GA, USA

Dr Dejana Selenic

Medical Transmission
Global AIDS Program, HIV Prevention Branch
CDC, Atlanta, GA, USA

Dr Steven Wiersma

Associate Director for Science and Global Activities
Division of Viral Hepatitis
National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention
CDC, Atlanta, GA, USA



WHO Secretariat

Dr Selma Khamassi

Medical Officer, Injection Safety, SIGN Secretariat
Health Systems and Services/Department of Essential Health Technologies/
Diagnostic Imaging and Medical Devices (HSS/EHT/DIM)
WHO, Geneva, Switzerland

Internal authors and reviewers (WHO)

Mr Yves Chartier

Sustainable Development and Healthy Environments/
Water, Sanitation and Health (SDE/WSH)
WHO, Geneva, Switzerland

Dr Neelham Dhingra

Coordinator, Blood Transfusion Safety
Health Systems and Services/Essential Health Technologies (HSS/EHT)
WHO, Geneva, Switzerland

Dr Micheline Diepart

Human Immunodeficiency Virus/
Acquired Immune Deficiency Syndrome (HIV/AIDS)
WHO, Geneva, Switzerland

Dr Gerald Dziekan

Evidence and Information for Policy/Patient Safety (EIP/Patient Safety)
WHO, Geneva, Switzerland

Dr Gerry Eijkemans

Sustainable Development and Healthy Environments/
Occupational and Environmental Health (SDE/OEH)
WHO, Geneva, Switzerland

Dr Selma Khamassi

Injection Safety and Related Infection Control, SIGN Secretariat,
Health Systems and Services/Department of Essential Health Technologies/Diagnostic Imaging
and Medical Devices (HSS/EHT/DIM)
WHO, Geneva, Switzerland

Dr Carmen L Pessoa-Silva

Biorisk Reduction for Dangerous Pathogens/
Epidemic and Pandemic Alert and Response (BDP/EPR)
WHO, Geneva, Switzerland

Ms Susan Wilburn

Sustainable Development and Healthy Environments/
Occupational and Environmental Health (SDE/OEH)
WHO, Geneva, Switzerland

WHO/SIGN also acknowledges the generous contribution of the CDC, which helped in the development and publication of this document.



Acronyms

AIDS	acquired immunodeficiency syndrome
CDC	Centers for Disease Control and Prevention, Atlanta, GA, USA
HBV	hepatitis B virus
HCV	hepatitis C virus
HIV	human immunodeficiency virus
PEP	post-exposure prophylaxis
SIGN	Safe Injection Global Network
SOP	standard operating procedure
WHO	World Health Organization



1 Background

Medical treatment is intended to save life and improve health, and all health workers have a responsibility to prevent transmission of health-care associated infections. Adherence to safe injection practices and related infection control is part of that responsibility – it protects patients and health workers.

What is a safe injection (1)

A safe injection, phlebotomy (drawing blood), lancet procedure or intravenous device insertion is one that:

- does not harm the recipient;
- does not expose the provider to any avoidable risk;
- does not result in any waste that is dangerous for other people.

1.1 Unsafe injection

Unsafe injections can result in transmission of a wide variety of pathogens, including viruses, bacteria, fungi and parasites (2). They can also cause non-infectious adverse events such as abscesses and toxic reactions. Reuse of syringes or needles is common in many settings. It exposes patients to pathogens either directly (via contaminated equipment) or indirectly (via contaminated medication vials) (3, 4). The risks of unsafe injection practices have been well documented for the three primary bloodborne pathogens – human immunodeficiency virus (HIV), hepatitis B virus (HBV) and hepatitis C virus (HCV). The estimated global burden of disease for the year 2000 from unsafe injection practices for these pathogens included (3):

- 21 million HBV infections (32% of new HBV infections);
- 2 million HCV infections (40% of new HCV infections);
- 260 000 HIV infections (5% of new HIV infections).

These bloodborne pathogens also contribute to illness among health workers – an estimated 4.4% of HIV infections and 39% of HBV and HCV infections are attributed to occupational injury (5). Among susceptible health workers who do not receive post-exposure prophylaxis (PEP), the risk of infection after needle-stick injury is 23–62% for HBV and 0–7% for HCV (6). Infections may also be transmitted (to other health workers and to patients) from cross-contamination of health workers' hands, medications, medical equipment and devices or environmental surfaces. Thus, proper injection techniques and procedures contribute to the safety of both patients and health workers (1).

1.2 Purpose and scope

The purpose of this toolkit is to promote implementation of safe practices associated with the following medical procedures:

- intradermal, subcutaneous and intramuscular needle injections;
- intravenous infusions and injections;
- dental injections;
- phlebotomy;
- lancet procedures.



The document complements and expands existing World Health Organization (WHO) guidelines and related materials (1, 7, 8). The toolkit describes:

- best injection practices (Chapter 2);
- best practices for phlebotomy and blood collection (Chapter 3);
- assessment and management of occupational risks and injuries (Chapter 4).

Important terms related to injection safety are included in the glossary. Key reference documents are included in the CD-ROM and the reference list. All of these documents may be copied for training purposes, provided that the source is acknowledged.

1.3 Target audience

This toolkit is intended to be used to guide training and daily practice of all health workers in public and private health services. It is primarily aimed at workers who give injections or draw blood, and at those who handle medical waste. However, it will also be useful for health facility administrators, those responsible for infection-control policy and practice, and those responsible for procurement of injection equipment and other health-care supplies.

1.4 Bloodborne virus transmission

Risk of transmission of bloodborne infections depends on the particular pathogen and on the volume and type of blood exposure (9–11). Pathogens such as HBV, HCV and HIV (discussed below) may be transmitted in the absence of visible blood contamination.

Vector-borne diseases such as malaria can also be transmitted through blood, but require large volumes, such as are found in a blood transfusion. Infections transmissible by blood transfusion are covered in other documents on blood safety.

1.4.1 Hepatitis B virus

Newly acquired HBV infection is often asymptomatic – only 30–50% of children over 5 years of age and adults have initial clinical signs or symptoms (12, 13). The fatality rate among people with reported cases of acute symptomatic hepatitis B is 0.5–1.0 (13).

Chronic HBV infection develops in about 90% of those infected as infants, 30% of infected children under 5 years of age, and less than 5% of infected individuals over 5 years of age (12, 13). Overall, about 25% of those who become chronically infected during childhood, and 15% of those who become chronically infected after childhood, die prematurely from cirrhosis or liver cancer (12, 13).

There is no specific treatment for acute hepatitis B; treatment for chronic infection with HBV is costly and often not available.

HBV is transmitted by percutaneous or mucosal exposure to infectious blood or body fluids. Infections can also result from unnoticed exposures, such as inoculation into cutaneous scratches, lesions or mucosal surfaces (14). Hepatitis B surface antigen (which indicates chronic infection) has been detected in multiple body fluids; however, only serum, semen and saliva have been shown to be infectious (12).



HBV is most highly concentrated in serum, with lower concentrations in semen and saliva. The virus is comparatively stable in the environment and remains viable for 7 days or longer on environmental surfaces at room temperature (12). Among susceptible health workers, the risk of HBV infection after a needle-stick injury involving an HBV-positive source is 23–62% (5, 6, 14). Prompt and appropriate interventions with PEP measures can lessen this risk. However, the recommendation is to vaccinate health workers, including waste handlers, with hepatitis B vaccine. The vaccination should be given during pre-service training for those who did not receive it in childhood (see Chapter 4) (15).

1.4.2 Hepatitis C virus

Individuals with acute HCV infection are typically either asymptomatic or have a mild clinical illness. Antibody to HCV (anti-HCV) can be detected in 80% of patients within 15 weeks after exposure, and in 97% by 6 months after exposure (16). Chronic HCV infection develops in 75–85% of infected individuals (16).

Most people remain asymptomatic until onset of cirrhosis or end-stage liver disease, which develops in approximately 10–20% of infected individuals within 20–30 years (16). There is no specific treatment for acute hepatitis C; treatment for chronic HCV infection is costly and is often not available (17).

HCV is transmitted primarily through percutaneous exposures to blood, but transmission is less efficient than for HBV. HCV is viable in the environment for at least 16–23 hours (18, 19). The risk for transmission from exposure to fluids or tissues other than HCV-infected blood has not been quantified, but is expected to be low. Transmission rarely occurs from exposure to blood through mucous membranes or nonintact skin (16, 17, 20). The average incidence of anti-HCV seroconversion after accidental percutaneous exposure from an HCV-positive source is 1.8% (range: 0–7%) (16). Currently, there is no vaccine or effective PEP for HCV (see Chapter 4).

1.4.3 Human immunodeficiency virus

Transmission of HIV occurs through sexual contact, vertical transmission or blood exposure caused by unsafe blood transfusions, unsafe medical injection practices and the sharing of needles and syringes by injecting drug users (21).

HIV is less stable in the environment and less transmissible than either HBV or HCV. Potentially infectious materials include blood and body fluids, semen and vaginal secretions that are visibly contaminated with blood; other body fluids are considered less infectious. HIV causes a brief primary infection several weeks after exposure, and quickly becomes detectable by antibody tests. There is no cure for HIV infection, but antiretroviral treatment is increasingly available for acquired immunodeficiency syndrome (AIDS).

Exposures that pose a risk of transmission in occupational settings include percutaneous injuries, contact of mucous membranes, or contact of nonintact skin with potentially infected fluids (2, 6, 14, 22). The average risk for HIV transmission after a percutaneous exposure to HIV-infected blood has been estimated to be about 0.3% (95% confidence interval [CI]: 0.2–0.5%) and after mucous membrane exposure, approximately 0.09% (95% CI: 0.006–0.5%). Risk from nonintact skin exposure has not been quantified, but is estimated to be less than that for mucous membrane exposure. Guidelines for the use of antiretroviral PEP are discussed in Chapter 4.



1.5 Prevention strategies

Eliminating unnecessary injections is the best way to prevent injection-associated infections. Up to 70% of injections in some countries are medically unnecessary (23). When effective treatment can be given by other routes (oral or rectal), this is preferred, because it reduces potential exposure to blood and infectious agents, and thus reduces infection risks.

Vaccination of health workers with hepatitis B vaccine is important in protecting both health workers and patients.

Methods for reducing exposure and preventing infection transmission include hand hygiene, barrier protection (gloves), minimal manipulation of sharp instruments (including injection equipment), and appropriate segregation and disposal of sharps waste (note: sharps are items such as needles that have corners, edges or projections capable of cutting or piercing the skin) (Table 1.1).

Injections are unsafe when given with unsterile or improper equipment or technique. It is important to avoid contamination of injectable medications. Physically separating clean and contaminated equipment and supplies helps to prevent cross-contamination. For example, immediate disposal of a used syringe and needle in a safety box placed within arm's reach is the first step in safe waste management (1, 24).

Table 1.1 Examples of conditions causing risks in giving injections or collecting blood

Patients or clients	Health workers who give injections or collect blood	Community or other health workers
Unnecessary injections	Unnecessary injections	Increased waste from unnecessary injections
Reuse of injection equipment	Two-handed recapping of needles	Unsafe disposal of sharps waste:
Non-sterile or reprocessed syringes and needles	Manipulation of used sharps	<ul style="list-style-type: none"> • outside safety boxes • mixed with hospital linen • in nonsecure disposal sites
Poor hand hygiene	Lack of sharps box within arm's reach	Lack of protective clothing (boots, gloves, etc.) for waste handlers
Cross-contamination through:	Poor positioning of patient	Reuse of needles or syringes
<ul style="list-style-type: none"> • poor hand hygiene • medication vials 	Poor phlebotomy technique	
Improper injection technique or site	Two-handed transfer of blood	
Sharps in hospital linen or other unexpected places	Unsafe transport of blood	
	Poor hand hygiene	
	Nonsegregated sharps waste	

Protection of health workers also requires a prompt response to and reporting of occupational exposures. Post-exposure management and prophylaxis is discussed in Chapter 3.

Injection safety is an important component of basic infection control. The concept of “standard precautions”, with mandatory safe practices, must be routinely applied in all health-care settings, and every person in such settings should be considered a potential source of infection. Best practices for injection, the collection and handling of blood samples, and waste management are discussed in the following chapter.



