UNITED REPUBLIC OF TANZANIA

MINISTRY OF HEALTH AND SOCIAL WELFARE

NATIONAL PHLEBOTOMY GUIDELINES FOR QUALITY AND SAFE HEALTH CARE SERVICES

MAY 2014

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Quality Improvement Series

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4. *National Infection Prevention and Control Guidelines for Healthcare Services in Tanzania*, MoHSW (2004)
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1 FOREWORD

Phlebotomy still remains as one of the most common invasive procedures in health care. The main indication for this procedure is usually laboratory testing. Testing is an integral aspect of decision-making process, and results of laboratory testing strongly influence medical diagnosis and therapies. Despite the benefits, when inappropriately performed, phlebotomy may lead to accidental exposures of blood-borne infections to both the phlebotomist and the patient, but also lead into patient mismanagement resulting from erroneous and misrepresentative laboratory findings.

The Ministry of Health Social Welfare (MoHSW) has engaged in activities to improve the quality and safety of health services including phlebotomy, handling of sharps and injections services as an integral component of infection prevention and control strategies since the year 2004.

Despite the effort to improve quality and safety of health care including the area of phlebotomy, errors during completing forms and identifying patients are common, costly and preventable. Other adverse effects for patients are common; they include bruising at the site of puncture, fainting, nerve damage and hematomas.

Phlebotomy also poses risks for health workers. It is still common to see a phlebotomist carry out dangerous practices known to increase the risk of needle-stick injury and transmission of disease. Dangerous practices include:

- recapping used needles using two hands;
- Transferring blood into vacuum tube by piercing tube cap with two hand technique
- reusing tourniquets and vacuum-tube holders that may be contaminated with bacteria and sometimes blood;
- Working alone with confused or disoriented patients who may move unexpectedly, contributing to needle-sticks.
- Inappropriate post-use handling and disposal of sharps
- Not maintaining hand hygiene

Blood-borne organisms that have been transmitted after needle-sticks include viruses such as hepatitis B and C and human immunodeficiency virus (HIV), bacteria such as syphilis and parasites such as malaria and several others

Hence the Ministry of health and Social Welfare has developed the National Phlebotomy Guidelines for Quality and Safe Health Care Services offered here, representing its intent and dedication to fight the risk of above mentioned infections and diseases which might occur during phlebotomy. These guidelines were developed to meet all national and international standards and outline the simple but important steps that can make phlebotomy safer for health care providers and patients.

Finally, the MoHSW is foreseeing that appropriate execution of these guidelines will bring the positive impact on the Infection Prevention and Control of blood borne pathogens.

Mr. Charles. A. Pallangyo

PERMANENT SECRETARY

ACKNOWLEDGEMENT

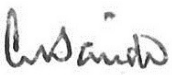
The development of the National Phlebotomy Guidelines for Quality and Safe Health Care Services is the result of the extensive and intensive effort lead by Ministry of health and Social Welfare through Health Services Inspectorate & Quality Assurance Section and involving in one hand broad consultations and on the other hand the collaborative work of various stakeholders including a number of individuals, several institution, organizations, development partners and interested groups.

The Ministry of Health and Social Welfare wish to express their gratitude to all the stakeholders who in one way or another were devoted in the contribution to the development of these phlebotomy guidelines. The authors and reviewers are experts in the field of injection safety and related infection control.

The Ministry wishes to distinguish the invaluable contributions by CDC – Tanzania through the Jhpiego Infection Prevention Program for financial and technical support during the development and printing of the document. Special appreciations also go to BD through TIBA program for their remarkable contribution in developing of the technical content of these guidelines.

Particular thanks go to the team of Infection prevention and Control experts who contributed to the development of this guide, their names appear in appendix 1.

Lastly, we would like to extend our sincere appreciation in advance, to all those whom following being exposed to this document, they will positively be influenced to join the Ministry's efforts to improving the quality of phlebotomy services in Tanzania.



Dr. Donan. W. Mmbando

CHIEF MEDICAL OFFICER

ABBREVIATIONS

BCC	Behaviour Change Communication
CDC	Centre for Disease Control
CSSD	Central Sterilization and Supplies Department
CT	Care and Treatment
FEFO	First Expiry First Out
FIFO	First In First Out
HBV	Hepatitis B virus
HCV	Hepatitis C virus
HCW	Health care waste
HIV	Human Immunodeficiency Virus
HQIT	Hospital Quality Improvement Team
HSIQAS	Health Services Inspectorate and Quality Assurance Section
ICU	Intensive Care Unit
IEC	Information Education and Communication
1PC	Infection Prevention
I.V	Intravenous
IS	Injection safety
IPC	Infection Prevention and Control
MOHSW	Ministry of Health and Social welfare
MOI/C	Medical Officer In charge
OPD	Out Patient Department
OT	Operating Theatre
PEP	Post Exposure Prophylaxis
PICC	Peripheral Inserted Central Catheter
PPE	Personal Protective equipment
PPM	Planned Preventive Maintenance
QI	Quality improvement
SBM-R	Standard Based Management and Recognition
SOP	Standard Operating Procedures
TB	Tuberculosis
WHO	World Health Organization

SECTION 1.0: INTRODUCTION

1.1 *OVERVIEW*

Phlebotomy – the drawing of blood – has been practiced for centuries and is still one of the most common invasive procedures in health care. However, practice varies considerably between countries, and between institutions and individuals within the same country. These differences include: variations in blood-sampling technique, training both formal and "on-the-job", use of safety devices, disposal methods, re-use of devices and availability of hepatitis B vaccine.

1.1.1 Issues in phlebotomy

By its nature, phlebotomy has the potential to expose health workers and patients to blood from other people, putting them at risk from blood borne pathogens. These pathogens include human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), and those causing viral haemorrhagic fevers (Crimean Congo haemorrhagic fever, Ebola, Lassa and Marburg) and dengue. For example, outbreaks of hepatitis B have been reported with the use of glucometers (devices used to determine blood glucose concentration). Diseases such as malaria and syphilis may also be transmitted via contaminated blood, and poor infection control practices may lead to bacterial infection where the needle is inserted and contamination of specimens. If a blood sample is poorly collected, the results may be inaccurate and misleading to the clinician, and the patient may have to undergo the inconvenience of repeat testing. The three major issues resulting from errors in collection are haemolysis, contamination and inaccurate labelling.

Factors that increase the risk of haemolysis include:

- use of a needle of too small a gauge (23 or more), or too large a gauge for the vessel;
- pressing the syringe plunger to force the blood into a tube, thus increasing the sheer force on the red blood cells;
- drawing blood specimens from an intravenous or central line;
- under-filling a tube so that the ratio of anticoagulant to blood is not appropriate;
- reusing tubes that have been refilled by hand with inappropriate amounts of anticoagulants;
- mixing a tube too vigorously;
- failing to let alcohol or disinfectant dry;
- using too great vacuum; for example, using too large tube for a paediatric patient, or using too large a syringe (10–20 ml).

1.1.2 The need for guidelines

Phlebotomy services are available worldwide in a range of health-care facilities (e.g. hospitals, outpatient facilities and clinics), and are usually performed by both medical and nonmedical personnel. Providers trained in phlebotomy appear to achieve lower incidence of compromised specimens than untrained ones

Phlebotomy practice in Tanzania varies among health-care personnel, even though perceptions of risk might be similar. To help standardize practice in all health facilities in the country, the MoHSW has decided to develop these guidelines to be used in all providers for on-the-job training, as well as students
in pre-services medical and allied health schools. The MOHSW hopes that standardized Implementation of these guidelines will substantially reduce the risks to both patients and staff, and also reduce laboratory errors and the associated complications. Since blood donation also has aspects of phlebotomy, these guidelines are also expected to contribute to improving of blood transfusion services in Tanzania.

1.2 OBJECTIVES

The objectives of these guidelines are to:

1.2.1 Improve knowledge and awareness of the risks associated with phlebotomy among all health workers involved in the practice;

1.2.2 Increase safe practices and reduce blood borne pathogens exposure and transmission;

1.2.3 Improve patient confidence, safety and comfort;

1.2.4 Improve the quality of specimen leading to better reliability of laboratory tests.

1.3 SCOPE

These guidelines recommend best practices for all levels of health care services delivery where phlebotomy is practiced. The guidelines extend the scope of the existing guidelines from the World Health Organization (WHO), the Safe Injection Global Network (SIGN), a WHO-hosted network, and the MoHSW.

This document provides guidance for the following best practices;

- Routine venepuncture in neonates, paediatrics and adults
- Special techniques for routine venepuncture
- Capillary blood collection techniques
- Arterial blood collection
- Blood collection for blood donation
- Safe transportation of blood specimen

Note: This document does not discuss collection from in-dwelling central lines, arterial lines or cord blood.

1.4 TARGET AUDIENCE

This document is aimed at:

- All people (health laboratory staff, nurses, clinicians, phlebotomists, health trainees) who perform or supervise phlebotomy in both the private and public health care facilities, including those involved in home-based care;
- Health trainers, and educators;
- Administrators and procurement officials (who need to be aware of which equipment and supplies are safe and cost effective).

2 SECTION 2.0: BEST PRACTICES IN PHLEBOTOMY

2.1 BACKGROUND

Using best practices in phlebotomy both in hospital and home-based care 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.

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
- *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 2.2*

Table 2-1 lists the main components of quality assurance and explains why they are important.

Table 2-1 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
Regular quality audits	Conducting regular audits to ensure compliance to the SOPs and continuous quality improvement
Correct identification of the patient	Identification should be through matching to the laboratory request form: • 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

Element	Notes
	practices will improve the quality of results from laboratory testing
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.

2.2 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.

2.3 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.*

2.4 BLOOD-SAMPLING SYSTEMS

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

- *Closed systems* –Use of multi-sample needle and vacuum tube system in which blood flow directly from vein to the tube without removal of its cap is called closed system. It is 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. Blood needs to be transferred to the specimen container manually. This also includes the practice of transferring blood syringe to vacuum tube by piercing the cap of the tube.

Table 2-2 Systems used for blood sampling

TYPE OF DEVICE	ADVANTAGES	DISADVANTAGES

TYPE OF DEVICE	ADVANTAGES	DISADVANTAGES
A) Conventional devices		
1. Hypodermic single-use needle and syringe	– 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	– Requires blood transfer, which creates additional risk of needle-stick injuries or blood splashing – Difficult to draw large or multiple blood samples – Can be re-used – Could result in inappropriate blood to additive ratio – Could result in sample hemolysis – A smaller syringe and paediatric tube should be used for paediatric patients
2. Vacuum-tube systems	– Safer than using hypodermic needle and syringe because does not require blood transfer – Allows numerous blood samples to be collected through single venipuncture – Causes no blood exposure to user while blood flows directly in the tube. – Ensures appropriate blood to additive ratio due to measured vacuum	– Requires user to be skilled in its use – Needle holders designed for reuse create additional risk of needle-stick injuries while removal of non-safety needles – Mixing components from different manufactures can create a problem – Use of vacuum tubes with large volume for paediatrics patients may result in vein collapse and failure to draw. – Relatively high cost
3. Winged steel needles (butterfly)	– Good for blood drawing from paediatric population or patient with small or difficult veins – Allows better precision than hypodermic needle and syringe	– Because of the air in the tubing, a tube without additive or a discard tube needs to be collected first while collecting blood for coagulation studies so that blood to additive ratio is maintained at recommended 9:1 ratio. – The difference between winged steel needles for evacuated-tube systems and winged infusion sets can create confusion – Relatively high cost
B) Safety-engineered devices		
1. Passive		
1.1. Auto-disable (Re-use prevention) syringes[a]	– **NOT recommended for phlebotomy**	– During probing, safety mechanism can be activated, requiring new venepuncture • Requires blood transfer, which creates risk of

TYPE OF DEVICE	ADVANTAGES	DISADVANTAGES
(NOT suitable for blood drawing)		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
1.2. Lancets	– Retractable and hence prevent needle-stick injuries	
2. Active		
2.1. Manually retractable syringes **(NOT suitable for blood drawing)**	– **NOT recommended for phlebotomy**	– 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
2.2. Self re-sheathing needles and syringes	– Sleeve moved over the needle provides guard around the used needle; this reduces the risk of needle-stick injury and prevents reuse	– 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
2.3. Winged steel needles with active safety mechanism	– Needle locking mechanism helps to reduce the risk of needle-stick injury and prevents reuse	– 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 (in case of collecting coagulation sample) – Additional training is necessary – Relatively high cost
2.4. Manually retractable evacuated tube systems	– 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	– Requires skill in its use – Some needle (or tube) holders are designed for reuse and this poses a risk of needle-stick injuries during disassembly ***(Note: MOHSW recommends single—use holders)*** – Mixing components from different manufactures can create a problem – Vacuum may be too strong for paediatric patients ***(Note: Smaller volume i.e. 1 – 5 ml tube with lower vacuum should be used for***

TYPE OF DEVICE	ADVANTAGES	DISADVANTAGES
		paediatric patients to reduce haemolysis) – 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 system

The system most appropriate for the procedure should be chosen. Closed systems are safer than open systems. Table 2-2 gives details of existing systems, and outlines the advantages and disadvantages of each device.