2 Best practices for injection

This chapter assimilates the best practices for delivering injections in health-care and related facilities. It is based on a range of evidence and expands the scope of the WHO publication *Best infection control practices for intradermal, subcutaneous, and intramuscular needle injection* (7). The chapter outlines recommended practices, skin preparation, preparation and administration of injections, and related health procedures.

Best injection practices described are aimed at protecting patients, health workers and the community.

2.1 General safety practices

This section describes the following practices that are recommended to ensure the safety of injections and related practices:

- hand hygiene;
- gloves where appropriate;
- other single-use personal protective equipment;
- skin preparation and disinfection.

2.1.1 Hand hygiene

Hand hygiene is a general term that applies to either handwashing, antiseptic handwash, antiseptic hand rub or surgical hand antisepsis (25). It is the best and easiest way to prevent the spread of microorganisms. Hand hygiene should be carried out as indicated below, either with soap and running water (if hands are visibly soiled) or with alcohol rub (if hands appear clean).

Practical guidance on hand hygiene

Perform hand hygiene BEFORE:

- starting an injection session (i.e. preparing injection material and giving injections);
- coming into direct contact with patients for health-care related procedures;
- putting on gloves (first make sure hands are dry).

Perform hand hygiene AFTER:

- an injection session;
- any direct contact with patients;
- removing gloves.


You may need to perform hand hygiene between injections, depending on the setting and whether there was contact with soil, blood or body fluids.

Avoid giving injections if your skin integrity is compromised by local infection or other skin conditions (e.g. weeping dermatitis, skin lesions or cuts), and cover any small cuts.

Indications and precautions for hand hygiene are shown in Table 2.1.



Table 2.1 Indications and precautions for hand hygiene


Key elements	Indications	Precautions
Hand hygiene (handwashing or alcohol-based handrub) 	Hand hygiene before and after contact with every patient is the single most important means of preventing the spread of infection <ul style="list-style-type: none"> When hands are visibly dirty or contaminated with proteinaceous material, wash them with antibacterial or plain soap and running water, then dry them using single-use paper towels When hands appear clean (i.e. are not visibly soiled), clean them with an alcohol-based hand product for routine decontamination, then dry them using single-use paper towels 	<ul style="list-style-type: none"> Ensure hands are dry before starting any activity DO NOT use alcohol-based hand products when hands are visibly soiled DO NOT use alcohol-based hand products after exposure of nonintact skin to blood or body fluids; in such cases, wash hands with antibacterial or plain soap and running water, then dry them using single-use paper towels

2.1.2 Gloves

Health workers should wear non-sterile, well-fitting latex or latex-free gloves when coming into contact with blood or blood products (26). Indications for glove use in injection practice are shown in Table 2.2.

Practical guidance on gloves

Table 2.2 Indications for glove use in injection practice

Key elements	Indications	Precautions
Glove use 	Wear non-sterile, well-fitting, single-use gloves: <ul style="list-style-type: none"> when there is a likelihood of coming into direct contact with a patient's blood or other potentially infectious materials (e.g. body fluids, moist body substances and saliva [in dental procedures]), mucous membranes and nonintact skin when performing venepuncture or venous access injections, because of the potential for blood exposure at the puncture site if the health worker's skin is NOT intact (e.g. through eczema, or cracked or dry skin) if the patient's skin is NOT intact (e.g. through eczema, burns or skin infections). 	When undertaking injections, DO NOT use gloves: <ul style="list-style-type: none"> for routine intradermal, subcutaneous and intramuscular injections if the health worker's skin is intact if the patient's skin is intact. Gloves DO NOT provide protection against needle-stick or other puncture wounds caused by sharp objects. Needles, scalpels and other sharps should be handled with extreme caution.

Note: This table provides information on glove use in relation to any type of injection. A table on glove use in general health-care settings is given in Annex A.

2.1.3 Other single-use personal protective equipment

Masks, eye protection and other protective clothing ARE NOT indicated for the injection procedures covered by this document unless exposure to blood splashes is expected.

Practical guidance on single-use personal protective equipment

When using single-use personal protective equipment, dispose of the equipment immediately after use.



2.1.4 Skin preparation and disinfection

Table 2.3 shows the skin preparation protocols for different types of injection.

Table 2.3 Skin preparation for different types of injection

Type of injection	Skin preparation and disinfection	
	Soap and water	60–70% alcohol (isopropyl alcohol or ethanol)
Intradermal	Yes	No
Subcutaneous	Yes	No
Intramuscular		
• immunization	Yes	No
• therapeutic	Yes ^a	Yes ^a
Venous access	No	Yes

^a Unresolved issue because there is insufficient evidence on the need to disinfect the skin with alcohol before an intramuscular injection to change the 2003 WHO recommendation (7); further studies are warranted.

Practical guidance on skin preparation and disinfection

To disinfect skin, use the following steps (27–29):

1. Apply a 60–70% alcohol-based solution (isopropyl alcohol or ethanol) on a single-use swab or cotton-wool ball. **DO NOT** use methanol or methyl-alcohol as these are not safe for human use.
2. Wipe the area from the centre of the injection site working outwards, without going over the same area.
3. Apply the solution for 30 seconds then allow it to dry completely.

DO NOT pre-soak cotton wool in a container – these become highly contaminated with hand and environmental bacteria.

DO NOT use alcohol skin disinfection for administration of vaccinations.



2.1.5 Summary of best practice

The steps outlined above are summarized in Table 2.4, below.

Table 2.4 Infection prevention and control practices

Do	Do not
DO carry out hand hygiene (use soap and water or alcohol rub), and wash carefully, including wrists and spaces between the fingers, for at least 30 seconds (follow WHO's 'My 5 moments for hand hygiene' ^a)	DO NOT forget to clean your hands
DO use one pair of non-sterile gloves per procedure or patient	DO NOT use the same pair of gloves for more than one patient DO NOT wash gloves for reuse
DO use a single-use device for blood sampling and drawing	DO NOT use a syringe, needle or lancet for more than one patient
DO disinfect the skin at the venepuncture site	DO NOT touch the puncture site after disinfecting it
DO discard the used device (a needle and syringe is a single unit) immediately into a robust sharps container	DO NOT leave an unprotected needle lying outside the sharps container
Where recapping of a needle is unavoidable, DO use the one-hand scoop technique (see Annex B)	DO NOT recap a needle using both hands
DO seal the sharps container with a tamper-proof lid	DO NOT overfill or decant a sharps container
DO place laboratory sample tubes in a sturdy rack before injecting into the rubber stopper	DO NOT inject into a laboratory tube while holding it with the other hand
DO immediately report any incident or accident linked to a needle or sharp injury, and seek assistance; start PEP as soon as possible, following protocols	DO NOT delay PEP after exposure to potentially contaminated material; beyond 72 hours, PEP is NOT effective

PEP, post-exposure prophylaxis; WHO, World Health Organization.

^a World Health Organization (30).

2.2 Injection devices and medications

2.2.1 Injection devices

Health-care settings should ensure that an adequate supply of single-use devices is available, to allow providers to use a new device for each procedure.

Practical guidance on use of injection devices

When using a sterile single-use device (i.e. a syringe and hypodermic needle that is not separated or manipulated unless necessary (7):

- use a new device for each procedure, including for the reconstitution of a unit of medication or vaccine;
- inspect the packaging of the device to ensure that the protective barrier has not been breached;
- discard the device if the package has been punctured, torn or damaged by exposure to moisture, or if the expiry date has passed.



2.2.2 Medication

Types of medication containers and recommendations on their use are given in Table 2.5.

Table 2.5 Recommendations on medication containers

Type of container	Recommendations	Reason
Single-dose vial	Preferred	Low likelihood of contamination
Multiple-dose vial	Only if unavoidable	High likelihood of contamination if aseptic technique is poor
Ampoules	Pop-open preferred	Breaking a glass ampoule may result in particulate matter escaping from the vial, it may also injure the person opening the ampoule
Fluid or solution bags (100–1000 ml) for reconstitution	Not recommended for routine injection	High likelihood of contamination

Practical guidance on giving medications

- When giving medication:
 - DO NOT use a single loaded syringe to administer medication to several patients (i.e. ensure one needle, one syringe, one patient!);
 - DO NOT change the needle in order to reuse the syringe;
 - DO NOT use the same mixing syringe to reconstitute several vials;
 - DO NOT combine leftover medications for later use.
- *Single-dose vials* – Whenever possible, use a single-dose vial for each patient, to reduce cross-contamination between patients.
- *Multidose vials* – Only use multidose vials if there is no alternative.
 - Open only one vial of a particular medication at a time in each patient-care area.
 - If possible, keep one multidose vial for each patient, and store it with the patient's name on the vial in a separate treatment or medication room.
 - DO NOT store multidose vials in the open ward, where they could be inadvertently contaminated with spray or spatter.
- *Discard a multidose vial:*
 - if sterility or content is compromised;
 - if the expiry date or time has passed (even if the vial contains antimicrobial preservatives);
 - if it has not been properly stored after opening;
 - within 24 hours of opening, or after the time recommended by the manufacturer, if the vial does not contain antimicrobial preservatives;
 - if found to be undated, improperly stored, inadvertently contaminated or perceived to be contaminated, regardless of expiration date.
- *Pop-open ampoules* – Whenever possible, use pop-open ampoules rather than ampoules that require use of a metal file to open. If using an ampoule that requires a metal file to open, protect your fingers with a clean barrier (e.g. a small gauze pad) when opening the ampoule (7).



2.2.3 Preparing injections

Injections should be prepared in a designated clean area where contamination by blood and body fluids is unlikely (1, 7).

Practical guidance on preparing injections

Three steps must be followed when preparing injections.

1. Keep the injection preparation area free of clutter so all surfaces can be easily cleaned.
2. Before starting the injection session, and whenever there is contamination with blood or body fluids, clean the preparation surfaces with 70% alcohol (isopropyl alcohol or ethanol) and allow to dry.
3. Assemble all equipment needed for the injection:
 - sterile single-use needles and syringes;
 - reconstitution solution such as sterile water or specific diluent;
 - alcohol swab or cotton wool;
 - sharps container.

Procedure for septum vials

Wipe the access diaphragm (septum) with 70% alcohol (isopropyl alcohol or ethanol) on a swab or cotton-wool ball before piercing the vial, and allow to air dry before inserting a device into the bottle.

- Use a sterile syringe and needle for each insertion into a multidose vial.
- Never leave a needle in a multidose vial.
- Once the loaded syringe and needle has been withdrawn from a multidose vial, administer the injection as soon as possible.

Labelling

- After reconstitution of a multidose vial, label the final medication container with:
 - date and time of preparation;
 - type and volume of diluent (if applicable);
 - final concentration;
 - expiry date and time after reconstitution;
 - name and signature of the person reconstituting the drug.
- For multidose medications that DO NOT require reconstitution, add a label with:
 - date and time of first piercing the vial;
 - name and signature of the person first piercing the vial.



2.2.4 Administering injections

An aseptic technique should be followed for all injections.

Practical guidance on administering injections

General

- When administering an injection:
 - check the drug chart or prescription for the medication and the corresponding patient's name and dosage;
 - perform hand hygiene;
 - wipe the top of the vial with 60–70% alcohol (isopropyl alcohol or ethanol) using a swab or cotton-wool ball;
 - open the package in front of the patient to reassure them that the syringe and needle have not been used previously;
 - using a sterile syringe and needle, withdraw the medication from the ampoule or vial.

Reconstitution

- If reconstitution using a sterile syringe and needle is necessary, withdraw the reconstitution solution from the ampoule or vial, insert the needle into the rubber septum in the single or multidose vial and inject the necessary amount of reconstitution fluid.
- Mix the contents of the vial thoroughly until all visible particles have dissolved.
- After reconstituting the contents of a multidose vial, remove the needle and syringe and discard them immediately as a single unit into a sharps container.