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 2-3 summarizes advice on appropriate gauge, length and device.

Table 2-3: 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	√	NA	NA	√ (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 or0.75 cm)	√ (Winged set [butterfly]; 0.5 inch or 0.75 cm)	

NOTE: 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.

Various phlebotomy equipment

Torniquets

Specimen collection container

Winged set

Lancets

3 SECTION 3.0: PRACTICAL GUIDANCE ON BEST PRACTICES IN PHLEBOTOMY

Before drawing blood from a patient or client, all healthcare providers performing the procedure ought to follow the understated standardized steps in alignment with the recommended national guidelines. A successful blood collection is one that ensures the following

- Patient safety
- Healthcare worker safety
- Quality specimen representing real patient condition or conditions

Specimen quality i.e. the specimen is a true representative of patient condition

For the above to happen, a number of factors need to be in place, and these include

- appropriate location for the procedure,
- justifiable and clearly defined indication for the procedure,
- quality patient-provider interaction,
- compliance to standard precautionary measures,
- use of appropriate equipment and supplies,
- appropriate blood drawing technique,
- appropriate sample mixing, handling and transportation,
- proper sample processing and analysis, and
- proper disposal of medical waste.

This section provides guidance on the standardized procedural steps for conducting the following blood drawing procedures

- Routine venepuncture in adults
- Routine venepuncture in paediatrics and neonates
- Special venepuncture techniques
- Capillary blood collection
- Arterial sampling
- Blood collection for blood donation

3.1 **3.1 ROUTINE VENEPUNCTURE IN ADULTS**

Common indications for venepuncture in adults include: (1) to obtain blood for diagnostic purposes; (2) to monitor levels of blood components; (3) to administer therapeutic treatments including medications, nutrition or chemotherapy; (4) to remove blood due to excess level of iron or red blood cells; and (5) to collect blood for later uses, mainly transfusion either in the donor or in another person.

Of all these, blood collection for blood analysis is by far the commonest, and hence explained in this section are the step-by-step recommended standard operating procedures for blood drawing in adults.

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 plastic tubes with rubber caps (the choice of tube will depend on the type of investigation to be carried out in the laboratory);
  - ― vacuum-extraction blood tubes; or
  - ― sterile plastic tubes with screw caps;

Note: Plastic tubes are preferred to glass tubes, as the latter are considered to be potential sharps.

- a sterile plastic 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 of different sizes) (Table XXX)

Table 3.1: Recommended needle gauge, length and device for routine injection and phlebotomy procedures for different age groups

Patient population				
Needle gauge	**Adult**	**Paediatric, elderly, small veins**	**Neonatal**	**Procedure**
16 – 18	√			Blood donation
19 – 20	NA	NA	NA	
21	√ (1-1.5 inch or 2.54 cm)	NA	NA	

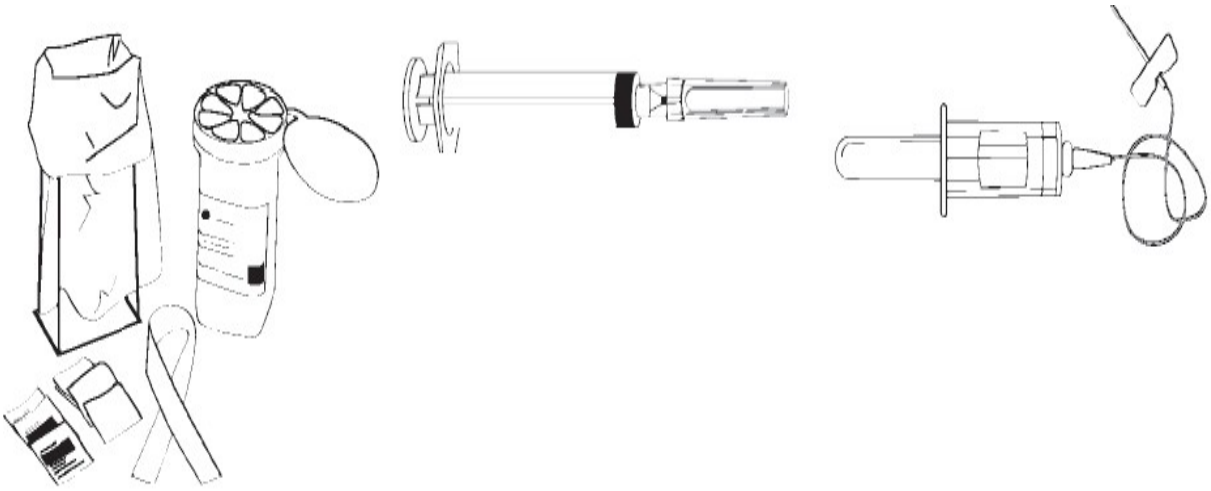
22	√ (1 inch or 2.54 cm)	√ (1 inch or 2.54 cm)	NA	
23	√ (1 – 1.5 inch or 2.54 cm)	√ (Winged set [butterfly]; 0.5 inch or 0.75 cm)	√ (Winged set [butterfly]; 0.5 inch or 0.75 cm)	

NA=Not Applicable

- a tourniquet;
- alcohol hand rub;
- 70% alcohol swabs for skin disinfection in a closed container;
- gauze or cotton-wool ball to be used for alcohol swab and also for applying over puncture site;
- laboratory specimen labels;
- water proof writing equipment
- laboratory forms;
- leak-proof transportation bags and containers;
- a puncture-resistant sharps container.
- holder

Note: The minimum required material for blood collection specimen in adults include; 70% alcohol, examination gloves, vaccutainer system (or if not available, standard needle and syringe) or blood lancet/pricker, tourniquet, plaster and a puncture- resistant safety box). If blood drawing is conducted in outpatient settings, a phlebotomy chair is recommended.

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



No.1. Assemble Equipment and include needle and syringe or vacuum tube, depending on which is to be used.

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 laboratory form, to ensure accurate identification).
- Ask whether the patent 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. 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.

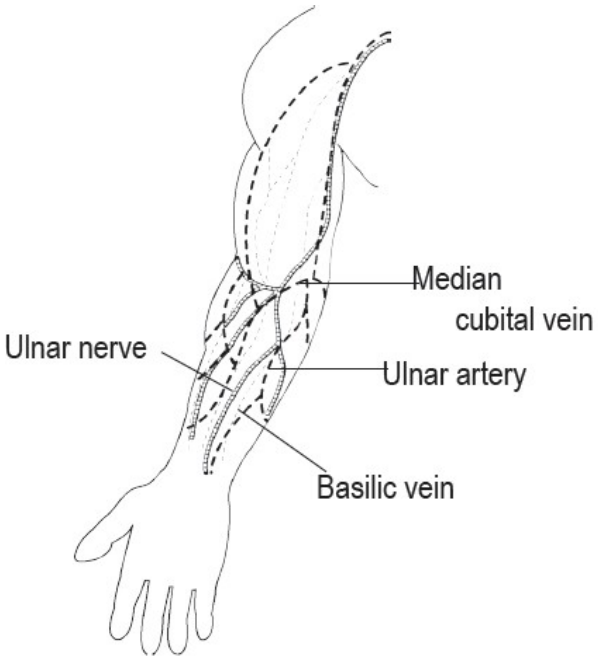
Note:
Phlebotomy procedure needs to be conducted in a clean and a well-lit area, with available
In an outpatient department or clinic, provide a comfortable room containing a clean surface with two chairs (one for the phlebotomist and the other for the patient), while in patient areas and wards should have curtains or partitions to offer privacy.

No.2. Identify and prepare the Patient

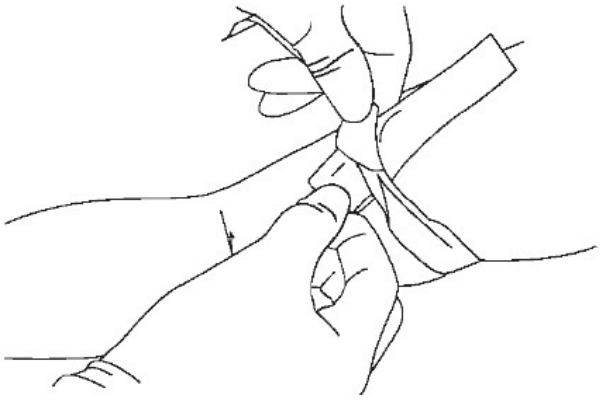
Step 3 – Select the site

General

- Extend the patient's arm and inspect the antecubital fossa or forearm.
- Locate a vein of a good size that is visible, straight and clear. The median cubital vein lies between muscles and is usually the most easy to puncture. Under the basilica 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.



No.3 (a): 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.



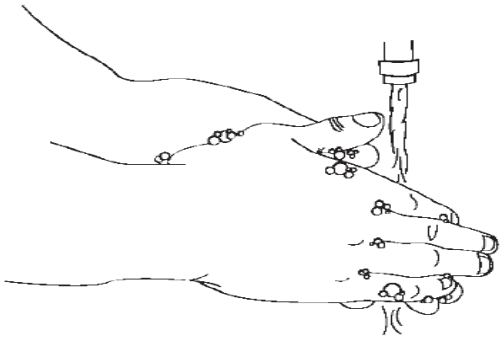
No.3 (b): Apply a tourniquet, about 4–5 finger widths above the selected venepuncture site.

NB: ***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. Nursing staff and physicians may access central venous lines for specimens following protocols. However, sufficient volume of blood should be discarded before blood is filled in tubes. The 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; that is
  - wash hands with running water and soap, and either air-dry or single-use towels
  - Note: Alcohol based hand rub solutions can be used if hands are not visibly soiled.



No.4. Perform hand hygiene (If using soap and water dry hands with single use towels)

Step 5 – Disinfect the entry site

- Put on non –sterile gloves before disinfecting the site
- Unless drawing blood cultures, clean the site with a 70% alcohol swab for 30 seconds and allow to dry completely (30 seconds). 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.
- Apply firm but gentle pressure. Start from the centre of the venepuncture site and work outwards in spiral to cover an area of 2 cm or more.
- Allow the area to dry. Failure to allow enough contact time increases the risk of haemolysis and 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. It the site is touched, repeat the disinfection.

No.5 (a): Put on well-fitting, non-sterile gloves.

No.5 (b): Disinfect the site using 70% isopropyl alcohol for 30 seconds and allow to dry completely (30 seconds)

Step 6 – Take blood

Venepuncture

Perform venepuncture as follows.

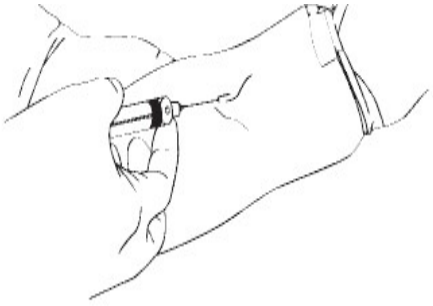
- Anchor the vein by holding the patient's arm and placing a thumb BELOW the venepuncture site.
- Ask the patient to form a fist so the veins are more prominent.

No.6 (a): Ask a patient to form a fist.

- 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.
- Remove the tourniquet as soon as blood flow is established, and always before it has been in place for one 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.

No.6 (c): Enter the vein swiftly at a 30 degree angle



No.6 (b): Anchor the vein by holding the patient's arm and placing a thumb BELOW the venepuncture site.

No.6 (d): Once sufficient blood has been collected, release the tourniquet BEFORE withdrawing the needle degree angle

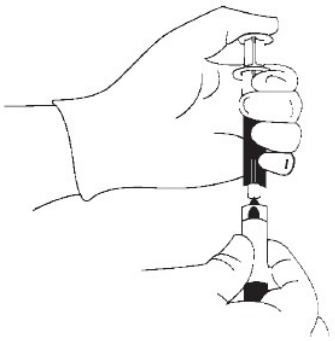
Step 7 – Fill the laboratory sample tubes

- When obtaining either single or multiple tubes of blood, if available, 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 standard syringe or winged needle set instead.
- If a syringe 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.
- If a winged needle set is used,, disconnect winged infusion set and discard in sharps container. Thereafter attach 21G or 22G syringe needle to syringe (or transfer device). Similar to above, with collection tubes seated in rack or "red block", transfer blood into the tubes by puncturing the stopper. **USE ONE HAND ONLY.**

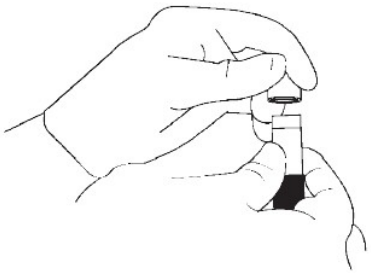
Fig X: Transfer Device

Fig Y: Transfer device inserted into syringe with blood

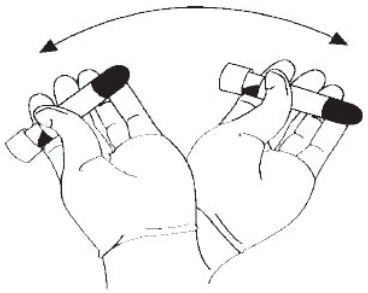
- Pierce the stopper on the vacuum tube with the needle directly above the tube using slow, steady pressure. Do not press the syringe plunger because additional pressure increases the risk of haemolysis.
- Where possible, keep the tubes in a rack and move the rack towards you. Inject downwards into the 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 as minimizing the pressure and velocity used to transfer the specimen reduces the risk of haemolysis. 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).



No.7 (a): If the tube does not have a rubber stopper, press the plunger in slowly to reduce haemolysis (this is safer than removing the needle).



No.7 (b): Place the stopper in the tube



No.7 (c): Following laboratory instructions, invert the sample gently to mix the additives with the blood before dispatch (see details below))

Mixing of specimen tubes

All specimen tubes contain additives that need to be mixed with blood sample. For instance, tubes with anticoagulants such as EDTA need to be mixed to ensure the specimen does not clot. Immediately after blood collection, the mixing should commence by holding up the collection tubes upright and gently invert them at 180^0 and back. Fig X below illustrates how to count one cycle of tube inversion. For details on the number of inversion required for each type of tube, refer to step 8 below.

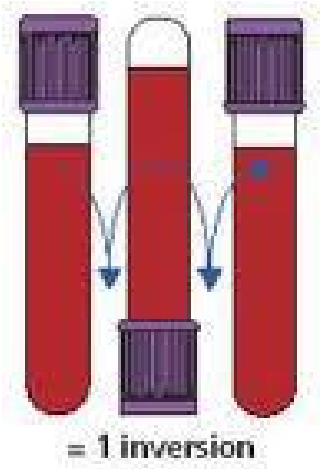


Fig X: Inversion of specimen collection tubes

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.

Table XX: Recommended order of draw for plastic vacuum tubes and the number of inversions required for appropriate mixing

Order of use	Type of tube/usual colour	Additive	Mode of action	uses	Number of inversions
1.	Blood culture bottle (yellow-black striped tubes)	Broth mixture	Preserves viability of microorganisms	Microbiology – aerobes, anaerobes, fungi	8 - 10
2.	Non-additive tube				0
3.	Coagulation tube (light blue top)	Sodium citrate*	Forms calcium salts to remove calcium	Coagulation tests (protime and thrombin time), requires full draw	3 - 4

Order of use	Type of tube/usual colour	Additive	Mode of action	uses	Number of inversions
4.	Clot activator (red top)	Clot activator	Blood clots and serum is separated by centrifugation	Chemistries, immunology and serology, blood bank (cross - match)	5 - 6
5.	Serum separator tube (red-grey tiger top or gold)	None	Contains a gel at the bottom to separate blood from serum on centrifugation	Chemistries, immunology and serology	5
6.	Sodium heparin (dark green top)	Sodium heparin or lithium heparin	Inactivates thrombin and thromboplastin	For lithium level use sodium heparin, for ammonia level use either	8 - 10
7.	PST (light green top)	Lithium heparin anticoagulant and a gel separator	Anticoagulant with lithium, separates plasma with PST at bottom of tube	Chemistries	8 - 10
8.	EDTA (Purple top)	EDTA	Forms calcium salts to remove calcium	Haematology, blood bank (cross-match) requires full draw	8 - 10
9.	Blood tube (pale yellow top)	Acid-Citrate-Dextrose (ACD, ACDA or ACDB)	Complement inactivation	HLA tissue typing, paternity testing, DNA studies	8 - 10
10.	Oxalate/Fluoride (light grey top)	Sodium fluoride and potassium oxalate	Antiglycolytic agent preserves glucose up to five days	Glucose, requires full draw (may cause haemolysis if short drawn)	8 - 10

ACD, acid-citrate-dextrose; DNA, deoxyribonucleic acid; EDTA, ethylene diamine tetraacetic acid; HLA, human leucocyte antigen; PST, plasma separating tube

[a]"1" indicates draw first and "10" draw last (if used)

[b] Verify with local laboratory in case local colour codes differ

[c] Gently invert tubes with additives to mix thoroughly; erroneous test results may be obtained when the blood is not thoroughly mixed with additives

[d] If a routine coagulation assay is the only test ordered, then a single light blue top tube may be drawn. If there is a concern about contamination by tissue fluids or thromboplastins, then a non-additive tube can be drawn before the additive tube. The PST tube contains lithium heparin anticoagulant and a gel separator; if used, draw in the order shown.

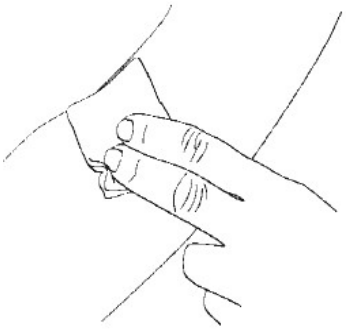
Source: Table adapted with permission from WebPath, Mercer University, United States (http://library.med.utah.edu/WebPath/webpath.html)

Order is based on United States National committee for clinical laboratory standards consensus (43).

***** When using a winged blood collection set for venipuncture and a coagulation (citrate) tube is the first specimen tube to be drawn, a discard tube should be drawn first. The discard tube must be used to fill the blood collection set tubing's "dead space" with blood but the discard tube does not need to be completely filled. This important step will ensure proper blood to-additive ratio. The discard tube should be a on additive or coagulation tube.

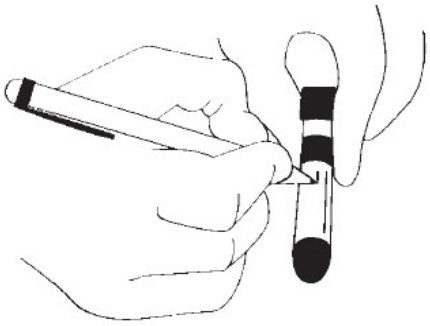
Step 9 – Sharp Disposal,

- Discard the used needle and syringe or blood sampling device into a puncture-resistant sharps container.
- Check the label on the samples 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 names, 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 above.
- 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.

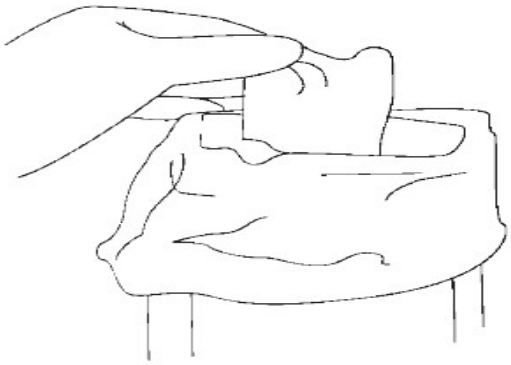


No.8 (a): Withdraw the needle gently and then give the patient a clean gauze or dry cotton wool ball to apply to the site with gentle pressure.

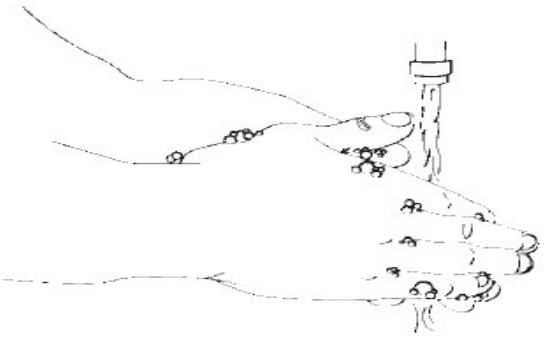
No.8 (b): Discard the used needle and syringe or blood sampling device into a puncture-resistant container.



No.8 (c): Check the label and forms for accuracy



No.8 (d): Discard sharps and broken glass into the sharps container. Place items that can drip blood or body fluids into the infectious waste.



No.8 (e): Remove gloves and place them in the general waste. Perform hand hygiene. If using soap and water, dry hands with single-use towels.

Note:

- Disposable holders with needle attached should be disposed of as one unit, reducing the risk of accidental needle stick injury
- Larger sharps containers may be required to accommodate disposable holders
- Do not attempt to remove the needle and reuse a disposable holder the threads on the holder are only designed to be used once and may cause the needle to release during collection.

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. Placing the requisition on the outside helps 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, clean carefully to remove all visible stains. Make a weaker solution and leave it in contact for a longer period of time. 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.

3.2 3.2 ROUTINE VENEPUNCTURE IN PEDIATRICS AND NEONATES

Venepuncture is the preferred method of blood sampling for term neonates, and when done appropriately, it causes less pain than heel-pricks. For this reason, anyone performing venous blood withdrawal in children and neonates must be well trained and practiced in venepuncture techniques. A uniform sampling technique is important to reduce pain and psychological trauma.

Illustrated under this section are the summary procedural steps for pediatric/neonatal venepuncture. The general principles are similar to venepuncture in adults, hence for additional details reference should be made to section 3.1

Step 1. Assemble Equipment and supplies for paediatric patients.

- Use a winged steel needle, preferably 23 or 23 gauge, with an extension tube (a butterfly):
    - avoid gauges of 25 or more because these may be associated with an increased risk of haemolysis;
    - use a butterfly with either a syringe or an evacuated tube with an adaptor; a butterfly can provide easier access and movement, but movement of the attached syringe may make it difficult to draw blood.
- Use a syringe with a barrel volume of 1–5 ml, depending on collection needs; the vacuum produced by drawing using a larger syringe will often collapse the vein.

Note: The minimum required material for blood collection specimen children include; 70% alcohol, examination gloves, vacutainer system (or if not available, 2mls standard needle and syringe) or blood lancet/pricker, tourniquet, plaster and a puncture- resistant safety box).

Note: Keep the tube and needle separate until the needle is in the vein.

- When using an evacuated tube, choose one that collects a small volume (1 ml or 5 ml) and has a low vacuum; this helps to avoid collapse of the vein and may decrease haemolysis.
- Where possible, use safety equipment with needle covers or features that minimize blood exposure. Auto-disable (AD) syringes are designed for injection, and are not appropriate for phlebotomy.

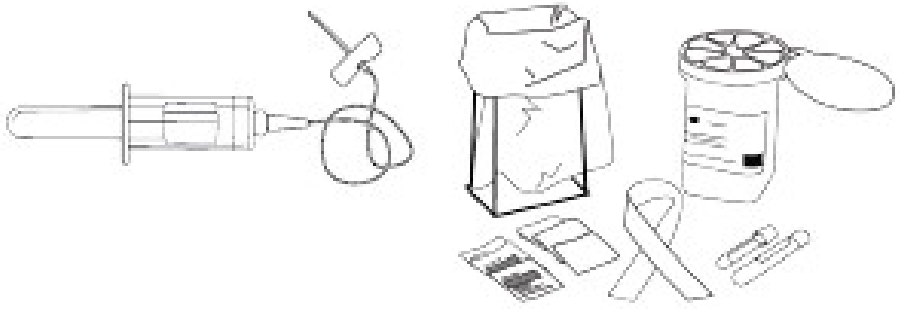


Fig X: equipments and supplies for venepuncture procedure in pediatrics and neonates

Step 2 – Identify and prepare the patient

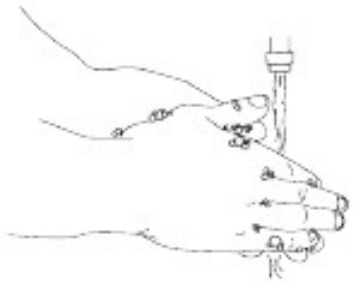
Similar to adults, healthcare provider should do the following

- Self-introduce to the patient, guardian(s) and/or family member accompanying the child as applicable
- Check that the laboratory form matches the patient's identity (i.e. match the patient's laboratory form, to ensure accurate identification).
- Ask for history of allergies, phobias or prior history of fainting following phlebotomy or injection procedure
- 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 selected venepuncture site
- Discuss the test to be performed and obtain verbal consent

Step 3 – Select the site, as described in the earlier section

- Rerefer to section 3.1, step 3

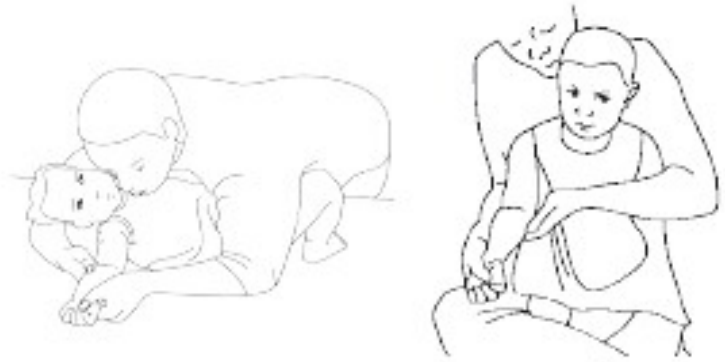
Step 4 - Perform hand hygiene with soap and water, as described in the earlier section



Step 5 - Immobilize the baby or child

Ask whether the parent would like to help by holding the child. If the parent wishes to help, provide full instructions on how and where to hold the child; if the parent prefers not to help, ask for assistance from another phlebotomist. Immobilize the child as described below.