Needleless system

- If a needleless system is available:
 - wipe the rubber septum of the multidose vial with an alcohol swab;
 - insert the spike into the multidose vial;
 - wipe the port of the needleless system with an alcohol swab;
 - remove a sterile syringe from its packaging;
 - insert the nozzle of the syringe into the port;
 - withdraw the reconstituted drug.

Delay in administration

- If the dose cannot be administered immediately for any reason, cover the needle with the cap using a one-hand scoop technique.
- Store the device safely in a dry kidney dish or similar container.

Important points

- DO NOT allow the needle to touch any contaminated surface.
- DO NOT reuse a syringe, even if the needle is changed.
- DO NOT touch the diaphragm after disinfection with the 60–70% alcohol (isopropyl alcohol or ethanol).
- DO NOT enter several multidose vials with the same needle and syringe.
- DO NOT re-enter a vial with a needle or syringe used on a patient if that vial will be used to withdraw medication again (whether it is for the same patient or for another patient).
- DO NOT use bags or bottles of intravenous solution as a common source of supply for multiple patients (except in pharmacies using laminar flow cabinets).



2.3 Prevention of sharps injuries to health workers

Use of best practices can help to prevent sharps injuries to health workers (31–33). Further information on this topic can be found in Chapter 4.

Practical guidance on prevention of sharps injuries

To avoid sharps injuries:

- ensure that the patient is adequately prepared for the procedure;
- do not bend, break, manipulate or manually remove needles before disposal;
- avoid recapping needles, but if a needle must be recapped, use a single-handed scoop technique;
- discard used sharps and glass ampoules immediately after use in the location where they were used, disposing of them into a robust sharps container that is leak and puncture resistant;
- place the sharps container within arm's reach (preferably in a secured area) to allow for easy disposal of sharps;
- seal and replace sharps container when the container is three quarters full.

2.4 Waste management

Use of sealed, puncture and leak-proof sharps containers helps to prevent access to used devices (24, 34).

Practical guidance on waste management

To ensure that waste is dealt with safely:

- transport and store sharps containers in a secure area before final disposal;
- close, seal and dispose of sharps containers when the containers are three quarters full; assign responsibility in written policy for monitoring the fill level of sharps containers and replacing them when three quarters full;
- discard waste that is not categorised as sharp or infectious in appropriate colour-coded bags;
- ensure that infectious waste bags and sharps containers are closed before they are transported for treatment or disposal.



3 Best practice in phlebotomy and blood collection

Phlebotomy is one of the most common invasive procedures in health care. This chapter outlines the risks associated with unsafe phlebotomy, and summarizes best practice in phlebotomy, with the aim of improving outcomes for health workers and patients. Institutions can use the principles given here to establish standing operating procedures (SOPs).

3.1 Potential effects of unsafe phlebotomy

Unsafe phlebotomy can cause adverse effects for patients; such effects are rare, but range from pain or bruising at the site of puncture, to fainting, nerve damage and haematoma. The adverse events that have been best documented are in blood transfusion services, where poor venepuncture practice or anatomical abnormality has resulted in haematoma and injury to anatomical structures in the vicinity of the needle entry (35).

Another issue for patients is that if a blood sample is poorly collected or destroyed during transportation, the results may be inaccurate and misleading to the clinician, or the patient may have to undergo the inconvenience of repeat testing (36).

Poor infection-control practices can lead to bacterial infection at the site where the needle was inserted into the skin (37).

Both patients and health workers can be exposed through phlebotomy to blood from other people, putting them at risk from bloodborne pathogens. These pathogens include (2, 5, 12, 14, 17, 23, 31):

- viruses, such as HBV, HCV and HIV;
- bacteria, such as syphilis;
- parasites, such as malaria.

An example of the spread of bloodborne pathogens through phlebotomy is the reporting of outbreaks of hepatitis B associated with the use of glucometers (devices used to determine blood glucose concentration) (38, 39).

Another issue for health workers is sharps injuries; these commonly occur between the use and disposal of a needle or similar device.

3.2 Background information on best practices in phlebotomy

Using best practices in phlebotomy reduces the risks to both patients and health workers. For example, the use of sharps protection devices and immediate disposal of the used syringe and needle as a single unit into a puncture-resistant sharps container (i.e. a safety container), markedly reduce needle-stick injuries and blood exposure among health workers (40).

In home-based care, phlebotomy can be made safer by improving sharps disposal, to minimize the risk of exposure to hollow-bore and venepuncture needles (41).

This section provides background information on phlebotomy, Sections 3.2.1–3.2.3 cover blood sampling, and Section 3.2.4 covers blood collection for transfusions.



Best practices in phlebotomy involve the following factors:

- *planning ahead* – this is the most important part of carrying out any procedure, and is usually done at the start of a phlebotomy session;
- *using an appropriate location* – the phlebotomist should work in a quiet, clean, well-lit area, whether working with outpatients or inpatients (see Section 3.3.1);
- *quality control* – this is an essential part of best practice in infection prevention and control; in phlebotomy, it helps to minimize the chance of a mishap;
- *standards for quality care for patients and health workers* – discussed in detail in Section 3.2.1.

Table 3.1 lists the main components of quality assurance and explains why they are important.

Table 3.1 Elements of quality assurance in phlebotomy

Element	Notes
Education and training	Education and training is necessary for all staff carrying out phlebotomy. It should include an understanding of anatomy, awareness of the risks from blood exposure, and awareness of the consequences of poor infection prevention and control.
Standard operating procedures (SOPs)	SOPs are required for each step or procedure. They should be written and be readily available to health workers.
Correct identification of the patient	Identification should be through matching to the laboratory request form: <ul style="list-style-type: none"> • for blood donation, the identity of the donor should be accurately matched to the results of screening tests • for blood sampling, after samples have been taken from a patient or donor, a system of identification and tracking is essential to ensure that the sample is correctly matched with the result and with the patient or donor.
The condition of the sample	The condition of the sample should be such that the quality of the results is satisfactory.
Safe transportation	Making safe transportation of blood or blood products part of best practices will improve the quality of results from laboratory testing (42).
An incident reporting system	A system is required for reporting all adverse events. A log book or register should be established with accurate details of the incident, possible causes and management of the adverse events (43).

3.2.1 Quality care for patients and health workers

Several factors can improve safety standards and quality of care for both patients and health workers, and laboratory tests. These factors include:

- availability of appropriate supplies and protective equipment;
- availability of PEP;
- avoidance of contaminated phlebotomy equipment;
- appropriate training in phlebotomy;
- cooperation on the part of patients.



3.2.2 Quality of laboratory sampling

Factors that influence the outcome of laboratory results during collection and transportation include:

- knowledge of staff involved in blood collection;
- use of the correct gauge of hypodermic needle to prevent haemolysis or abnormal results;
- the appropriate anatomical insertion site for venepuncture;
- the use of recommended laboratory collection tubes;
- patient–sample matching (i.e. labelling);
- transportation conditions;
- interpretation of results for clinical management.

Each of these issues is discussed in detail in *WHO guidelines on drawing blood: best practices in phlebotomy (44)*.

3.2.3 Blood-sampling systems

Several choices of blood-sampling system are available for phlebotomy.

- *Closed systems* – A hypodermic needle and syringe or a vacuum-extraction tube system are the closed systems most commonly used in blood sampling.
- *Open systems* – Open systems include a hypodermic needle and syringe, and a winged steel needle attached to a syringe.

Choice of system

The system most appropriate for the procedure should be chosen. Closed systems are safer than open systems (45, 46). Table 3.2 gives details of existing systems, and outlines the advantages and disadvantages of each device.

Table 3.2 Systems used for blood sampling

Type of device	Advantages	Disadvantages
<i>Conventional devices</i>		
Hypodermic single-use needle and syringe	<ul style="list-style-type: none"> • Widely available • Inexpensive • Comes in wide range of needle lengths and gauges • Use does not require special training • Can be safer for blood drawing in paediatric population • For patient with small or difficult veins, blood drawing can be easier • Can be used for arterial blood drawing 	<ul style="list-style-type: none"> • Requires blood transfer, which creates additional risk of needle-stick injuries or blood splashing • Difficult to draw large or multiple blood samples • Can be reused • A smaller syringe and paediatric tube should be used for paediatric patients
Vacuum-tube systems	<ul style="list-style-type: none"> • Safer than using hypodermic needle and syringe because does not require blood transfer • Allows numerous blood samples to be collected through single venepuncture 	<ul style="list-style-type: none"> • Requires user to be skilled in its use • Needle holders designed for reuse create additional risk of needle-stick injuries • Mixing components from different manufactures can create a problem • Paediatrics requires a reduced vacuum • Relatively high cost



Table 3.2 continued

Type of device	Advantages	Disadvantages
Winged steel needles (butterfly)	<ul style="list-style-type: none"> • Good for blood drawing from paediatric population or patient with small or difficult veins • Allows better precision than hypodermic needle and syringe 	<p>Because of the air in the tubing, a tube without additive or a discard tube needs to be collected first</p> <p>The difference between winged steel needles for evacuated-tube systems and winged infusion sets can create confusion</p> <p>Relatively high cost</p>
Safety-engineered devices		
<i>Passive</i>		
Auto-disable syringes ^a NOT recommended for blood drawing	<ul style="list-style-type: none"> • NOT recommended for phlebotomy • If properly used, safety mechanism prevents reuse • Do not require activation of the safety mechanism 	<ul style="list-style-type: none"> • During probing, safety mechanism can be activated, requiring new venepuncture • Requires blood transfer, which creates risk of needle-stick injuries • Difficult to draw large or multiple blood samples • Does not offer needle-stick prevention • Air in the syringe can affect test results • Additional training is necessary
Lancets	<ul style="list-style-type: none"> • Retractable 	
<i>Active</i>		
Manually retractable syringes	<ul style="list-style-type: none"> • Safety mechanism retracts the needle into the syringe reducing the hazard of needle-stick exposure and reuse 	<ul style="list-style-type: none"> • Safety mechanism cannot be activated when syringe is full of blood or during the blood transfer • Requires user's compliance • Requires blood transfer, which creates risk of needle-stick injuries • Difficult to draw large or multiple blood samples • Relatively high cost
Self re-sheathing needles and syringes	<ul style="list-style-type: none"> • Sleeve moved over the needle provides guard around the used needle; this reduces the risk of needle-stick injury and prevents reuse 	<ul style="list-style-type: none"> • Needle cannot be covered when syringe is full of blood or during blood transfer • Requires user's compliance • Additional training is necessary • Relatively high cost
Winged steel needles with active safety mechanism	<ul style="list-style-type: none"> • Needle locking mechanism helps to reduce the risk of needle-stick injury and prevents reuse • If syringe is used for blood drawing, blood can be transferred in a safer way 	<ul style="list-style-type: none"> • If used in connection with vacuum tubes, because of the air in the tubing, a tube without additive or a discard tube needs to be collected first • Additional training is necessary • Relatively high cost
Manually retractable evacuated tube systems	<ul style="list-style-type: none"> • Safer than using hypodermic needle and syringe because does not require blood transfer • Allows numerous blood samples to be collected through single venepuncture • Safety mechanism prevents reuse and helps to reduce the risk of needle-stick injuries 	<ul style="list-style-type: none"> • Requires skill in its use • Needle holders designed for reuse create risk of needle-stick injuries • Mixing components from different manufactures can create a problem • Vacuum may be too strong for paediatric patients • Additional training is necessary • Relatively high cost

^a Auto-disable syringes DO NOT prevent needle-stick injuries, and put both patient and worker at risk if used for phlebotomy. Therefore, they are NOT recommended for blood drawing.



Choice of gauge

It is best to choose the gauge of hypodermic needle that fits comfortably into the most prominent vein with little discomfort. Table 3.3 summarizes advice on appropriate gauge, length and device.

Table 3.3 Recommended needle gauge, length and device for routine injection and phlebotomy procedures for different age groups

Needle gauge	Patient population			Procedure
	Adult	Paediatric, elderly, small veins	Neonatal	
16–18	✓			✓ Blood donation
19–20	NA	NA	NA	
21	✓ (1–1.5 inch or 2.54 cm)	NA	NA	
22	✓ (1 inch or 2.54 cm)	✓ (1 inch or 2.54 cm)	NA	
23	✓ (1–1.5 inch or 2.54 cm)	✓ (Winged set [butterfly]; 0.5 inch or 0.75 cm)	✓ (Winged set [butterfly]; 0.5 inch or 0.75 cm)	

NA, not applicable.