- Designate one phlebotomist as the technician, and another phlebotomist or a parent to immobilize the child.
- Ask the two adults to stand on opposite sides of an examination table.
- Ask the immobilizer to:
    - stretch an arm across the table and place the child on its back, with its head on top of the outstretched arm;
    - pull the child close, as if the person were cradling the child;
    - grasp the child's elbow in the outstretched hand;
    - use their other arm to reach across the child and grasp its wrist in a palm-up position (reaching across the child anchors the child's shoulder, and thus prevents twisting or rocking movements; also, a firm grasp on the wrist effectively provides the phlebotomist with a "tourniquet").

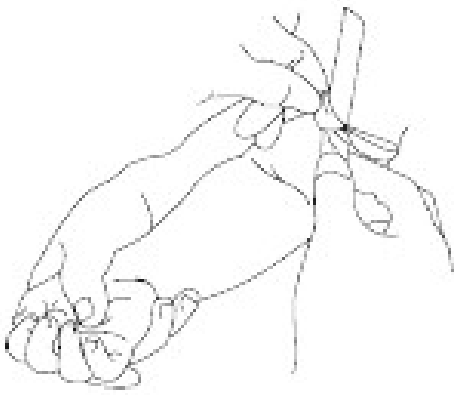


If necessary, take the following steps to improve the ease of venepuncture.

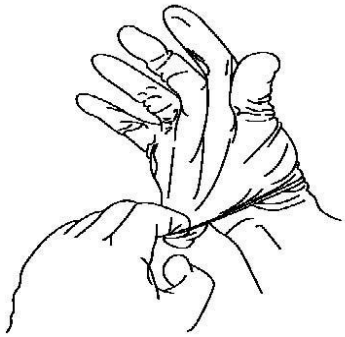
- Ask the parent to rhythmically tighten and release the child's wrist, to ensure that there is an adequate flow of blood.
- Keep the child warm, which may increase the rate of blood flow by as much as sevenfold, by removing as few of the child's clothes as possible and, in the case of an infant, by:
    - swaddling in a blanket; and
    - having the parent or caregiver hold the infant, leaving only the extremity of the site of venepuncture exposed.
- Warm the area of puncture with warm cloths to help dilate the blood vessels.

Use a transilluminator or pocket pen light to display the dorsal hand veins and the veins of the antecubital fossa

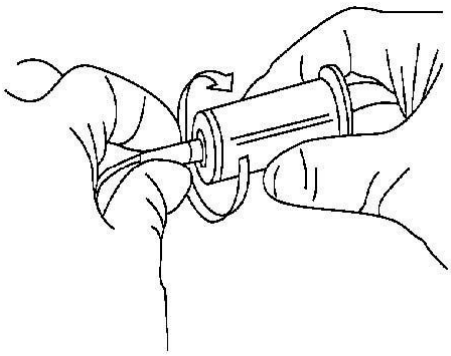
Step 6: Put the tourniquet on the patient about two finger widths above the venepuncture site



Step 7: Put on well-fitting, non-sterile gloves

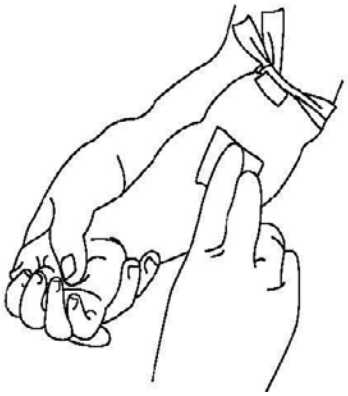


Step 8. Attach the end of the winged infusion set to the end of the vacuum tube and insert the collection tube into the holder until the tube reaches the needle.

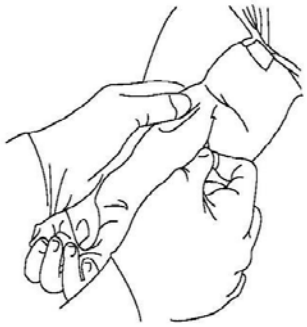


Step 7: Remove the plastic sleeve from the end of the butterfly.

Step 8: Disinfect the collection site and allow to dry
Note: Skin antisepsis (but DO NOT use chlorhexidine on children under 2 months of age)



Step 9: Use a thumb to draw the skin tight, about two finger widths below the venepuncture site

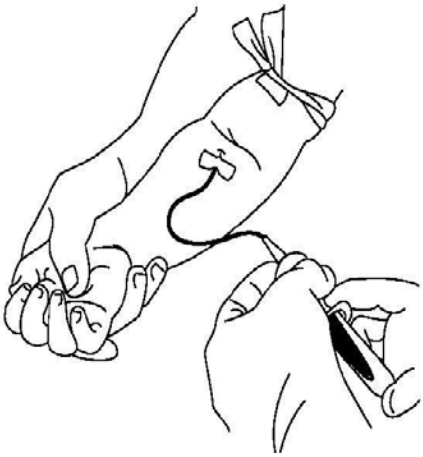


Step 10: Push the vacuum tube completely onto the needle

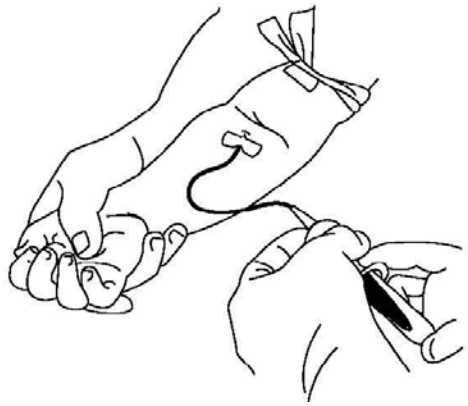
- Once the infant or child is immobilized, puncture the skin 3–5 mm distal to (i.e. away from) the vein; this allows good access without pushing the vein away.
- If the needle enters alongside the vein rather than into it, withdraw the needle slightly without removing it completely, and angle it into the vessel.
- Draw blood slowly and steadily.

Note: For Finger and hill-rpick procedure, please refer to the next section

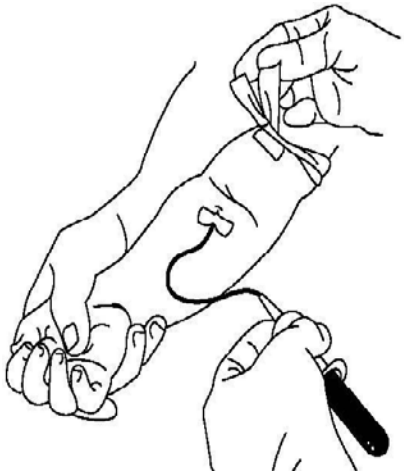
Step 11: Blood should begin to flow into the tube



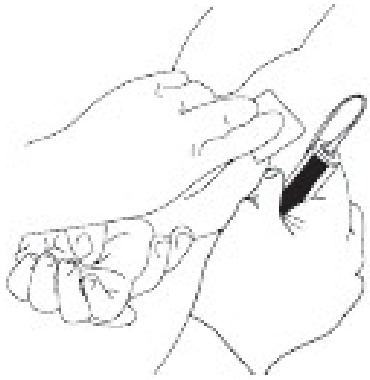
Step 12: Fill the tube until it is full or until the vacuum is exhausted; if filling multiple tubes, carefully remove the full tube and replace with another tube, taking care not to move the needle in the vein.



Step 13: After the required amount of blood has been collected, release the tourniquet.

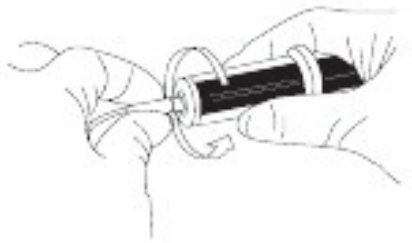


Step 14: Place dry gauze over the venepuncture site and slowly withdraw the needle.



Step 15: Ask the parent to continue applying mild pressure.

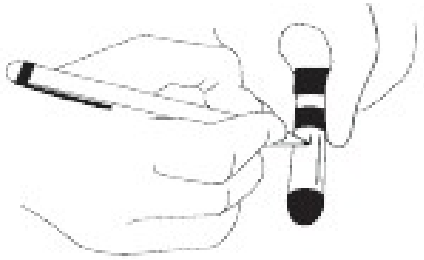
Step 16: Remove the butterfly from the vacuum tube holder.



Step 17: Dispose of the butterfly in a sharps container.

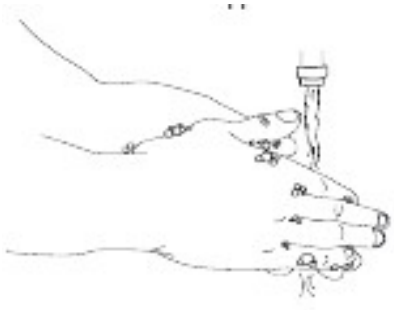
Step 18: Properly dispose of all contaminated supplies.

Step 19: Label the tube with the patient identification number and date



Step 20: Put an adhesive bandage on the patient if necessary.

Step 21: Remove gloves, dispose of them appropriately and perform hand hygiene (if using soap and water, dry hands with single-use towels).



3.3 SPECIAL VENEPUNCTURE TECHNIQUES

While venous blood collection in considered to be most challenging in children, it can equally be difficult in case of geriatric and adult cancer patients. Both these patient types may have small and fragile veins for performing venepuncture. Besides paediatrics and geriatric patients with difficult-to-find veins, other conditions which may require special venepuncture techniques are those by which the antecubital fossa is inaccessible in a patient. These include the situations by which the patient has the following

- Intravenous lines in both arms
- Burned or scarred areas
- Casts(s) on arm(s)
- Partial or radical mastectomy on one or both sides
- Thrombosed veins
- Edematous arms

Under the above described circumstances, the use of normal multi-sample needle may not result in a successful specimen collection. Instead, the use of alternate equipment and accessing other venepunctures sites such as hands and legs is recommended. These guidelines recommend the use of winged sets made up of lower gauge needle (22/23G) and a flexible extended tubing that helps to reduce the stress exerted on vein during application of vacuum - whether it happens with evacuated system or a syringe (see figure X below).

Figure X: Winged set

Note: This type of a winged set has a luer slip (black end) which is the non-patient end. This end can fit into either holder (through a luer adapter) or a syringe as shown aboveThe non-patient end can (without luer adapter) can be fitted to the nozzle of a hypodermic syringe. This combination is useful while accessing very fragile veins where the operator would like to modulate the vacuum applied in order to prevent the vein from collapsing. Different colours of the wings signify different gauge size. E.g. green, 21G; blue, 23G; and dark blue 25G. The higher the G

number the smaller the needle size. On the market there are some that do not have the luer slip. Also there are those that have a safety shield attached to the needle and those that do not.

Alternative sites besides the antecubital fossa include:

a) Veins of the hand

In case the veins are not visible, one could consider wrapping a warm, wet and clean towel around the hand for a few minutes. Warming the site increases the blood flow and helps make the veins easier to feel. Where there is uncertainty about a vein, tapping the site sharply a few minutes may assist, This helps dilate the veins and make it more prominent.

Wrist veins tend to move or roll aside as the needle is inserted, therefore is critical to hold the hand such that veins are well anchored. It is preferable to used blood collection set to perform venepuncture on wrist veins

b) ***Veins of the feet***

The use of the veins in the feet for blood specimen collection should be a last resort. Blood flow in extremities such as feet may not be representative of the general circulation (particularly in patients with vascular disease – e.g. diabetes) and may yield erroneous results. Further, venepuncture of veins in the lower extremities can have dangerous consequences such as thrombus formation especially in patients with coagulopathy.

In cases where a patient has an IV line in place, special considerations need to be taken in order to avoid misrepresentative laboratory findings. For details see table X below.

Table X: Special considerations for patients with IV line in-situ

SITUATION	SITE SELECTION
IV line present on one arm	• Obtain blood from the opposite arm
IV line present in both arms	• Draw blood from a vein distal (below) to the IV site • Ask the physician / nurse to turn off the IV line for at least 2 minutes. Note: Unless when the person drawing blood is a medical personnel, any other authorized involved in care, the person drawing blood should not turn off the IV line without prior permission. • Place tourniquet between the IV and venepuncture site • Perform venepuncture, discarding the first 5 mls of blood • Indicate the IV solution, arm used and drawn below IV on the request form

Key procedural steps when withdrawing blood using the winged blood collection set

1. Hold the winged blood collection set with a holder or syringe attached to the non-patient end
2. While anchoring the veins and keeping the sling taught with thumb of the non-dominant hand, enter the vein at 10 – 15 degrees angle
3. Using non dominant hand:
    - If using evacuated collection, push the tube into the holder using the thumb while an index and middle finger grasp the wings of the tube holder
    - If using syringe, slowly withdraw the syringe plunger
4. Blood now begins to glow
5. Release the tourniquet
6. Once last tube has filled and been withdrawn or required amount of blood has been withdrawn in syringe, put a clean gauze pad on site and apply light pressure using three fingers as shown in the picture
7. Gently and quickly withdraw the needle and continue applying pressure on site
8. If the wing set has a safety feature, activate it immediately
9. Discard the complete assembly without removing the holder into a puncture – resistant safety box

Key considerations while using a wing set collection system

- Palpating the vein allows blood collector to estimate the position, depth, angle and size of the vein.
- When collecting blood using a wing set the following need to be ensured
- Press down lightly on the skin where you perceive the vein (with the tip your gloved finger)
- Trace the path several times to determine its suitability for venepuncture.
- By varying the amount of pressure, feel for the curvature, angle, position and elasticity of the veins under the surface of the skin.
- If the vein is not immediately evident, ask the patient to open and close their fist tightly but not pump (clench and unclench repeatedly). Tightening the forearm muscles will help to enhance blood occlusion in the veins, usually making them palpable.
- Press and release the vein several times as veins have resilience or bounce
- A thrombosed vein lacks resilience, feels cordlike, rolls easily and should not be used
- If you feel a pulse, you may have located an artery and it must be avoided.
- To avoid puncturing an artery, NEVER select a vein that lies over, or is close to, where you feel a pulse. - Nicking an artery may result in a patient bleeding episode, hematoma and potential resulting nerve damage.
- NEVER perform venepuncture when you cannot feel the vein. Blind probing can cause injury to damaging nerves and tendons. Defer to someone else for the collection or consider skin puncture, if appropriate

- Remember to ask patient to release the clenched fist as soon as the needle enters the vein and blood begins to flow into the blood collection tube

Transfer of blood from syringe into specimen container

1. Remove the cap of the container and gently transfer specimen into it by pushing the plunger
2. Ensure there is no froth formation during the blood flow into the container
3. Do not overfull
4. Replace the container cap

3.4 CAPILLARY BLOOD COLLECTION

Capillary blood collection which is also commonly known as **'dermal'** also frequently referred to as 'capillary sampling" is a procedure that involves penetrating dermis of the skin of fingers, heels or (rarely) ear lobes. Though it is commonly performed in children, it can be performed on patients of any age, for specific tests that require small quantities of blood.

Situations which necessitate adult capillary blood drawing

- Severe burns – may result in lack of availability of suitable venepuncture sites
- Extreme obesity – Difficult to find appropriate veins (difficult to locate / palpate) Hypercoagulability (thrombotic tendency) – Venepuncture could result in serious consequences for the patient leading conditions like deep vein thrombosis etc.
- Geriatric or fragile veins – Difficult to access / find veins
- Need to preserve veins for therapy – Patients such as those on chemotherapy have superficial, delicate veins that need to be preserve for their therapy
- Home testing – e.g. glucose testing etc.
- Apprehensive patients – Patients who refuse venous access
- Point of care testing – within wards e.g. glucose etc.

Choice of site for capillary sampling

Adult patients

The finger is usually the preferred site for capillary testing in an adult patient. The sides of the heel are only used in paediatric and neonatal patients. Ear lobes are sometimes used in mass screening or research studies.

Paediatric and neonatal patients

Selection of a site for capillary sampling in a paediatric patient is usually based on the age and weight of the patient. If the child is walking, the child's feet may have calluses that hinder adequate blood flow. Table XX shows the conditions influencing the choice of heel or finger-prick.

Table XX Conditions influencing the choice of heel or finger

CONDITIONS	HEEL-PRICK	FINGER-PRICK
Age	Birth to about 6 months	Over 6 months
Weight	From 3 – 10 kg, approximately	Greater than 10 kg
Placement of lancet	On the medial or lateral plantar surface	On the side of the ball of the finger perpendicular o the lines of the fingerprint

CONDITIONS	HEEL-PRICK	FINGER-PRICK
Recommended finger	Not applicable	Second and third finger (i.e. middle and ring finger); avoid the thumb and index finger because of calluses, and avoid the little finger because the tissue is thin

Note: Specimens requiring a skin puncture are best obtained after ensuring that a baby is warm.

Selection of lancet

a) Adult patients

A lancet slightly shorter than the estimated depth needed should be used because the pressure compresses the skin; thus, the puncture depth will be slightly deeper than the lancet length. In one study of 52 subjects, pain increased with penetration depth, and thicker lancets were slightly more painful than thin ones (*67*). However, blood volumes increased with the lancet penetration and depth.

Lengths vary by manufacturer (from 0.85 mm for neonates up to 2.2 mm). In a finger-prick, the depth should not go beyond 2.4 mm, so a 2.2 mm lancet is the longest length typically used.

b) Paediatric and neonatal patients

In heel-pricks, the depth should not go beyond 2.4 mm. For premature neonates, a 0.85 mm lancet is available.

The distance for a 7 pound (3 kg) baby from outer skin surface to bone is:

- medial and lateral heel – 3.32 mm;
- posterior heel – 2.33 mm (this site should be avoided, to reduce the risk of hitting bone);
- toe – 2.19 mm.
- The recommended depth for a finger-prick is:
- for a child over 6 months and below 8 years – 1.5 mm;
- for a child over 8 years – 2.4 mm.

Too much compression should be avoided, because this may cause a deeper puncture than is needed to get good flow.

Order of draw

With skin punctures, the haematology specimen (EDTA) is collected first, followed by the chemistry and blood bank specimens. This order of drawing is essential to minimize the effects of platelet clumping. The order used for skin punctures is the reverse of that used for venepuncture collection. If more than two specimens are needed, venepuncture may provide

more accurate laboratory results.

Practical guidance on capillary sampling

1. Selection of site, appropriate sized lancet and other equipments

- Using the guidance given in Section 7.1, decide whether to use a finger or heel-prick, and decide on an appropriate size of lancet.
- DO NOT use a surgical blade to perform a skin puncture.
- DO NOT puncture the skin more than once with the same lancet, or use a single puncture site more than once, because this can lead to bacterial contamination and infection.

Note: Basic supplies needed for capillary sampling include, specimen collection equipment (i.e. tubes, slides, and filter paper for dry blood spot [DBS] if applicable) DBS), capillary tube(s), gauze /cotton wool balls, clean), puncture-resistant sharps ontainers, adhesive bandage,70% alcohol, laboratory specimen labels; water proof writing equipment, laboratory forms, leak-proof transportation bags and containers, and a puncture-resistant sharps container.

Example of various sized lancets.

Color	Dimensions	Blood Volume
	Needle: 30 G x 1.5 mm depth	Low Blood Flow Single Drop
	Needle: 21 G x 1.8 mm depth	Medium Blood Flow
	Blade: 1.5 mm width x 2.0 mm depth	High Blood Flow

2. Procedure for capillary sampling

a) Adult patients

Step1. Prepare the skin

- Apply 70% alcohol to the entry site and allow to air dry. Residual alcohol causes rapid hemolysis and can have adverse effects on test results.
- Inform patient or care taker about imminent pain
- Hold the finger/heel and firmly place a new sterile lancet at the selected site on the finger/heel
- Puncture the skin with one quick, continuous and deliberate stroke, to achieve a good flow of blood and to prevent the need to repeat the puncture.
- In case of finger sticks, orient lancet across the fingerprint groves (helps in drop formation)
- Wipe the first drop of blood with a clean, dry gauze pad. The first drop contains excess of tissue fluid which would dilute the sample and alter results

- Avoid squeezing the finger or heel too tightly because this dilutes the specimen with tissue fluid (plasma) and increases the probability of haemolysis.
- When the blood collection procedure is complete, apply firm pressure to the site to stop the bleeding

Step 2. Take laboratory samples in the correct order to minimize erroneous test results

- With skin punctures, collect the specimens in the order below, starting with haematology specimens:
    - haematology specimens;
    - chemistry specimens;
    - blood bank specimens.

b) **Paediatric and neonatal patients**

Step 1. Immobilize the child

- First immobilize the child by asking the parent to:
    - sit on the phlebotomy chair with the child on the parent's lap;
    - immobilize the child's lower extremities by positioning their legs around the child's in a cross-leg pattern;
    - extend an arm across the child's chest, and secure the child's free arm by firmly tucking it under their own;
    - grasp the child's elbow (i.e. the skin puncture arm), and hold it securely;
    - use his or her other arm to firmly grasp the child's wrist, holding it palm down.

Step 2. Prepare the skin

- Prepare the skin with 70% alcohol, as described above for adult patients. Residual alcohol causes rapid hemolysis and can have adverse effects on test results.
- DO NOT use povidone iodine for a capillary skin puncture in paediatric and neonatal patients; instead, use alcohol, as stated in the instructions for adults.
- Inform patient or care taker about imminent pain

If possible, gently warm the puncture site

- A warm, moist towel OR warming device
- Neither should be heated higher than 42oC
- Contact time 3 to 5 minutes
  Note : warming can increase blood flow up to 7 folds (times)

Step 3. Puncture the skin

- Puncture the skin as described above for adult patients.
- If necessary, take the following steps to improve the ease of obtaining blood by finger-prick in paediatric and neonatal patients:
    - ask the parent to rhythmically tighten and release the child's wrist, to ensure that there is

sufficient flow of blood;

- keep the child warm by removing as few clothes as possible, swaddling an infant in a blanket, and having a mother or caregiver hold an infant, leaving only the extremity of the site of capillary sampling exposed.

- Hold the finger/heel and firmly place a new sterile lancet at the selected site on the finger/heel

Note: If using self-retracting safety lancet, activate the lancet OR if using manual lancet perform single puncture with one smooth motion

- In case of finger sticks, orient lancet across the fingerprint groves (helps in drop formation)
- Wipe the first drop of blood with a clean, dry gauze pad. The first drop contains excess of tissue fluid which would dilute the sample and alter results
- Avoid excessive massaging or squeezing of fingers because this will cause haemolysis and impede blood flow.

Complications

If not performed well, capillary sampling can lead to complications which may include:

- collapse of veins if the tibial artery is lacerated from puncturing the medial aspect of the heel;
- osteomyelitis of the heel bone (calcaneus);
- nerve damage if the fingers of neonates are punctured;
- haematoma and loss of access to the venous branch used;
- scarring;
- localized or generalized necrosis (a long-term effect);
- skin breakdown from repeated use of adhesive strips (particularly in very young or very elderly patients) – this can be avoided if sufficient pressure is applied and the puncture site is observed after the procedure.

Note: Heel- puncture precautions that need to be taken to avoid contact with heel bone (Calcaneus), which is the main cause osteomyelitis include.
- Do not puncture deeper than 1.5 mm
- Do not puncture through previous punctures
- Do not puncture outside the medial and lateral aspects of the heel previously described
- Do not puncture the posterior curvature of heel
- Do not puncture in the arch
- Do not puncture areas of the foot other than the heel

Step 4. Take laboratory samples in the order that prevent cross-contamination of sample tube additives

- As described above for adult patients, collect the capillary haematology specimen first, followed by the chemistry and blood bank specimens.
- Clean up blood spills.
- Collect all equipment used in the procedure, being careful to remove all items from the patient's bed or cot; to avoid accidents, DO NOT leave anything behind.

Upon completion of blood sample collection, proper follow up care which is comprised of two separate steps i.e. patient follow-up care – data entry (i.e. completion of requisitions), and provision of comfort and reassurance, must follow.

1. Data entry or completion of requisitions

Record relevant information about the blood collection on the requisition and specimen label; such information may include: date of collection, patient name, patient identity number, unit location (nursery or hospital room number), test or tests requested, amount of blood collected (number of tubes), method of collection, and phlebotomist's initials.

2. Comfort and reassurance

Show the child that you care either verbally or physically. A simple gesture is all it takes to leave the child on a positive note; for example, give verbal praise, a handshake, a fun sticker or a simple pat on the back.