If the needle is too large for the vein for which it is intended, it will tear the vein and cause bleeding (haematoma); if the needle is too small, it will damage the blood cells during sampling, and laboratory tests that require whole blood cells, or haemoglobin and free plasma, will be invalid.

Blood collection for transfusion requires a larger gauge than is used for blood drawing.

3.2.4 Blood collection for blood transfusion purposes

Collection of large volumes of blood is an everyday practice in blood transfusion services. The donated blood is tested, and processed to ensure that it is free from major infections that are transmissible by transfusion, therefore ensuring that it will not harm the recipient of the blood.

Before a blood donation

WHO has developed a set of basic requirements for blood transfusion services, which cover the steps to be undertaken before donation (47). Blood donation should be voluntary; it should not involve duress, coercion or remuneration. Also, potential blood donors should be selected carefully, according to the national criteria for donor selection.

Before a person donates blood (48):

- the potential donor should be given pre-donation information, advice and counselling about the process of blood donation;
- a relevant history of the donor should be taken, covering health and high-risk behaviour, and including:
 - history of mastectomy (blood should be taken from the arm opposite the site of surgery) (49, 50);
 - current and recent medications or chronic infections;



- history of prolonged bleeding or a past diagnosis of bleeding disorders;
- history of previous donations, to ensure the waiting period is respected;
- a preliminary physical check-up of the donor should be undertaken, including weight, blood pressure, signs of infection or scarring at potential sites;
- the donor should be offered fluids, to help reduce the risk of fainting after blood donation (51);
- the person should provide informed written consent, based on the national requirements.

Collection systems – minimum requirements

The relevant guidance given on planning, location and infection prevention and control practices should be followed, as should the guidance on closed systems. Additional requirements for a collection system for blood donation are given below.

- Equipment:
 - All equipment used for collection of blood donations should be regularly calibrated, maintained and serviced, as required. Such equipment includes blood pressure monitors, scales, donor couches or chairs, blood collection monitors or mixers, blood bag tube sealers, blood transportation boxes and blood bank refrigerators.
 - Furniture and equipment in the area of blood donation and processing should be made of cleanable surfaces (e.g. vinyl rather than fabric). Containers used to transport supplies and specimens should also be cleanable by disinfectants, such as sodium hypochlorite bleach solutions. Fabric or textile carriers should be machine washable.
 - A closed collection system with a sterile blood collection bag containing anticoagulant, and with an integral tube and needle should be used. Some bags include diversion pouches to sequester the first 20 ml of blood collected, to minimize contamination from skin flora and the skin core (52). If blood for haemoglobin testing is gathered with a capillary stick, a single-use sterile lancet should be used and then placed immediately in a sharps container (safety box).
- Location:
 - Premises should be of sufficient size for efficient operations, with separate areas for clean and dirty processes, clean running water, and surfaces cleanable by disinfectants.
 - Floors should not be carpeted.
 - Waiting areas should be outside the collection area, to minimize the risk of respiratory pathogens for workers.
 - All fixed and mobile blood donation sites should be safe, clean, hygienic and tidy, and should meet defined standards of environmental safety.
 - The donation sites should be organized in a way that ensures the safety of blood donors, staff and donated blood units, and avoids errors in the blood donation process.



3.3 Practical guidance on best practices in phlebotomy

This section provides practical guidance – Sections 3.3.1–3.3.3 cover blood sampling, and Sections 3.3.4–3.3.6 cover blood donation.

3.3.1 Provision of an appropriate location

- In an outpatient department or clinic, provide a dedicated phlebotomy cubicle containing:
 - a clean surface with two chairs (one for the phlebotomist and the other for the patient);
 - a handwash basin with soap, running water and paper towels;
 - alcohol hand rub.
- In the blood-sampling room for an outpatient department or clinic, provide a comfortable reclining couch with an arm rest.
- In inpatient areas and wards:
 - close the bed curtain to offer privacy;
 - ensure that blood sampling is done in a private and clean manner.

3.3.2 Provision of clear instructions

Ensure that the indications for blood sampling are clearly defined, either in a written protocol or in documented instructions (e.g. in a laboratory form) (36, 53).

3.3.3 Procedure for drawing blood

At all times, follow the strategies for infection prevention and control listed in Table 2.4, in Section 2.1.5.

Step 1 – Assemble equipment

Collect all the equipment needed for the procedure and place it within safe and easy reach on a tray or trolley, ensuring that all the items are clearly visible. The equipment required includes:

- a supply of laboratory sample tubes, which should be stored dry and upright in a rack; blood can be collected in
 - sterile glass or plastic tubes with rubber caps (the choice of tube will depend on what is agreed with the laboratory);
 - vacuum-extraction blood tubes;
 - glass tubes with screw caps;
- a sterile glass or bleeding pack (collapsible) if large quantities of blood are to be collected;
- well-fitting, non-sterile gloves;
- an assortment of blood-sampling devices (safety-engineered devices or needles and syringes, see below), of different sizes;
- a tourniquet;
- alcohol hand rub;
- 70% alcohol swabs for skin disinfection;



- gauze or cotton-wool ball to be applied over the puncture site;
- laboratory specimen labels;
- writing equipment;
- laboratory forms;
- leak-proof transportation bags and containers;
- a puncture-resistant sharps container.

Ensure that the rack containing the sample tubes is close, but away from the patient, to avoid it being accidentally tipped over.

Step 2 – Identify and prepare the patient

Where the patient is adult and conscious, follow the steps outlined below.

- Introduce yourself to the patient, and ask the patient to state their full name.
- Check that the laboratory form matches the patient's identity (i.e. match the patient's details with the laboratory form, to ensure accurate identification).
- Ask whether the patient has allergies, phobias or has ever fainted during previous injections or blood draws.
- If the patient is anxious or afraid, reassure the person and ask what would make them more comfortable.
- Make the patient comfortable in a supine position (if possible).
- Place a clean paper or towel under the patient's arm.
- Discuss the test to be performed and obtain verbal consent, as shown in Annex F of *WHO guidelines on drawing blood: best practices in phlebotomy* (44). The patient has a right to refuse a test at any time before the blood sampling, so it is important to ensure that the patient has understood the procedure.

Step 3 – Select the site

Illustrations to accompany these guidelines are given in Figure 3.1 in Section 3.4, at the end of this chapter.

General

- Extend the patient's arm and inspect the antecubital fossa or forearm.
- Locate a vein of good size that is visible, straight and clear. The diagram in Section 3.4 shows common positions of the vessels, but many variations are possible. The median cubital vein lies between muscles and is usually the most easy to puncture. Under the basilic vein runs an artery and a nerve, so puncturing here runs the risk of damaging the nerve or artery and is usually more painful. **DO NOT** insert the needle where veins are diverting, because this increases the chance of a haematoma.
- The vein should be visible without applying the tourniquet. Locating the vein will help in determining the correct size of needle.
- Apply the tourniquet about 4–5 finger widths above the venepuncture site and re-examine the vein.



Hospitalized patients

In hospitalized patients, do not take blood from an existing peripheral venous access site because this may give false results. Haemolysis, contamination and presence of intravenous fluid and medication can all alter the results (54). Nursing staff and physicians may access central venous lines for specimens following protocols. However, specimens from central lines carry a risk of contamination or erroneous laboratory test results.

It is acceptable, but not ideal, to draw blood specimens when first introducing an in-dwelling venous device, before connecting the cannula to the intravenous fluids.

Step 4 – Perform hand hygiene and put on gloves

- Perform hand hygiene:
 - wash hands with soap and water, and dry with single-use towels; or
 - if hands are not visibly contaminated, clean with alcohol rub – use 3 ml of alcohol rub on the palm of the hand, and rub it into fingertips, back of hands and all over the hands until dry.
- After performing hand hygiene, put on well-fitting, non-sterile gloves.

Step 5 – Disinfect the entry site

- Unless drawing blood cultures, or prepping for blood collection, clean the site with a 70% alcohol swab and allow to dry (27–29, 36).

Note: alcohol is preferable to povidone iodine, because blood contaminated with povidone iodine may falsely increase levels of potassium, phosphorus or uric acid in laboratory test results (55, 56).
- Apply firm but gentle pressure. Start from the centre of the venepuncture site and work downward and outwards to cover an area of 2 cm or more for 30 seconds.
- Allow the area to dry for at least 30 seconds. Failure to allow enough contact time increases the risk of contamination.
- DO NOT touch the cleaned site; in particular, DO NOT place a finger over the vein to guide the shaft of the exposed needle. If the site is touched, repeat the disinfection.

Step 6 – Take blood

Venepuncture

Perform venepuncture as follows.

- Anchor the vein by holding the patient's arm and placing a thumb BELOW the venepuncture site.
- Ask the patient to form a fist so the veins are more prominent.
- Enter the vein swiftly at a 30 degree angle or less, and continue to introduce the needle along the vein at the easiest angle of entry.
- Once sufficient blood has been collected, release the tourniquet BEFORE withdrawing the needle. Some guidelines suggest removing the tourniquet as soon as blood flow is established, and always before it has been in place for two minutes or more.
- Withdraw the needle gently and apply gentle pressure to the site with a clean gauze or dry cotton-wool ball. Ask the patient to hold the gauze or cotton wool in place, with the arm extended and raised. Ask the patient NOT to bend the arm, because doing so causes a haematoma.



Step 7 – Fill the laboratory sample tubes

- When obtaining multiple tubes of blood, use evacuated tubes, with a needle and tube holder. This system allows the tubes to be filled directly. If this system is not available, use a syringe or winged needle set instead.
- If a syringe or winged needle set is used, best practice is to place the tube into a rack before filling the tube. To prevent needle-sticks, use one hand to fill the tube or use a needle shield between the needle and the hand holding the tube.
- Pierce the stopper on the lab tube with the needle directly above the tube, using slow steady pressure. Do not press the syringe plunger because additional pressure increases the risk of haemolysis.
- Where possible, keep the tubes in a rack and move the rack towards you. Inject downwards into the appropriate coloured stopper. DO NOT remove the stopper because it will release the vacuum.
- If the sample tube does not have a rubber stopper, inject extremely slowly into the tube, to reduce the risk of haemolysis (to reduce the risk of haemolysis when transferring blood through a needle on a syringe, minimize the pressure and velocity used to transfer the specimen). DO NOT recap and remove the needle.
- Before dispatch, invert the tubes containing additives for the required number of times (as specified by the local laboratory).

See Figure 3.2 in Section 3.4.

Step 8 – Draw samples in the correct order

Draw blood collection tubes in the correct order, to avoid cross-contamination of additives between tubes. As colour coding and tube additives may vary, verify recommendations with local laboratories. Details of the recommended order are given in *WHO guidelines on drawing blood: best practices in phlebotomy* (44).

Step 9 – Clean contaminated surfaces and complete patient procedure

- Discard the used needle and syringe or blood-sampling device into a puncture-resistant sharps container.
- Check the label and forms for accuracy. The label should be clearly written with the information required by the laboratory, which is typically the patient's first and last name, file number, date of birth, and the date and time when the blood was taken.
- Discard used items into the appropriate category of waste. Items used for phlebotomy that would not release a drop of blood if squeezed (e.g. gloves) may be discarded in the general waste, unless local regulations state otherwise.
- Perform hand hygiene again, as described in step 4.
- Recheck the labels on the tubes and the forms before dispatch.
- Inform the patient when the procedure is over.
- Ask the patient or donor how they are feeling; check the insertion site to verify that it is not bleeding, then thank the patient and say something reassuring and encouraging before the person leaves.



Step 10 – Prepare samples for transportation

- Pack laboratory samples safely in a plastic leak-proof bag with an outside compartment for the laboratory request form. Place the requisition on the outside to help avoid contamination.
- If there are multiple tubes, place them in a rack or padded holder to avoid breakage during transportation.