A small amount of sucrose (0.012–0.12 g) is safe and effective as an analgesic for newborns undergoing venepuncture or capillary heel-pricks.

In the event of an unsuccessful attempts in paediatric patients

Adhere strictly to a limit on the number of times a paediatric patient may be stuck. If no satisfactory sample has been collected after two attempts, seek a second opinion to decide whether to make a further attempt, or cancel the tests.

Note: Key dimensions for a successful skin puncture include,
- Patient safety and comfort
- Device selection according to:
- Patient's age and safe penetration depth
  - < 2.0 mm for all heel stick*
  - < 1.5 mm for finger stick on children over 12 months
  - < 2.0 mm for finger stick on children over 8 yrs.
  - < 2.4 mm for finger stick on adults
- Required blood volume (according to test types)

3.5 BLOOD COLLECTION FOR BLOOD TRANSFUSION PURPOSES

The process for collecting blood from donors is similar to that used for blood sampling; however, a few additional measures are required for collection of donated blood. These measures are primarily to ensure patient safety, but also to minimize exogenous contamination of a donated blood unit or its derived components, particularly contamination from the skin flora of the donor's arm. Because of the volume or blood collected and the length of storage, pathogens can multiply during storage. Safe collection ensures that the blood products are safe for therapeutic use throughout their shelf life.

Skin flora is a common source of contaminants; it is therefore important to use an effective antiseptic on the donor's arm before blood donation. Transfusion with blood components that are contaminated with exogenous bacteria or other agents can cause fatal complications; however, based on available literature and expert opinion, the recommended option for skin antisepsis for blood donation is the one step application of a combination of 2% chlorhexidine gluconate and 70% isopropyl alcohol for
30 seconds; and then followed by 30 seconds drying time. Blood donations should be collected only by trained and qualified blood transfusion services personnel.

3.1.1 Before a person donates blood

- 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)
    - 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
- The person should provide informed written consent, based on the national requirements.

Minimum requirements for blood donation collection systems

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. 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).

Note: For procedures related to blood donation for transfusion, the following are the materials and supplies are needed: - Blood pressure monitor (BP Machine), Blood donor coach/chairs, Weighing Scales, Blood Collection monitor or mixer, Blood bag tube sealers, Blood Bags (450 and 250 mls capacities), Red vaccutainer tubes, Blood Transportation boxes (Cool Boxes), Blood Bank Refrigerators, Sodium Hypochlorite Bleach solution (0.5 %), Povidon Iodine, Examination gloves, Safety Boxes, Pair of scissors/Forceps, Marker pens

- 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.
  - Walls should be painted with wash and wear paints.

3.1.2 During blood donation

For collection of blood for donation, follow the six steps given below.

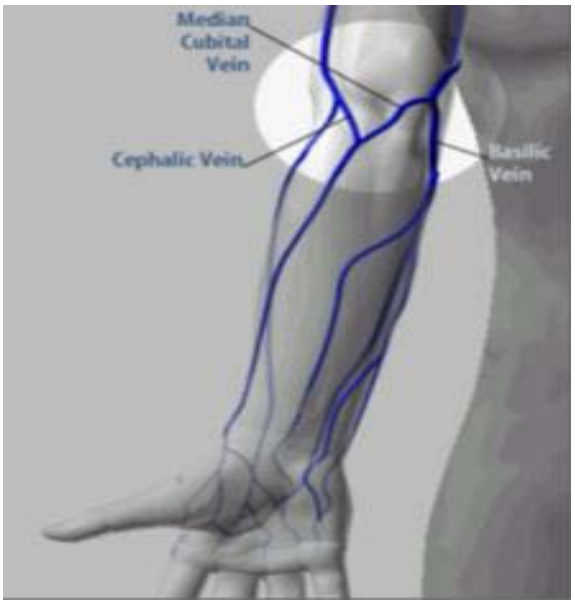
Step1 – Identify donor and label blood collection bag and test tubes

- 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 (median Cubital vein), 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):
  - use a product combining 2% chlorhexidine gluconate in 70% isopropyl alcohol;
  - cover the whole area 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 is not available, use the following procedure – takes about two minutes):
  - *step 1* – use 70% isopropyl alcohol;
  - cover the whole area 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* – use tincture of iodine (more effective than povidine iodine) or chlorhexidine 2%);
  - cover the whole area 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).
- Whichever procedure is used, DO NOT touch the venepuncture site once the skin has been disinfected.

Step 4 – Perform the venipuncture

Perform venepuncture using a smooth, clean entry with the needle, Take into account the points given below, which are specific to blood donation.

- In general, use a 16-gauge needle, 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, but all should be cut off at the end of the procedure (as described in step 6, below) rather than recapped.
- 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, palor 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.

3.1.3 After a blood donation

Donor care

After 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.
- 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.

Note: Haemolysis, clot in an anticoagulated sample (due to Overfilling of tubes, Inadequate mixing, Difficult draw Slow filling of evacuated tubes), platelet clumps (due to Poor mixing and Overfilling additive tubes) compromises specimen quality.

3.6 3.6 ARTERIAL BLOOD SAMPLING

An arterial blood sample is collected from an artery, primarily to determine arterial blood gases. Arterial blood sampling should only be performed by health workers for whom the procedure is in the legal scope of practice for their position in their country and who have demonstrated proficiency after formal training.

The sample can be obtained either through a catheter placed in an artery, or by using a needle and syringe to puncture an artery. These syringes are pre-heparinized and handled to minimize air exposure that will alter the blood gas values. This chapter describes only the procedure for a radial artery blood draw.

3.6.1 Choice of site

Several different arteries can be used for blood collection. The first choice is the radial artery, which is located on the thumb side of the wrist; because of its small size, use of this artery requires extensive skill in arterial blood sampling. Alternative sites for access are brachial or femoral arteries, but these have several disadvantages in that they:

- may be harder to locate, because they are less superficial than the radial artery;
- have poor collateral circulation;
- are surrounded by structures that could be damaged by faulty technique.

3.6.2 Practical guidance on arterial blood sampling

Equipment and supplies

Assemble the relevant items described in Section 2.2.3, plus the following specimen collection equipment and supplies:

- pre-heparinized syringe;
- needles (20, 23 and 25 gauge, of different lengths) – choose a size that is appropriate for the site (smaller gauges are more likely to lyse the specimen);

- a safety syringe with a needle cover that allows the syringe to be capped before transport, without manually recapping (this is best practice for radial blood sampling);
- a bandage to cover the puncture site after collection;
- a container with crushed ice for transportation of the sample to the laboratory (if the analysis is not done at the point of care);
- where applicable, local anesthetic and an additional single-use sterile syringe and needle.

Procedure for arterial blood sampling using radial artery

For sampling from the radial artery using a needle and syringe, follow the steps outlined below.

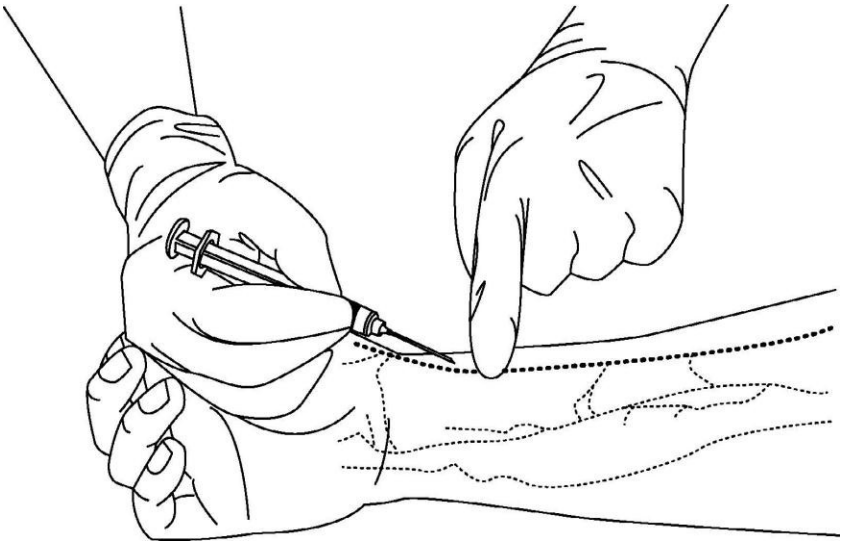
- Approach the patient, introduce yourself and ask the patient to state their full name.
- Place the patient on their back, lying flat. Ask the nurse for assistance if the patient's position needs to be altered to make them more comfortable. If the patient is clenching their fist, holding their breath or crying, this can change breathing and thus alter the test result.
- Locate the radial artery by performing an Allen test (see Annex I) for collateral circulation. If the initial test fails to locate the radial artery, repeat the test on the other hand. Once a site is identified, note anatomic landmarks to be able to find the site again. If it will be necessary to palpate the site again, put on sterile gloves.
- Perform hand hygiene, clear off a bedside work area and prepare supplies. Put on an impervious gown or apron, and face protection, if exposure to blood is anticipated.
- Disinfect the sampling site on the patient with 70% alcohol and allow it to dry.
- If the needle and syringe are not preassembled, assemble the needle and heparinized syringe and pull the syringe plunger to the required fill level recommended by the local laboratory.
- Holding the syringe and needle like a dart, use the index finger to locate the pulse again, inform the patient that the skin is about to be pierced then insert the needle at a 45 degree angle, approximately 1 cm distal to (i.e. away from) the index finger, to avoid contaminating the area where the needle enters the skin.
- Advance the needle into the radial artery until a blood flashback appears, then allow the syringe to fill to the appropriate level. DO NOT pull back the syringe plunger.
- Withdraw the needle and syringe; place a clean, dry piece of gauze or cotton wool over the site and have the patient or an assistant apply firm pressure for sufficient time to stop the bleeding. Check whether bleeding has stopped after 2–3 minutes. Five minutes or more may be needed for patients who have high blood pressure or a bleeding disorder, or are taking anticoagulants.
- Activate the mechanisms of a safety needle to cover the needle before placing it in the ice cup. In the absence of a safety-engineered device, use a one-hand scoop technique to recap the needle after removal.
- Expel air bubbles, cap the syringe and roll the specimen between the hands to gently mix it. Cap the syringe to prevent contact between the arterial blood sample and the air, and to prevent leaking during transport to the laboratory.
- Label the sample syringe.

- Dispose appropriately of all used material and personal protective equipment.
- Remove gloves and wash hands thoroughly with soap and water, then dry using single-use towels; alternatively, use alcohol rub solution.
- Check the patient site for bleeding (if necessary, apply additional pressure) and thank the patient.
- Transport the sample immediately to the laboratory, following laboratory handling procedures.

Illustrations for arterial blood sampling

Arterial blood sampling

Locate artery and take a sample



SECTION 4: POSSIBLE COMPLICATIONS DURING SPECIMEN COLLECTION BY VENIPUNCTURE AND THE ACTIONS TO TAKE IF THESE OCCUR. However well conducted, blood collection procedure can lead into some complications. Illustrated in table XX below are various types of complications and the recommended course of actions.