Step 11 – Clean up spills of blood or body fluids

If blood spillage has occurred (e.g. because of a laboratory sample breaking in the phlebotomy area or during transportation, or excessive bleeding during the procedure), clean it up. An example of a safe procedure is given below.

- Put on gloves and a gown or apron if contamination or bleaching of a uniform is likely in a large spill.
- Mop up liquid from large spills using paper towels, and place them into the infectious waste.
- Remove as much blood as possible with wet cloths before disinfecting.
- Assess the surface to see whether it will be damaged by a bleach and water solution.
- For cement, metal and other surfaces that can tolerate a stronger bleach solution, flood the area with an approximately 5000 parts per million (ppm) solution of sodium hypochlorite (1:10 dilution of a 5.25% chlorine bleach to water). This is the preferred concentration for large spills. Leave the area wet for 10 minutes.
- For surfaces that may be corroded or discoloured by a strong bleach solution, clean carefully to remove all visible stains. Make a weaker solution and leave it in contact for more than 10 minutes. For example, an approximately 525 ppm solution (1:100 dilution of 5.25% bleach) is effective.
- Prepare bleach solution fresh daily and keep it in a closed container because it degrades over time and in contact with the sun.

If a person was exposed to blood through nonintact skin, mucous membranes or a puncture wound, complete an incident report (see Section 4.3 for details of how to manage exposures to infectious materials). For transportation of blood samples outside a hospital, equip the transportation vehicle with a blood spillage kit (for details, see *WHO guidelines on drawing blood: best practices in phlebotomy* (44)).

3.3.4 Collecting blood for blood donation

For collection of blood for donation, use the procedure detailed above for blood sampling (e.g. for hand hygiene and glove use), as far as it is relevant, and follow the six steps given below.

Step 1 – Identify donor and label blood collection bag and test tubes

- Ask the donor to state their full name.
- Ensure that:
 - the blood collection bag is of the correct type;
 - the labels on the blood collection bag and all its satellite bags, sample tubes and donor records have the correct patient name and number;
 - the information on the labels matches with the donor's information.



Step 2 – Select the vein

- Select a large, firm vein, preferably in the antecubital fossa, from an area free from skin lesions or scars.
- Apply a tourniquet or blood pressure cuff inflated to 40–60 mm Hg, to make the vein more prominent.
- Ask the donor to open and close the hand a few times.
- Once the vein is selected, release the pressure device or tourniquet before the skin site is prepared.

Step 3 – Disinfect the skin

- If the site selected for venepuncture is visibly dirty, wash the area with soap and water, and then wipe it dry with single-use towels.
- *One-step procedure* (recommended – takes about one minute):
 - cover the whole area with 2% chlorhexidine gluconate in 70% isopropyl alcohol and ensure that the skin area is in contact with the disinfectant for **at least** 30 seconds;
 - allow the area to dry **completely**, or for a minimum of 30 seconds by the clock.
- *Two-step procedure* – (if chlorhexidine gluconate in 70% isopropyl alcohol disinfectant is not available, use the following procedure – takes about two minutes):
 - *step 1* – cover the whole area with 70% isopropyl alcohol and ensure that the skin area is in contact with the disinfectant for **at least** 30 seconds;
 - allow the area to dry **completely** (about 30 seconds);
 - *step 2* – cover the whole area with tincture of iodine (more effective than povidine iodine) or 2% chlorhexidine) and ensure that the skin area is in contact with the disinfectant for **at least** 30 seconds;
 - allow the area to dry **completely** for 30 seconds.
- Whichever procedure is used, DO NOT touch the venepuncture site once the skin has been disinfected.

Step 4 – Perform the venepuncture

Perform venepuncture using a smooth, clean entry with the needle, as described in step 6 of Section 3.3.3. Take into account the points given below, which are specific to blood donation.

- In general, use a 16-gauge needle (see Table 3.3), which is usually attached to the blood collection bag; use of a retractable needle or safety needle with a needle cover is preferred if available).
- Ask the donor to open and close the fist slowly every 10–12 seconds during collection.
- Remove the tourniquet when the blood flow is established or after 2 minutes, whichever comes first.

Step 5 – Monitor the donor and the donated unit

- Closely monitor the donor and the injection site throughout the donation process; look for:
 - sweating, pallor or complaints of feeling faint that may precede fainting;
 - development of a haematoma at the injection site;
 - changes in blood flow that may indicate the needle has moved in the vein and needs to be repositioned.
- About every 30 seconds during the donation, mix the collected blood gently with the anticoagulant, either manually or by continuous mechanical mixing.



Step 6 – Remove the needle and collect samples

- Cut off the needle using a sterile pair of scissors.
- Collect blood samples for laboratory testing.

3.3.5 After a blood donation

Donor care

Once the blood has been collected:

- Ask the donor to remain in the chair and relax for a few minutes.
- Inspect the venepuncture site; if it is not bleeding, apply a bandage to the site; if it is bleeding, apply further pressure.
- Ask the donor to sit up slowly and ask how the person is feeling.
- Before the donor leaves the donation room, ensure that the person can stand up without dizziness and without a drop in blood pressure.
- Offer the donor some refreshments.

Blood unit and samples

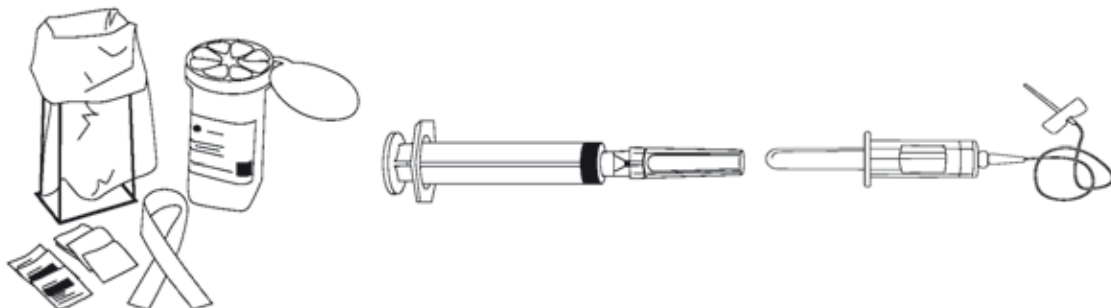
- Transfer the blood unit to a proper storage container according to the blood centre requirements and the product (57–59).
- Ensure that collected blood samples are stored and delivered to the laboratory with completed documentation, at the recommended temperature and in a leak-proof, closed container (57, 59, 60).

3.3.6 Adverse events in blood donation

Be aware of possible adverse events, and the actions to take if these occur. The document *WHO guidelines on drawing blood: best practices in phlebotomy* (44) provides details of possible adverse reactions and their prevention. The most frequent adverse events include haematoma, a vasovagal reaction or faint, and a delayed faint.

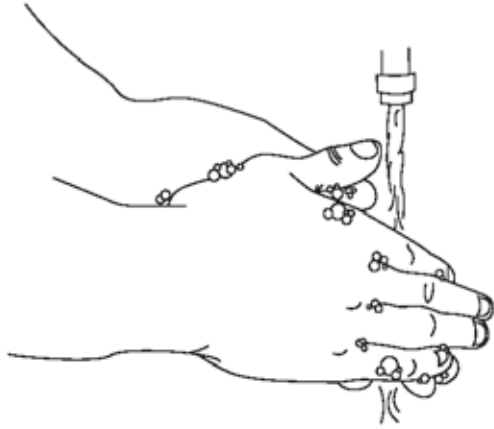
3.4 Illustrations for best practices in phlebotomy

Figure 3.1 Venepuncture in adults



1. Assemble equipment, and include needle and syringe or vacuum tube, depending on which is to be used.

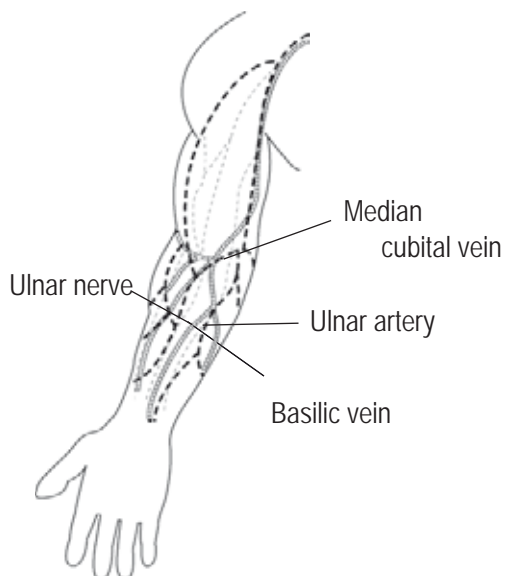




2. Perform hand hygiene (if using soap and water, dry hands with single-use towels).



3. Identify and prepare the patient.



4. Select the site, preferably at the antecubital area (i.e. the bend of the elbow). Warming the arm with a hot pack, or hanging the hand down may make it easier to see the veins. Palpate the area to locate the anatomic landmarks. **DO NOT** touch the site once alcohol or other antiseptic has been applied.



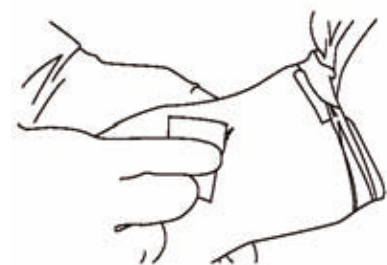
5. Apply a tourniquet, about 4–5 finger widths above the selected venepuncture site.



6. Ask the patient to form a fist so that the veins are more prominent.



7. Put on well-fitting, non-sterile gloves.

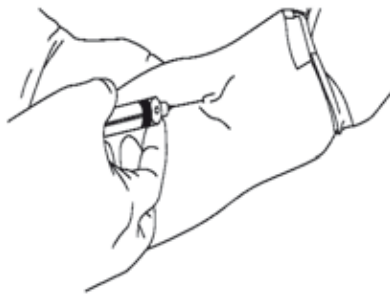


8. Disinfect the site using 70% isopropyl alcohol for 30 seconds and allow to dry completely (30 seconds).

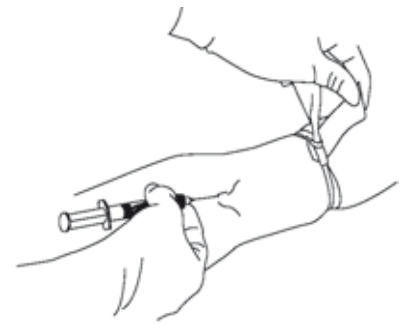




9. Anchor the vein by holding the patient's arm and placing a thumb **BELOW** the venipuncture site.



10. Enter the vein swiftly at a 30 degree angle.



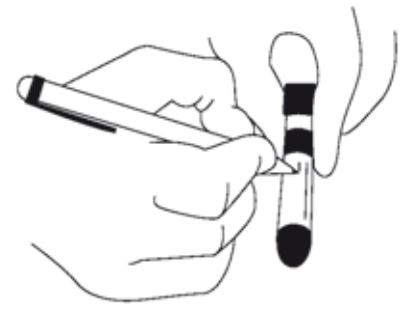
11. Once sufficient blood has been collected, release the tourniquet **BEFORE** withdrawing the needle.



12. Withdraw the needle gently and then give the patient a clean gauze or dry cotton-wool ball to apply to the site with gentle pressure.



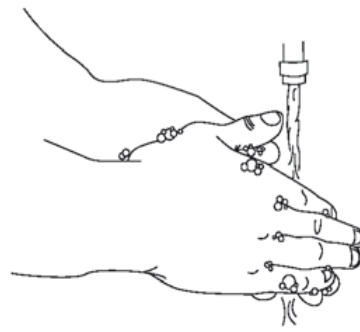
13. Discard the used needle and syringe or blood-sampling device into a puncture-resistant container.



14. Check the label and forms for accuracy.



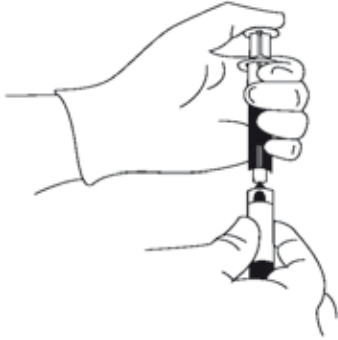
15. Discard sharps and broken glass into the sharps container. Place items that can drip blood or body fluids into the infectious waste.



16. Remove gloves and place them in the general waste. Perform hand hygiene. If using soap and water, dry hands with single-use towels.



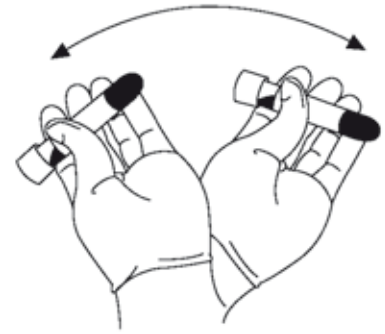
Figure 3.2 Filling tubes



1. If the tube does not have a rubber stopper, press the plunger in slowly to reduce haemolysis (this is safer than removing the needle).



2. Place the stopper in the tube.



3. Following laboratory instructions, invert the sample gently to mix the additives with the blood before dispatch.



4 Occupational risks and management of bloodborne pathogens

Preventing occupational exposure to and infection from bloodborne pathogens is a key element of injection safety. Thus, such prevention is an important part of any comprehensive programme for protecting health workers and patients.

The main interventions that are needed to prevent exposure and infection are:

- basic occupational health care, including immunization and awareness of current health status;
- prevention of needle-stick injuries and other blood exposures;
- management of exposures to blood; this includes PEP.

Each of these interventions is discussed below.

4.1 Basic occupational health care

4.1.1 Immunization against hepatitis B

WHO considers universal immunization to be the most effective preventive measure against diseases induced by infection with hepatitis B. Strategies include:

- integration of hepatitis B vaccine (HepB) into routine infant immunization programmes (13, 61);
- provision of a HepB dose at birth to prevent perinatal transmission (13, 61);
- vaccination of those at risk, including health workers (with a catch-up vaccination).

All health workers – including waste disposal workers, and emergency and safety workers exposed to the risk of bloodborne pathogens – are at risk of exposure. They should be immunized either before training or as soon as possible when at work, unless they are already immunized (15).

The World Health Assembly has resolved that all health workers should be protected from infection with HBV by receiving immunization for hepatitis B early in their careers (15).

Vaccines are widely available that are safe, cost effective and meet the current WHO quality requirements (13).

Routine immunization of health workers against infection with HBV is recommended.

- Pre-vaccination serological testing is unnecessary.
- Many different schedules are available. A schedule including three doses at 0, 1 and 6 months is highly effective; it provides long-term protection in most individuals. The usual adult dose is 1.0 ml (twice the monovalent paediatric dose of 0.5 ml) and the vaccine is administered intramuscularly.
- Serological testing at 2–6 months after the third dose of HBV vaccine can demonstrate whether an antibody response has developed against hepatitis B surface antigen (62).



4.1.2 Testing for HBV, HCV and HIV

All health workers should have access to the tests available for HBV, HCV and HIV infection. If they know their own status for these infections, health workers can access treatment and care if necessary. Also, in cases of exposure to HBV, HCV or HIV, test results provide baseline information on immune status; this is critical for the safe and efficient management of the post-exposure procedures available for hepatitis B and HIV.

Any testing should be undertaken in conditions that respect the worker's rights and is based on informed consent. These conditions are described in guidelines developed by the International Labour Organization and WHO, on health services and HIV/AIDS (63).

4.2 Prevention of needle-stick injuries and other blood exposures using a hierarchy of controls

Methods used to control occupational hazards have traditionally been discussed in terms of a hierarchy and presented in order of priority. A hierarchy of controls to prevent needle-stick injuries and other blood exposures is given below by order of effectiveness (most effective first) (64, 65).

- **Elimination of hazard** – Complete removal of a hazard from the work area is the most effective way to control hazards; this approach should be used whenever possible. Examples include (24, 66):
 - removing sharps and needles when possible (e.g. by substituting jet injectors for needles and syringes, or using needleless intravenous systems);
 - eliminating all unnecessary injections;
 - eliminating unnecessary sharps such as towel clips.
- **Engineering controls** – These are used to isolate or remove a hazard from a workplace. Examples include (33, 67–69):
 - sharps disposal containers;
 - when possible, use of sharps protection devices for all procedures (devices with needles that retract, sheathe or blunt immediately after use).
- **Administrative controls** – These are policies, such as SOPS, which aim to limit exposure to the hazard. Examples include (1, 62):
 - allocation of resources demonstrating a commitment to health-worker safety;
 - a needle-stick injury prevention committee;
 - an exposure control plan;
 - removal of all unsafe devices;
 - consistent training on the use of safe devices.
- **Work practice controls** – These are controls to change the behaviour of workers, to reduce exposure to occupational hazards. Examples include (1, 62):
 - no needle recapping;
 - placing sharps containers at eye level and within arms' reach;
 - sealing and discarding sharps containers when they are three quarters full;
 - establishing means for the safe handling and disposal of sharps devices before beginning a procedure.



- *Personal protective equipment* – These provide barriers and filters between the worker and the hazard. They will prevent exposures to blood splashes but will not prevent needle-stick injuries (34, 70, 71). Examples include eye goggles, gloves, masks and gowns.

4.3 Overview of management of exposure to blood

This section discusses management of occupational exposure to blood and other potentially infectious material. The exposure can occur through needle-stick and sharp injuries, and from splashes contaminated with blood or body fluids. Management includes first aid, risk assessment, notification and reporting for HBV, HCV and HIV, and provision of PEP. The prophylaxis should be administered as soon after exposure as possible; it entails medical evaluation, follow-up care and prevention, and is specific to the etiologic agent involved (43).

The risks of transmission of infection from an infected patient to the health worker following a needle-stick injury are estimated to be (6):

- hepatitis B – 3–10% (up to 30%);
- hepatitis C – 0.8–3%;
- HIV – 0.3% (mucous membrane exposure risk is 0.1%).

Factors that can increase the risk of transmission of HIV include a deep wound, visible blood on the device, a hollow-bore blood-filled needle, use of the device to access an artery or vein, and high-viral-load status of the patient (6, 63). Together, these factors can increase the risk of transmission of HIV from a contaminated sharp to 5%.

The box below summarizes the steps to take in case of occupational exposure to blood. The management of exposure to specific agents (HBV, HCV and HIV) is discussed in detail below. In all cases, the person who has been exposed to potentially infectious material should be counseled; where PEP is available, the counselling should include the decision on whether or not to take PEP.

Box 4.1 Steps to take in cases of occupational exposure to blood






1. Apply first aid care, as appropriate (see Section 4.3.1, below).
2. Notify a supervisor. The health-care worker should report immediately to the medical services and seek advice on the need for PEP for HIV and HBV.
3. Carry out an immediate medical evaluation, including a risk assessment and follow-up care (e.g. counseling and PEP) as appropriate.
4. Complete an exposure form documenting the circumstance and report the exposure in the needle stick injury surveillance system.



4.3.1 First aid

The first aid given is based on the type of exposure (e.g. splash, needle-stick or other injury) and the means of exposure (e.g. intact skin, nonintact skin) (14, 72). Table 4.1 shows the first aid to apply in different situations.

Table 4.1 First-aid care of the exposure site

Injury or exposure	Management
<p>Needle-stick or other sharps injury</p> 	<p>Immediately wash the affected area with soap and water Allow injury to bleed freely</p>
<p>Splash of blood and/or body fluids on nonintact skin</p> 	<ol style="list-style-type: none"> 1. Immediately wash the affected area with soap and water 2. DO NOT use disinfectant on skin 3. DO NOT scrub or rub the area
<p>Splash of blood or body fluids to eyes</p> 	<p>Flush the area gently but thoroughly with running water or saline for at least 15 minutes while the eyes are open Keep eyelid gently inverted</p>
<p>Splash of blood or body fluids to mouth or nose</p> 	<ol style="list-style-type: none"> 1. Immediately spit out the blood or fluids and rinse the mouth with water several times 2. Blow the nose and clean the affected area with water or saline 3. DO NOT use disinfectant
<p>Splash of blood and/or body fluids on intact skin</p> 	<p>Immediately wash the affected area with soap and water DO NOT rub the area</p>



4.3.2 Notification

The health-care worker should report immediately to the medical services and seek advice on the need for PEP for HIV and HBV.

4.3.3 Risk assessment

In managing exposure, the first step is to carry out an immediate medical evaluation, including a risk assessment (72).

To assess the risk of transmission from the exposure:

- determine the risk associated with the exposure by considering the
 - type of fluid (e.g. blood, visibly bloody fluid, other potentially infectious fluid or tissue and concentrated virus);
 - type of exposure (i.e. percutaneous injury, mucous membrane or nonintact skin exposure and bites resulting in blood exposure);
- evaluate the risk associated with the exposure sources by
 - assessing the risk of infection for all bloodborne pathogens using available information (e.g. interview, medical records);
 - perform tests on the source person based on informed consent, but DO NOT test discarded needles or syringes for virus contamination;
- combine the results to evaluate the risk to the exposed person.

Ensure that only a suitably trained person performs the medical evaluation, risk assessment and prescription of PEP.

Where logistic reasons (e.g. testing facilities not being readily available) make it difficult to evaluate the immune status of the person exposed, it may be useful to withdraw and store a blood sample, to help in obtaining baseline information. However, only do this if the exposed person gives informed consent.

Give PEP, even if test results are not yet available.

4.4 Evaluation and management of exposure to HBV

4.4.1 Risk of transmission of HBV

The risk of transmission of HBV is higher than that for HCV or HIV. Among susceptible health workers, the risk of HBV infection after a needle-stick injury involving an HBV-positive source is 23–62% (6, 14).



4.4.2 Management of HBV exposure

PEP for HBV can be highly effective in preventing transmission of the virus after exposure. PEP for HBV is based on the hepatitis B vaccine, either alone or combined with hepatitis B immune globulin (HBIG).

- For PEP to be effective, the initial dose of vaccine must be administered soon after exposure; the longer the gap between exposure and administration of the vaccine, the less effective the PEP.
- Few studies have researched the maximum time after exposure during which PEP is effective, but it is likely to be less than seven days for needle-stick exposures (14).

The steps to take after HBV exposure are to:

- evaluate the exposed person for HBV – assess the person’s immunization status for hepatitis B (i.e. by taking their history of hepatitis B vaccination);
- administer HBV PEP for exposures that pose a risk of infection transmission.

WHO has no specific guidelines for HBV PEP; however, it does recommend HBV PEP (73). This document refers to the CDC guidelines (14). As shown in Table 4.2, the regimen recommended for HBV PEP depends on the vaccination status of the exposed person. HBV PEP is safe for pregnant and lactating women.

Table 4.2 Hepatitis B post-exposure prophylaxis and immunization follow-up in occupational settings

Source of exposure	Action according to vaccination status	
	Unvaccinated or incompletely vaccinated (< 3 doses)	Vaccinated (3 or more doses)
Unknown or hepatitis B positive	Initiate and complete vaccination Give hepatitis B immune globulin (where available)	No PEP
Negative	Initiate and complete vaccination	No PEP

PEP, post-exposure prophylaxis.

4.4.3 Follow-up of HBV exposure

Perform follow-up testing for antibodies to hepatitis B in individuals who receive hepatitis B vaccine in response to an exposure. The recommendation is to test for antibodies 1–2 months after the last dose of vaccine. However, if the person received hepatitis B immune globulin in the previous 3–4 months, it is not possible to use the test for antibodies to hepatitis B to determine the response to the vaccine.

4.5 Evaluation and management of exposure to HCV

4.5.1 Risk of transmission of HCV

The risk of transmission of HCV is relatively low. The seroconversion rate after accidental percutaneous exposure from an HCV-positive source is 1.8% (range: 0–7%), and one study indicated that transmission occurred only from hollow-bore needles. HCV is rarely transmitted from exposure of mucous membranes or nonintact skin to contaminated blood (14, 16).