ADVERSE EVENT	CAUSE	MANAGEMENT	REMARKS
*Haematoma	– Poor or failed venepuncture – Skin pierced at too great an angle – and exiting vein – Needle puncturing through the vein twice during the donation Vein punctured such that part of the bevel of needle is out of the vein – Inadequate pressure after the donation due to early removal of the tourniquet	– Abort the procedure as soon as hematoma formation is observed during procedure – Apply pressure and a firm bandage – Advise donor to move arm freely but to avoid heavy lifting – Apologize, and reassure the donor	Give relevant contact information to donor in case the donor has any further inquiries
**Vasovagal reaction or faint, due to a hypothalamic response resulting in bradycardia, vomiting, sweating, arterial dilatation and a low blood pressure	– Anxiety – Lowered blood volume and other associated causes: o hypoglycaemia o lack of fluids o poor sleep o Atmosphere in donation room (hot or humid) *Signs and symptoms* – Staring – Sighing – Pallor or sweating – Slow pulse – Drop in blood	*Mild vasovagal reaction* – Discontinue donation – Recline chair – Loosen clothes – Monitor blood pressure and pulse – Reassure donor – Give fluids to the donor to drink (recovery is usually rapid) *Severe vasovagal reaction* – Call physician – If the donor becomes unconscious, put the	*Care of the donor* The physician will: – explain to the donor the nature of what has happened – reassure the person that this is only related to the donation process *Future donations* – Severe faints – person should not donate again

ADVERSE EVENT	CAUSE	MANAGEMENT	REMARKS
	pressure – Vomiting – Loss of consciousness (occasionally) – Convulsions (rare)	person in recovery position (i.e. head to the side and chin up) and ensure that airways are clear. – Occasionally, severe faint with delayed recovery, or epileptiform episode with or without incontinence, might occur; this is usually an anoxic fit rather than epilepsy. – In the case of an epileptiform fit, generally, do not report to donor because it may cause unnecessary anxiety – If incontinence occurs, then inform the donor and deal with privately *Faints* – These are usually self limiting and do not require investigation because they have no underlying	– Mild faints – person may donate, but defer if develops another fainting attack

ADVERSE EVENT	CAUSE	MANAGEMENT	REMARKS
		pathology	
+Delayed faint (syncope)	Physical stress – Inadequate fluid Intake cause unknown occurs 1–4 hours after donation, usually outside the blood bank	– Hot drinks or water before donating blood; – sitting in a supine position, – audio or visual distraction; and – minimal pain and stress during blood donation	Try to find cause *Future donations* May donate, but if develops a second time, then defer
++Arterial puncture	– Brachial artery sometimes lies anatomically very close to the vein – Detected by observing that the blood collected is bright red and has a rapid flow – May result in late complications such as arteriovenous fistulae Mark on the requisition form that arterial blood was collected since the reference ranges may be different for various tests.	– Discontinue donation or continue if identified towards the completion of the donation – Call the donor care physician – Apply firm pressure (by the nurse or medical staff), for at least 15 minutes – Apply pressure bandage and check the radial pulse – Inform and reassure donor, and explain that the puncture is unlikely to have serious consequences, but that	Give relevant contact information to donor in case the person has any further inquiries

ADVERSE EVENT	CAUSE	MANAGEMENT	REMARKS
		bad bruising may occur, and healing takes about 10–14 days	
Nerve damage	– Nerve endings brushed during venepuncture – Pressure from haematoma *Symptoms and signs* – Pain or parasthesia – Motor or sensory loss	– Recovery is usually spontaneous and rapid within 24 hours (in rare cases, up to 6 months) – Refer the donor to the physician to explain and reassure the donor, and refer the donor to a neurologist if the damage is severe	Give relevant contact information to donor in case the donor has any further inquiries
Improper positioning of tube	– Improper insertion	– Proper insertion of the tube into holder	
Rolling of vein	– Poorly anchored vein prior to puncture	– Remove tube from needle holder to preserve the vacuum – Withdraw needle until bevel is just under the skin, anchor vein and redirect needle into vein – Reinsert the same needle into the holder	

ADVERSE EVENT	CAUSE	MANAGEMENT	REMARKS
Puncture through vein	– Happens when the needle is first inserted or the holder is not kept steady when the tubes are pushed onto and removed from the needles	– Withdraw needle slightly to establish flow. If **Blood flow is restored:** – Take care when removing tube, inserting and removing subsequent tubes to ensure holder/needle assembly is well anchored (use the wings). Continue but be alert for hematoma; if begins to form cease procedure. **If Blood flow is not restored:** – Remove tourniquet, ensure patient's hand is open, withdraw tube, and remove needle from patient's arm. Consider alternative site e.g. on opposite arm, and if not possible consider jugular vein. NB: Application of pressure to site at the end procedure is key. Keep arm straight and elevate if possible.	

ADVERSE EVENT	CAUSE	MANAGEMENT	REMARKS
Needle bevel obstruction	– When the bevel of the needle lies against the wall of the vein preventing free blood flow.	– Pull back slightly on the needle – If there is still no blood flow, remove tourniquet, ensure patient's hand is open, withdraw tube, and remove needle from patient's arm **Avoid** – Rotating needle--it may damage vessel wall. (Rotate with care – up to ¼ turn OK) – Changing angle of needle. Major redirection may lead to significant tissue damage. If done, it should be in moderation and with care. Best to remove tube while needle repositioned (same tube can be re-inserted in holder when vein accessed).	
Collapsed vein	– vacuum draw of tube, or pressure created by pulling the plunger of a syringe	– Ensure needle is in the vein (and that problem is due to vein collapse). – Experiment with tourniquet pressure (increase or decrease as appropriate).If blood flow does not	

ADVERSE EVENT	CAUSE	MANAGEMENT	REMARKS
		resume, remove tube from needle holder, wait a few seconds for blood flow to re-establish and re-insert tube. If still no blood flow, remove tourniquet, ensure patient's hand is open, withdraw tube, and withdraw needle NB: Partial draw tubes are useful in 'softening' the draw with small and fragile veins susceptible to collapse	
Partially inserted needle	– If bevel of needle is not totally within lumen of vein	– Release tourniquet and withdraw needle immediately. Apply firm pressure to site for several minutes. Ask patient to maintain pressure for prolonged period (if possible) or request assistance from nursing staff as appropriate – Consider an alternative site e.g. on opposite arm	
Tube pop off	– When needle sleeve pushes slightly the tube off the needle	– If re-establish blood flow, re-advance the tube to the end of the holder and maintain	

ADVERSE EVENT	CAUSE	MANAGEMENT	REMARKS
		it in this position until the tube is filled.	
Anticoagulant reflux	– If tube not properly oriented and tourniquet suddenly released, pressure inside tube may momentarily exceed that in the vein. Blood might then flow back into patient's vein (reflux) from the collection tube	– patient's arm should be maintained in a downward position to ensure tube remains below the site and fills from bottom upwards	
Blood spill out	– Failure to remove tourniquet before withdrawing needle maintains pressure inside vein.	– Tourniquet tension should be reduced (or the tourniquet removed) when blood begins to flow into the first tube. NB: Always check for any residual tourniquet tension before removing needle	

Remember that the patient/client may develop other complications like Excessive hemorrhage and Bleeding, Petechiae (Red spots under the skin), Nausea, Vomiting, Convulsions / Seizures and Fainting. In the event these occur, standard treatment guidelines and protocaols should be used as appropriate

4 SECTION 4.0: SAFE SPECIMEN TRANSPORTATION

4.1 4.1. REASONS FOR SPECIMEN TRANSPORTATION

Specimen may be transported to another health facility a particular test is not performed at the transporting facility, equipment breakdown, no competent laboratory personnel at the site of collection, for proficiency tests (quality assurance programme) and for Forensic reasons.

4.2 4.2. PREPARATION OF SPECIMEN BEFORE TRANSPORTATION

All specimens should be assessed for validity according to the sample rejection /acceptance criteria form accompanying it (see appendix …….)

4.3 4.3. PACKAGING OF SPECIMEN BEFORE TRANSPORTATION

Regardless of the sophistication of the packing materials it is important to properly package and ship specimen for referral testing. The following factors are necessary for specimen packaging and shipping: - the right packaging, right temperature, right timeframe and inclusion of the airway bill forms

4.4 4.4. SAFETY FOCUS IN SPECIMEN TRANSPORTATION

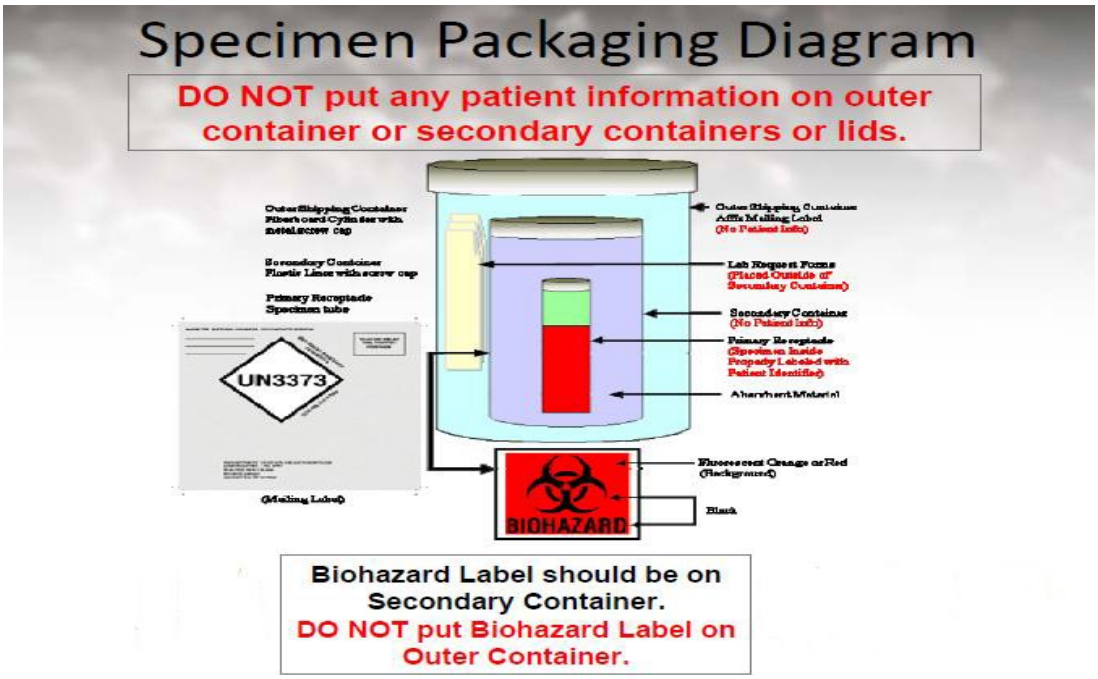
When handling the hazardous biological materials, one must comply with the biosafety procedures.

4.5 4.5. PREPARE SAMPLES FOR TRANSPORTATION

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

4.6 4.6. TRIPLE PACKAGING SYSTEM

- Primary receptacles shall be packed in secondary packaging in such a way that, under normal conditions of transport, they cannot break, be punctured or leak their contents into the secondary packaging.
- Secondary packaging shall be secured in outer packaging with suitable cushioning material.
- Any leakage of the contents shall not compromise the integrity of the cushioning material or of the outer packaging



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, clean carefully to remove all visible stains. Make a weaker solution and leave it in contact for a longer period of time. 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.

Emergency spill kit contains disposable gown, gloves, face/eye protection, red bio-hazardous bags, disposable absorbent materials, disposable cloth/paper towel, disinfectant and forceps.

LIST OF CONTRIBUTORS

Dr. Henock A. M. Ngonyani	MoHSW
Dr. Eliudi Eliakimu	MoHSW
Dr. Joseph Hokororo	MoHSW
Dr. Bayoum Awadhi	MoHSW
Mr. Gustav Moyo	MoHSW
Mr. Edwin Mkwama	MoHSW
Ms. Lucy Issarow	MoHSW
Ms. Elizabeth G. Chezue	MoHSW
Honest Anicetus	MoHSW
Noah I. Mwasalujonja	MoHSW
Jackline Makupa	MoHSW
Andrew Z. Kapaya	MoHSW
Dickson Majige	MoHSW
Jackson Kaigi	MoHSW
Grace Mlingi	MoHSW
Dr. Charles Massambu	MoHSW
Natalie Hendler	Jhpiego
Dr. Chandrakant Ruparelia	Jhpiego
Dr. Albert Komba	Jhpiego
Steven Chombo	Jhpiego
Valentina Msechu	Jhpiego
Dr. Mselenge Mdegela	Jhpiego
Lemmy Mabuga	Jhpiego
Sonia Elabd	Jhpiego
Maryjane Lacoste	Jhpiego
Renuka Gadde	BD
Dr. Adarshpal Singh	BD
Dejana Selenic	CDC

Daimon Simbeye	CDC
Dr. Kokuhumbya Kazaura	CDC
Dr. Joseph Chintowa	ICAP
Dr. David Polepole	MUHAS
Mr. Yahya Nassoro	MUHAS
Ester Mbusa	Saint John's University Of Tanzania
Fikiri M. Mazige	Primary Health Care Institute, Iringa
Dr. Beda Hamisi	Clinical Assistant Training Center, Songea
Dr. Joseph Mapunda	Clinical Assistant Training Center, Songea
Fransisco Chibunda	Bugando Medical Centre
Zubeda Salum	Muhimbili National Hospital
Regina Nyambo	Muhimbili National Hospital
Niyonizigiye Anicet	Muhimbili National Hospital
Eda A. Kaseko	Mbeya Consultant Referral Hospital
Felistas P. Hellar	Mbeya Consultant Referral Hospital
Emmanuel Geofrey	Mbeya Consultant Referral Hospital
Eliakim A. Mwanga	Morogoro Regional Hospital
Dr. Gloria Ngajilo	Amana Hospital
Januarius Soko	Health Resource Centre- Eastern zone Morogoro
Said Chibwana	CHMT, Mtwara Municipal
Raphael Kukula	Principal Health Officer
Sultan S. Mlandula	Principal Pharmacist

REFERENCES

1. World Health Organization (WHO). (2010). WHO guidelines on drawing blood: best practices in phlebotomy. The WHO Document Production Services, Geneva, Switzerland.

2. World Health Organization (WHO). **(2010).** WHO best practices for injections and related procedures toolkit. WHO/EHT/10.02. The WHO Document Production Services, Geneva, Switzerland; March, 2010.