4.5.2 Management of exposure to HCV

There is no recommended PEP for exposure to HCV-positive blood. Immunoglobulin and antiviral agents are not recommended as PEP, and there is no vaccine against HCV. Instead, the procedure is to identify infection as soon as possible and refer the person for evaluation of treatment options.

There are no guidelines for administration of therapy during the acute phase of hepatitis C. However, a few studies suggest that antiviral therapy might be beneficial when started early in the course of the infection.

The steps to take after HCV exposure are simply to perform baseline testing for antibodies to HCV and for alanine aminotransferase (ALT).

4.5.3 Follow-up of HCV exposure

Perform follow-up testing for individuals potentially exposed to HCV.

- Test for anti-HCV and ALT 4–6 months after exposure.
- Test for HCV ribonucleic acid (RNA) at 4–6 weeks if early diagnosis of HCV infection is desired.
- Confirm repeatedly positive results in anti-HCV enzyme immunoassays (EIAs) with supplemental tests.

If an individual has seroconverted, refer the person to a specialist.

4.6 Management of exposure to HIV

4.6.1 Risk of transmission of HIV

The risk of acquiring HIV infection following an exposure through the skin (i.e. percutaneous) to blood known to be infected with HIV is approximately 0.3% (14). This figure is derived from studies carried out in well-resourced countries with a low background prevalence of HIV. The risk may be greater in countries with higher prevalence or in settings that have limited resources, where the reuse of medical supplies and equipment is higher and overall safety standards are lower.

4.6.2 Management of exposure to HIV

Refer the person exposed to the risk of transmission to a trained person for medical evaluation, risk assessment and prescription of PEP. The decision on whether or not to take PEP should be based on the recommendations shown in Tables 4.3 and 4.4, appropriate information, and counselling on adherence and on the possible adverse reactions to the antiretroviral drugs.



Table 4.3 HIV post-exposure prophylaxis following occupational exposure

PEP recommended	PEP not recommended
<p>PEP is recommended if exposure meets ALL the following criteria:</p> <ul style="list-style-type: none"> • exposure within 72 hours • exposed individual not known to be HIV-infected • source of exposure is HIV-infected or of unknown status • exposure was to one or more of the following <ul style="list-style-type: none"> – blood – body tissues – visibly blood-stained fluid – concentrated virus – cerebrospinal fluid – synovial fluid – pleural fluid – peritoneal fluid – pericardial fluid – amniotic fluid • exposure was through one or more of the following <ul style="list-style-type: none"> – skin penetration with spontaneous bleeding or deep puncture – splash of significant amount of fluid to mucous membrane – prolonged contact of an at-risk substance with nonintact skin • if skin penetration occurred, exposure was from a recently used hollow-bore needle or other sharp object visibly contaminated with blood. 	<p>PEP is not recommended if ANY of the following conditions apply:</p> <ul style="list-style-type: none"> • more than 72 hours has elapsed since the exposure • exposed person is already HIV positive • exposure was to body fluids from a person known to be HIV negative (unless this person is identified as at high risk for being recently infected and is within the “window period”^a) • exposure is to noninfectious body fluids (e.g. faeces, saliva, urine or sweat) • exposure does NOT pose a risk of transmission, because <ul style="list-style-type: none"> – only intact skin was exposed to potentially infectious body fluids; – the exposed person is already HIV positive.

HIV, human immunodeficiency virus; PEP, post-exposure prophylaxis.

^a The window period is the time between the onset of HIV infection and the appearance of detectable antibodies to the virus.

Table 4.4 Evaluation of risk of HIV infection

Exposure type	HIV status of source		
	Positive	Unknown	Negative
Percutaneous: more severe^a	Recommend two-drug regimen ^b	Consider HIV prevalence in population or subgroup	DO NOT recommend PEP provided there is NO risk that the source person might be in window period
Percutaneous: less severe^c	Recommend two-drug regimen ^b	DO NOT recommend PEP	DO NOT recommend PEP
Splash^d: more severe^e	Recommend two-drug regimen ^b	Consider HIV prevalence in population or subgroup	DO NOT recommend PEP provided there is no risk that the source person might be in window period
Splash: less severe^f	DO NOT recommend PEP. Two-drug regimen optional	DO NOT recommend PEP	DO NOT recommend PEP

HIV, human immunodeficiency virus; PEP, post-exposure prophylaxis.

^a Injury with large hollow-bore needle, deep puncture, visible blood on device, needle used in artery or vein.

^b In cases where the source person is known to be HIV positive with drug resistance or in settings where the drug resistant HIV prevalence is above 15%, a three-drug regimen with the addition of a protease inhibitor is recommended.

^c Injury with small bore or solid needle, superficial injury.

^d Exposure to nongenital mucous membrane, or nonintact skin exposures.

^e Exposure to large volume of blood or semen.

^f Exposure to smaller volume, or to less infectious fluid (e. g. cerebrospinal fluid) (74, 75).



Testing and counselling

For people potentially exposed to HIV, testing is highly recommended but should never be mandatory (76).

- If testing is available, offer a test, but ensure that the person receives appropriate counselling, with the option to opt out of testing.
- Where possible, also test the source patient, with that person's informed consent.
- DO NOT delay the administration of antiretroviral drugs for PEP while waiting for test results.
- If the test results of the source person are negative, consider stopping PEP.

Issues to raise in PEP counselling include:

- the importance of treatment adherence;
- the importance of HIV prevention in general and at the workplace;
- recommendations on the use of condoms and the avoidance of donating blood, sperm or organs until a test at 6 months after exposure is negative;
- information on contraception for women of childbearing age;
- information on alternatives to breastfeeding for lactating mothers.

Administration of PEP

Do not administer PEP to a person who is HIV positive, because PEP generally includes only two drugs to be taken for only 28 days, and is thus not a treatment for HIV infection. HIV treatment is based on a combination of three antiretroviral drugs taken continuously. If desired, it is acceptable to administer antiretroviral drugs for PEP, and to stop the treatment if the exposed person is found to be HIV positive.

In situations where PEP is required:

- administer the antiretroviral drugs for PEP as soon as possible after the exposure (ideally within 4 hours);
- continue the PEP regimen continuously for 28 days;
- use the two-drug regimen (recommended by WHO) unless there is suspicion or evidence of drug resistance, or unless there are national guidelines on choice of PEP regimen (in which case, follow these in preference);
- evaluate the person taking PEP within 72 hours, to monitor for possible adverse drug reactions and adherence, and follow-up (as described below) for at least two weeks.

HIV PEP standard drug regimen

Table 4.5 shows the WHO recommended two-drug combination therapies for PEP for HIV exposure.

As explained above, in cases where the source person is known to be HIV positive with drug resistance, or in settings where the drug resistant HIV prevalence is above 15%, a three-drug regimen with the addition of a protease inhibitor is recommended. Possible regimens are given in Table 4.6.



Table 4.5 WHO recommended two-drug regimens for HIV post-exposure prophylaxis

Preferred regimens	Alternative regimen
1. ZDV + 3TC	1. TDF + 3TC ^a
2. d4T + 3TC	

3TC, lamivudine; d4T, stavudine; TDF, tenofovir; WHO, World Health Organization; ZDV, zidovudine.

^a Prescribed in fixed dose combination tablets where possible.

Table 4.6 WHO recommended three-drug regimens for HIV post-exposure prophylaxis

Preferred regimens	Alternative regimens
1. ZDV + 3TC plus LPV/r	1. ZDV + 3TC plus SQV/r or ATV/r or FPV/r
	2. TDF + 3TC plus SQV/r or ATV/r or FPV/r
	3. TDF + FTC plus SQV/r or ATV/r or FPV/r
	4. (d4T) + 3TC plus SQV/r or ATV/r or FPV/r

3TC, lamivudine; ATV/r, atazanavir/ritonavir; d4T, stavudine; FPV/r, fosamprenavir/ritonavir; FTC, emtricitabine; LPV/r, lopinavir/ritonavir; SQV/r, saquinavir/ritonavir; TDF, tenofovir; WHO, World Health Organization; ZDV, zidovudine.

When giving PEP:

- DO NOT prescribe certain combinations of medication (e.g. didanosine + stavudine) for women of childbearing age unless a pregnancy test is negative;
- DO NOT prescribe non-nucleoside reverse transcriptase inhibitors for PEP;
- ensure that lactating women are aware that antiretroviral drugs are present in breast milk and that the virus itself could be transmitted through breastfeeding;
- when and where alternatives to breastfeeding are feasible, discuss this with the mother.

4.6.3 Follow-up of HIV exposure

An exposed health worker should seek or be referred for medical follow-up (77).

- The aim of follow-up visits is to:
 - support adherence to PEP;
 - prevent or treat side effects of PEP;
 - identify a possible seroconversion.
- Test for HIV antibodies at baseline, 6 weeks and 6 months after exposure.
- Test for HIV antibodies if illness compatible with an acute retroviral syndrome occurs.
- Repeat the test for HIV antibodies at 6 weeks and 6 months after exposure; if seroconversion occurs, refer the exposed person for treatment, care and support.
- Advise anyone who has been exposed to use precautions to prevent secondary transmission during the follow-up period; such precautions include:
 - avoiding pregnancy;
 - seeking safe alternatives to breastfeeding;
 - avoiding blood, tissue or sperm donation, and using condoms for sexual intercourse until a test at 6 months shows that the exposed person remains seronegative.
- Evaluate individuals taking PEP within 72 hours, to monitor for possible adverse drug reactions and treatment adherence. Follow up for at least two weeks.



Reporting of HIV exposure

Reporting of the incident should lead to the evaluation of the safety of working conditions and appropriate measures when relevant. All reports should be strictly confidential.

Prompt reporting of exposures is important to:

- ensure timely and appropriate PEP and follow-up;
- provide information useful for future prevention; for example, information about the circumstances of the exposure can be used to evaluate the occupational health programme and make recommendations for changes in products, practices and policies;
- document the injury in the case of seroconversion;
- monitor the frequency of needle-stick injuries and exposure events by person, place and time, as part of occupational exposure surveillance.

The data collected are of two kinds:

- data for risk assessment and post-exposure management;
- data that describe the circumstances of the exposure; these are used for making recommendations for future prevention.



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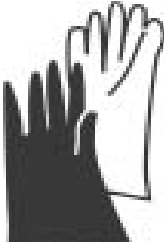
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Annex A: Indications for glove use in health care

Key elements	Indications	Precautions
<p>Glove use</p> 	<p>Wear non-sterile, well-fitting, single-use gloves:</p> <ul style="list-style-type: none"> when handling potentially infectious materials or when coming into contact with contaminated items and surfaces when there is a likelihood of coming into direct contact with a patient's blood or other potentially infectious materials (e.g. body fluids, moist body substances and saliva [in dental procedures]), mucous membranes and nonintact skin when performing venepuncture or venous access injections, because of the potential for blood exposure at the puncture site if the health worker's skin is NOT intact (e.g. through eczema, or cracked or dry skin) if the patient's skin is NOT intact (e.g. through eczema, burns or skin infections). <p>Change gloves:</p> <ul style="list-style-type: none"> between tasks and procedures on the same patient, and after contact with material that may contain a high concentration of microorganisms during a procedure if gloves become visibly soiled, torn or punctured after contact with each patient. <p>After treatment is complete, and before leaving areas of patient-care activity:</p> <ul style="list-style-type: none"> remove gloves promptly and discard perform hand hygiene immediately after removing and discarding gloves. <p>Gloves DO NOT replace the need for hand hygiene.</p> <p>Wear sterile gloves ONLY for procedures where an aseptic technique is required (e.g. intravascular infusion and devices).</p>	<p>When undertaking injections, DO NOT use gloves:</p> <ul style="list-style-type: none"> for routine intradermal, subcutaneous and intramuscular injections if the health worker's skin is intact if the patient's skin is intact. <p>Natural rubber latex allergy is a serious and life threatening condition that affects 8–12% of regular users of natural rubber latex gloves. Health workers and patients with an allergy to natural rubber latex must NOT come into contact with any latex products. Health workers with an allergy should use gloves made from synthetic material.</p> <p>Health workers must NOT:</p> <ul style="list-style-type: none"> wash or decontaminate gloves for reuse wear gloves <ul style="list-style-type: none"> away from the bedside or laboratory bench at nursing stations to handle phones or charts to handle clean linen to clean equipment or patient-care supplies in hallways or elevators. <p>Gloves DO NOT provide protection against needle-stick or other puncture wounds caused by sharp objects. Needles, scalpels and other sharps should be handled with extreme caution.</p>



Annex B: Disassembly of needle from syringe or other devices

Safe methods of removing the needle from the syringe or other devices are necessary to protect health workers from injury.

This procedure must be carried out close to a sharps container, and the needle must be discarded immediately.

NEVER disassemble an exposed used needle with your bare hands.

If the needle has to be disassembled from the barrel or syringe, re-sheath using a one-hand scoop technique, then remove the needle using a removal device. Both of these procedures are explained below.

One-hand scoop technique

1. Leave the needle cap on the surface and guide the tip of the used needle tip into it using only one hand. Clean the surface with disinfectant afterwards to avoid leaving blood.
2. Place the needle cap against a firm upright surface with its opening towards the phlebotomist, and place the used needle tip into it.
3. Lift the needle and syringe vertically and, once the tip is covered, use the other hand to fix the cap into place.

Use of a removal device

- *Needle pliers* – Hold the needle with pliers or artery forceps. Dislodge the needle by unscrewing it or by pulling it off. Discard immediately into a sharps container.
- *Needle guard (mushroom)* – Place the cap in the device. Using one hand, insert the needle tip into the cap vertically and turn firmly to fix the needle in the cap. Lift the syringe or barrel and removed the covered needle. Discard immediately.



Glossary

Abscess

A collection of pus (dead neutrophils) that has accumulated in a cavity formed by the tissue on the basis of an infectious process (usually caused by bacteria or parasites) or other foreign materials (e.g. splinters, bullet wounds or injecting needles). It is a defensive reaction of the tissue to prevent the spread of infectious materials to other parts of the body.

Acquired immunodeficiency syndrome (AIDS)

Morbidity resulting from infection with the human immunodeficiency virus.

Administrative controls to reduce exposure

A method of minimizing patient or employee exposures through enforcement of policies and procedures, modification of work assignment, training in specific work practices, and other administrative measures designed to reduce the exposure.

Alcohol-based hand rub

An alcohol-containing preparation (liquid, gel or foam) designed for application to the hands to reduce the growth of microorganisms. Such preparations may contain one or more types of alcohol with excipient (a relatively inert substance used as a carrier for the active ingredients of a medication) or other active ingredients and humectants.

Antigen (or immunogen)

Any substance that can be recognized by the adaptive immune system and prompt an immune response.

Antiseptic handwashing

Washing hands with water and soap or other detergents containing an antiseptic agent. Recommended when carrying out an aseptic technique.

Antiseptics

Antimicrobial substances applied to living tissue or skin to prevent infection. They differ from antibiotics, which destroy bacteria within the body, and from disinfectants, which are used on nonliving objects. Some antiseptics are true germicides, capable of destroying microbes whereas others are bacteriostatic and only prevent or inhibit their growth.

Aseptic technique

The manner of conducting procedures to prevent microbial contamination. An aseptic technique alters the method of hand hygiene, PPE worn, the location and physical characteristics where a procedure is conducted, the use of skin antisepsis and disinfectants in the environment, the manner of opening of packages and the use of sterile supplies.

Auto-disable (AD) syringe

A syringe designed to prevent reuse by locking or disabling after giving a single injection. Several types of AD syringes are commercially available.

Biohazard (biological hazard)

A risk to the health of humans caused by exposure to harmful bacteria, viruses or other dangerous biological agents, or by a material produced by such an organism.

Bloodborne pathogens

Pathogenic microorganisms in human blood that are transmitted through exposure to blood or blood products, and cause disease in humans. Common pathogens of occupational concern include hepatitis B virus, hepatitis C virus and human immunodeficiency virus.



Colour coding

Designation of different colours for the storage of different categories of health-care wastes.

Cross-contamination

The act of spreading microbes (bacteria and viruses) from one surface to another. Since bloodborne viruses can live on objects and surfaces for up to a week, and other pathogens for months or more, microbes could be spread when surfaces are not disinfected correctly or equipment is not cleaned and sterilized between patients.

Decontamination

The process of removing pathogenic microorganisms from objects and equipment to make them safe to handle.

Disinfection

Killing of infectious agents outside the body by direct exposure to chemical or physical agents. Disinfection is necessary only for diseases spread by indirect contact.

Disposal

Intentional burial, deposit, discharge, dumping, placing or release of any waste material into or on any air, land or water. In the context of this document, disposal refers to the storage and subsequent destruction of injection or blood sampling equipment to avoid reuse or injury.

Elimination of hazard

Administration of medications by ways other than injection (e. g. use of tablets, inhalers).

Engineering controls

Methods of isolating or removing hazards from the workplace. Examples include sharps disposal containers and safer medical devices (e.g. sharps with engineered sharps-injury protections and needleless systems), laser scalpels and ventilation, including the use of ventilated biological cabinets (laboratory fume hoods). In the context of sharps injury prevention, engineering controls means control that isolates or removes the bloodborne pathogens from the workplace.

Hand hygiene

Any type of hand cleansing.

Handwashing

Washing hands with soap and water, and drying thoroughly afterwards with single-use towels.

Hepatitis B infection

Hepatitis caused by hepatitis B virus (HBV) and transmitted by exposure to blood or blood products, or during sexual intercourse. It causes acute and chronic hepatitis. Chronic hepatitis B can cause liver disease, cirrhosis and liver cancer.

Hepatitis C infection

Hepatitis caused by a hepatitis C virus (HCV) and transmitted by exposure to blood or blood products. Hepatitis C is usually chronic and can cause cirrhosis and primary liver cancer.

Hepatitis D infection

Hepatitis caused by the hepatitis D virus (HDV), a defective virus that needs HBV to exist. HDV is found in the blood of persons infected with the hepatitis B virus.



Hierarchy of controls

A concept developed in occupational health industrial hygiene to emphasize prevention. The hierarchy, in order of priority for their efficacy in controlling exposure to hazards and preventing injury or illness resulting from exposure hazards, is as follows:

- elimination of the hazard;
- engineering controls;
- administrative controls;
- work practice controls;
- use of personal protective equipment.

See also fact sheet 4 of the *Joint ILO/WHO guidelines on health services and HIV/AIDS (77)* for the application of the hierarchy of controls to the hazard of bloodborne pathogen exposure and needle-stick injuries.

Human immunodeficiency virus (HIV)

A virus mainly transmitted during sexual intercourse or through exposure to blood or blood products. HIV causes acquired immunodeficiency syndrome (AIDS).

Infection control

A health-care organization's program, including policies and procedures, for the surveillance, prevention and control of health-care associated infections. Such a program includes all patient care and patient care support departments and services. Examples of infection control measures include immunization, hand hygiene, antimicrobial stewardship, review of facility constructions, supervision of disinfection and sterilization, surveillance, use of protective clothing and isolation.

Injection

Percutaneous introduction of a medicinal substance, fluid or nutrient into the body. This may be accomplished most commonly by a needle and syringe, but also by jet injectors, transdermal patches, micro-needles and other newer devices. The injections are commonly classified by the target tissue (e. g. intradermal, subcutaneous, intramuscular, intravenous, intraosseous, intra-arterial, peritoneal).

Intradermal injection

A shallow injection given between the layers of the skin, creating a "weal" on the skin.

Intramuscular injection

An injection given into the body of a muscle.

Intravascular

Within a blood vessel.

Intravenous injection

An injection given into a vein.

Jet injector

A needle-free device that allows the injection of a substance through the skin under high pressure.

Lancet

A blood-sampling device to obtain a capillary sample of blood for testing. It is most commonly used by people with diabetes during blood glucose monitoring. The depth of skin penetration can be adjusted by selecting lancets of different lengths.

Needle-stick

Penetrating stab wound caused by a needle.



Occupational exposure

Exposure to materials that results from the performance of an employee's duties.

Other potentially infectious materials

Body fluids that are potentially infectious for HIV, HBV and HCV, including:

- semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any body fluid that is visibly contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids;
- any unfixed tissue or organ (other than intact skin) from a human (living or dead);
- cell or tissue cultures, or organ cultures containing HIV;
- culture medium or other solutions containing HIV, HBV or HCV;
- blood, organs, or other tissues from experimental animals infected with HIV, HBV or HCV.

Parenteral

Piercing mucous membranes or the skin barrier such as subcutaneous, intramuscular, intravenous or arterial routes, through such events as injections, needle-sticks, cuts or abrasions.

Pathogen

A microorganism capable of causing disease.

Personal protective equipment (PPE)

Specialized equipment worn by an employee to protect against a hazard. PPE includes gloves, lab coats, gowns, aprons, shoe covers, goggles, glasses with side shields, masks and resuscitation bags. The purpose of PPE is to prevent blood and body fluids from reaching the workers' skin, mucous membranes, or personal clothing. It must create an effective barrier between the exposed worker and any blood or other body fluids.

Phlebotomy

The act of drawing or removing blood from the circulatory system through an incision or puncture in order to obtain a sample for analysis and diagnosis.

Post-exposure care and prophylaxis for HIV

Preventive interventions offered to manage the specific aspects of exposure to HIV, and prevent HIV infection in exposed individuals. The services include counselling, risk assessment, HIV testing (based on informed consent), first care and, when needed, the provision of short-term (28 days) antiretroviral drugs, with follow-up and support.

Post-exposure prophylaxis (PEP)

A medical response given to prevent the transmission of bloodborne pathogens after potential exposure. It is available for HIV and hepatitis B.

Proteinaceous

Relating to or of the nature of protein.

Quality control

A management function whereby control of the quality of raw materials, assemblies, produced materials and components; services related to production; and management, production and inspection processes is exercised for the purpose of preventing undetected production of defective material or the rendering of faulty services.

Recapping

The act of replacing a protective sheath on a needle. Recapping needles using two-handed methods increases the risk of needle-stick injuries and is not recommended. However, where such action is unavoidable, the one-hand scoop technique reduces the risk of needle-sticks.



Safe injection

An injection that does no harm to the recipient, does not expose the health worker to any risk and does not result in waste that puts the community at risk.

Sharp

Any object that can penetrate the skin; sharps include needles, scalpels, broken glass, broken capillary tubes and exposed ends of dental wires.

Sharps container

A puncture-resistant, rigid, leak-resistant container designed to hold used sharps safely during collection, disposal and destruction. Sometimes referred to as a “sharps box” or “safety box”.

Sharps injury

An exposure event occurring when any sharp penetrates the skin.

Sharps protection devices

A sharp or needle device used for withdrawing body fluids, accessing a vein or artery, or administering medications or other fluids. The device has a built-in safety feature or mechanism that effectively reduces the risk of an exposure incident.

Single-use syringe

A sterile syringe intended for the aspiration of fluids or for the injection of fluids immediately after filling (ISO 7886-1).

Solid sharp

A sharp that does not have a lumen through which material can flow; for example, a suture needle, scalpel or lancet.

Standard precautions

A set of practices designed to prevent the spread of infection between health workers and patients from contact with infectious agents in recognized and unrecognized sources of infection. Such precautions are recommended for use with all patients, regardless of patient diagnoses or presumed infectious status. Key elements include hand hygiene, cleaning of the environment, reprocessing of equipment between patients, use of personal protective equipment, placement of patients with known infection or colonization into isolation, laundry management, injection safety, preventing exposure to bloodborne pathogens, waste management and respiratory hygiene.

Sterile

Free from living microorganisms.

Subcutaneous injection

An injection delivered under the skin.

Syringes with reuse prevention features

A sterile single-use hypodermic syringe of a design such that it can be rendered unusable after use (ISO 7886-4).

Work practice controls

Techniques that reduce the likelihood of exposure by changing the way a task is performed.



ISBN 978 92 4 159925 2



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WHO/EHT/10.02

World Health Organization
Injection Safety & Related Infection Control
Safety Injection Global Network (SIGN) Secretariat
20 Appia Avenue – CH 1211
Geneva 27 – Switzerland