3. Ministry of Health and Social Welfare. (2007). National Infection Prevention and Control Guidelines for Healthcare Services in Tanzania. A Pocket Guide for Healthcare Providers

4. Ministry of Health and Social Welfare. (2004). National Infection Prevention and Control Guidelines for Healthcare Services in Tanzania.

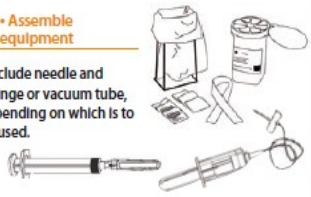
5. BD Safe Phlebotomy Curriculum for Tanzania (2012)

6. Procedures for Collection of Diagnostic Blood Specimens by Venipuncture; Approved Standards – Sixth Edition, developed by Clinical Laboratory Standards Institute (CLSI)

APPENDICES

1 • Assemble equipment

• Include needle and syringe or vacuum tube, depending on which is to be used.



2 • Perform hand hygiene.

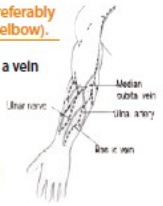
3 • Identify and prepare the patient.

Ask the patient to state his full name.

4 • Select the site (preferably at the bend of the elbow).

• Palpate the area; locate a vein of a good size that is visible, straight and clear.

• The vein should be visible without applying the tourniquet.



5 • Apply a tourniquet

4–5 finger widths above the selected 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.

Use 70% isopropyl alcohol and allow to dry.

DO NOT touch the site once disinfected.

For hospitalized patients

• Do not take blood from an existing peripheral venous access site because this may give false results.

• Nursing staff and physicians may access central venous lines for specimens following protocols.

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

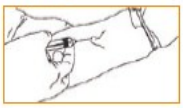
9 • Anchor the vein

by holding the patient's arm and placing a thumb BELOW the venepuncture site.

DO NOT touch the cleaned site; in particular, DO NOT place a finger over the vein to guide the needle.

10 • Perform venepuncture

Enter the vein swiftly at a 30 degree angle.



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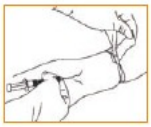
11 • Once sufficient blood has been collected,

release the tourniquet BEFORE withdrawing the needle.



12 • Withdraw the needle gently

• give the patient a clean gauze or dry cotton-wool ball to press gently on the site.

• Ask the patient NOT to bend the arm.

13 • Discard the used needle and syringe

or blood-sampling device immediatly into the sharps container.

14 • Check the label and forms for accuracy.

15 • 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.

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.

1

Practical guidance on venepuncture for laboratory testing

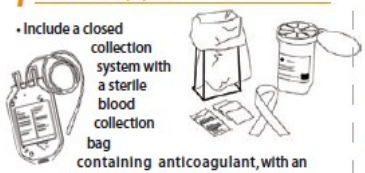
World Health Organization

SIGN

WHO guidelines on drawing blood: Best practices in phlebotomy

1 • Assemble equipment

• Include a closed collection system with a sterile blood collection bag containing anticoagulant, with an integrally attached tube and needle.



2 • Perform hand hygiene.

(If using soap and water, dry hands with single-use towels)

3 • Identify and prepare the donor.

Ask the donor to state his full name.

4 • Label blood collection bag and test tubes.

Ensure that:

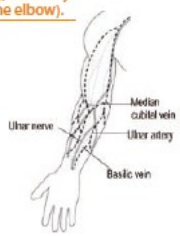
• the blood collection bag is of the correct type;

• the labels on the blood collection bag and satellite bags, sample tubes and donor records have the correct patient name and number.

5 • Select the site (preferably at the bend of the elbow).

• Palpate the area; locate a vein of a good size that is visible, straight and clear.

• The vein should be visible without applying the tourniquet.



6 • Apply a tourniquet

or blood pressure cuff inflated to 40–60 mm Hg.

7 • Ask the donor

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

8 • Put on well-fitting, non-sterile gloves.

9 • Disinfect the site.

If visibly dirty, wash with soap and water, and then wipe dry with single-use towels.

• **One-step procedure** (recommended – takes about one minute):

> use a product combining 2% chlorhexidine gluconate in 70% isopropyl alcohol;

> cover the area and ensure that the skin is in contact with the disinfectant for at least 30 seconds;

> allow to dry completely (30 seconds).

• **Two-step procedure** (if chlorhexidine gluconate in 70% isopropyl alcohol disinfectant is not available, use this procedure – takes about two minutes):

> **step 1** – use 70% isopropyl alcohol;

• cover the area and ensure that the skin is in contact with the disinfectant for at least 30 seconds;

• allow to dry completely (about 30 seconds);

> **step 2** – use tincture of iodine or chlorhexidine (2%);

• cover the area and ensure that the skin is in contact with the disinfectant for at least 30 seconds;

• allow to dry completely (30 seconds).

DO NOT touch the site after disinfection.

10 • Perform venepuncture

using a smooth, clean entry with a 16-gauge needle.

• 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.

11 • Monitor the donor.

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.

12 • Mix the collected blood gently with the anticoagulant,

either manually or by continuous mechanical mixing, about every 30 seconds during the donation.

13 • Once sufficient blood has been collected,

• 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.

• Collect samples.

• Cut off the needle using a sterile pair of scissors.

• Collect blood samples for laboratory testing.

14 • Care for the donor after the donation.

• Ask the donor to remain in the chair and relax for a few minutes.

• Inspect the site; if it is not bleeding, apply a bandage to the site; if it is bleeding, apply further pressure.

• 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 refreshments.

15 • Ensure the blood unit and samples are stored and delivered appropriately.

Practical guidance on venepuncture for blood donation

2

World Health Organization

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WHO guidelines on drawing blood: Best practices in phlebotomy

1 • Assemble equipment and supplies

2 • Identify and prepare the patient.

Place the patient on their back, lying flat.

3 • Identify the site.

- Locate the radial artery by performing an **Allen test.**
- If the initial test fails, repeat the test on the other hand.

Allen test

1- Instruct the patient to clench their fist; if the patient is unable to do this, close their hand tightly.

Using your fingers, apply occlusive pressure to both the ulnar and radial arteries.

2- While still applying pressure, have the patient relax their hand, and check whether the palm and fingers have blanched. If not, you have not completely occluded the arteries.

4 • Perform hand hygiene.

(If using soap and water, dry hands with single-use towels)

5 • Put on well-fitting, non-sterile gloves.

6 • Disinfect the site,

using 70% isopropyl alcohol, and allow to dry.

7 • Assemble the needle and heparinized syringe.

Pull the syringe plunger to the required fill level.

8 • Holding the syringe and needle like a dart,

- use the index finger to locate the pulse again,
- inform the patient that the skin is about to be pierced,
- then insert the needle at a 45 degree angle, approximately **1 cm away** from the index finger.

9 • Advance the needle into the radial artery until a blood flashback appears;

- allow the syringe to fill to the appropriate level.

DO NOT pull back the plunger.

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10 • Withdraw the needle gently ,

- Give the patient a clean gauze or dry cotton-wool ball to press firmly on the site.
- Check whether bleeding has stopped after 2–3 minutes (longer may be needed for patients who have high blood pressure or a bleeding disorder, or are taking anticoagulants).

11 • Cover the needle

(use a safety needle or the one-hand scoop technique) before placing it in the ice cup.

12 • Expel air bubbles. cap the syringe

and roll the specimen between the hands to gently mix it.

13 • Label the syringe.

14 • Dispose appropriately of all used materials.

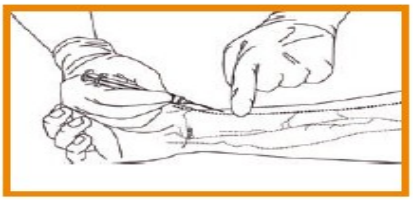
- Remove gloves and place in general waste.

15 • Perform hand hygiene.

16 • Transport the sample immediately to the laboratory.

Practical guidance on arterial blood sampling

3



World Health Organization

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WHO guidelines on drawing blood: **Best practices in phlebotomy**

1 • Use a winged steel needle,

usually 23 or 25 gauge, with an extension tube (butterfly).

Keep the tube and needle separate until the needle is in the vein.

2 • Collect supplies and equipment.

3 • Perform hand hygiene.

(If using soap and water, dry hands with single-use towels)

4 • Immobilize the baby or child.

• Select the site.

A transilluminator or pocket pen light can be used to display the dorsal hand veins and the veins of the antecubital fossa.

5 • Apply a tourniquet

about two finger widths above the venepuncture site.

6 • Put on well-fitting, non-sterile gloves.

7 • Attach the end of a winged infusion set to the end of the vacuum tube,

and insert the collection tube into the holder until the tube reaches the needle.

8 • Remove the plastic sleeve from the end of the butterfly.

9 • Disinfect the collection site.

Use 70% isopropyl alcohol and allow to dry.

10 • Use a thumb to draw the skin tight,

about two finger widths below the venepuncture site.

11 • Push the vacuum tube completely onto the needle.

12 • Blood should begin to flow into the tube.

13 • Fill the tube until it is full or until the vacuum is exhausted.

• If filling multiple tubes, carefully remove the full tube and replace with another tube, taking care not to move the needle in the vein.

14 • Release the tourniquet

when the required amount of blood has been collected.

▶▶▶

15 • Place dry gauze over the venepuncture site

and slowly withdraw the needle.

16 • Ask the parent to continue applying mild pressure.

17 • Remove the butterfly from the vacuum tube holder.

18 • Dispose of the butterfly in a sharps container.

19 • Properly dispose of all contaminated supplies.

20 • Label the tube

with the patient identification number and date.

21 • Put an adhesive bandage on the patient if necessary.

20 • Remove gloves, dispose of them appropriately.

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

Improving the ease of venepuncture for paediatric and neonatal patients

- Ask the parent to rhythmically tighten and release the child's wrist, to ensure that there is sufficient flow of blood
- Keep the child warm by:
  - removing as few clothes as possible,
  - swaddling an infant in a blanket,
  - having a mother or caregiver hold the infant, leaving only the extremity of the site of venepuncture exposed.
- Warm the area of puncture with warm cloth.
- Comfort and reassurance are important.
- Limit the number of times a paediatric patient is stuck. If no satisfactory sample has been collected after two attempts, seek a second opinion to decide whether to make a further attempt or cancel the tests.

Practical guidance on paediatric and neonatal blood sampling

4

World Health Organization

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WHO guidelines on drawing blood:
Best practices in phlebotomy

Choosing heel or finger-prick

	Heel-prick	Finger-prick
Age:	Birth to about 6 months	Over 6 months
Weight:	From 3 to 10 kg, approximately	Greater than 10 kg
Placement of lancet:	On the medial or lateral plantar surface	On the side of the ball of the finger perpendicular to the lines of the fingerprint
Depth:	<2.4 mm (for premature neonates, a 0.85 mm lancet is available)	Child > 6 months and < 8 years – 1.5 mm
		Child > 8 years – 2.2 mm
		Adult – 2.2 mm
Recommended finger	Not applicable	Second and third finger (i.e. middle and ring finger). Avoid the thumb and index finger because of calluses, and avoid the little finger because the tissue is thin

1 • Lancet and collection tube.

2 • Collect supplies and equipment.

3 • Perform hand hygiene.

(If using soap and water, dry hands with single-use towels)

4 • Put on well-fitting, non-sterile gloves.

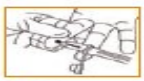
5 • Select the site.

Apply 70% isopropyl alcohol and allow to air dry.

6 • Puncture the skin.

7 • Wipe away the first drop of blood.

8 • Avoid squeezing the finger too tightly.



9 • Dispose of all sharps appropriately (into a sharps container).

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For paediatric and neonatal patients

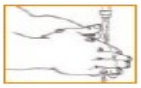
- You may need to ask the parent or assistant phlebotomist to help immobilize the child.
- Comfort and reassurance are important.
- Limit the number of times a paediatric patient is stuck. If no satisfactory sample has been collected after two attempts, seek a second opinion to decide whether to make a further attempt or cancel the tests.

10 • Dispose of waste materials appropriately.

11 • Remove gloves and place in general waste.

12 • Perform hand hygiene

(If using soap and water, dry hands with single-use towels).



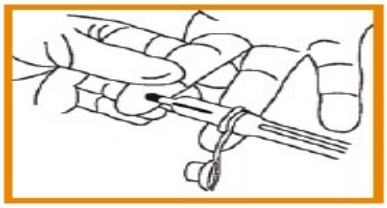
Take laboratory samples in the correct order

(Note: this is the reverse of that used for venepuncture collection)

1- haematology specimens;
2- chemistry specimens;
3- blood bank specimens.

Practical guidance on capillary sampling (finger and heel-prick)

5



World Health Organization

SIGN

WHO guidelines on drawing blood:
Best practices in phlebotomy