- ***Hemoconcentration:*** When a tourniquet is applied too long or the patient excessively pumps their fist, the blood flow can stagnate in an area, causing hemoconcentration. Hemoconcentration can cause an alteration in test results, especially for ammonia, calcium, coagulate, potassium, and protein tests. To prevent hemoconcentration, make sure to remove the tourniquet prior to the 1–minute time limit. If the patient is pumping their fist, politely ask them to stop and wait a few minutes before performing the blood collection from that arm.
- ***Other physical reactions:*** Minor physical reactions (diaphoresis [sweating], dizziness, nausea) can occur during or after a venipuncture, but these are often not serious and usually go away without treatment in a few minutes. Be aware that these reactions can be an indication that the patient is experiencing a complication of the blood collection. Ask the patient how they are feeling, and stay with the patient until they have fully recovered.
- ***Collection/processing errors:*** Collection errors can be more common than physical complications, and the consequences of a collection error can be serious or fatal. Examples of collection errors include misidentification of the patient, improper site selection and preparation, using the wrong tube, incorrect order of the draw, underfilling the tubes, failure to invert the tubes, failing to document the time you obtained or received a specimen, and mislabeling of specimens. The physical complications of venipuncture are visible and distressing to the patient, but collection errors can sometimes cause the most harm.
- ***Syncope:*** As a phlebotomist, you cannot prevent syncope, but it is possible to anticipate it. Ask the patient whether they have ever fainted during a venipuncture. If so, have them lie down, and proceed with the collection cautiously. Also, if the patient seems anxious or if it is their first phlebotomy procedure, be prepared and on alert for a syncope episode. Syncope is the result of a sudden lack of blood supply to the brain. It is not unusual for people to faint during a blood collection. If a patient faints during a collection, make sure they do not fall and suffer an injury. Syncope can also be the result of a dangerous medical problem. Keep the patient safe from injury, and immediately call for help. Do not leave the patient alone until they fully recover. Do not continue to collect blood on a patient who is unconscious.

- ***Seizure:*** In some cases, a patient can experience a seizure during a blood collection or while in the care of a phlebotomist. If a patient begins to have a seizure during a blood collection, stop the procedure immediately and seek emergency medical assistance or call 911. Be sure to document the time of the seizure onset. Take steps to help prevent injury to the patient. Do not attempt to restrain the patient or force anything into the patient's mouth. Remove anything from the area that can injure the patient. Stay with the patient until the seizure is over and they have recovered or emergency personnel have arrived. Do not bring additional attention to the patient, and provide as much privacy as the situation allows. After a seizure, a patient often needs several minutes to fully recover.
- ***Shock:*** Common symptoms of shock are cold, clammy, and pale skin; rapid pulse; an increase in shallow breathing; and a blank stare. If you suspect shock, call for help. Ensure that the patient has an open airway. If the patient is lying down, lower the head below the body. Keep the patient warm and safe until help arrives.
- ***Nausea:*** A patient can state that they are feeling nauseous or sick to their stomach. The patient might not say anything but can demonstrate symptoms such as color change to the face or excessive sweating. If a patient is experiencing nausea before a collection, wait to perform the procedure until the patient states that they no longer feel nauseated. If a patient states they are nauseated during the collection, stop and provide a basin, trash can with a liner, or another container in case the patient vomits. Even if the patient does not feel like they are going to vomit, you should still have something ready. If the patient does vomit, make sure that the container used is treated as biowaste. Do not resume the procedure until the nausea is gone. Do not leave a patient who feels nauseated alone. A cold compress on the patient's head or the back of the neck can help them feel better. If the patient vomits, provide a wet cloth or tissue for them to clean off their mouth. You also can provide a glass of water if the patient is not a choking risk or on a fluid restriction. Inform the nurse or provider that the patient has vomited and what actions you took to address it.
- ***Diaphoresis:*** Severe sweating can be a sign of nausea, syncope, or a panic attack. The sweating itself is not a condition, but it can indicate other underlying difficulties. Unless the room is extraordinarily warm, excessive sweating should not be ignored. It is important to try to determine why the patient is diaphoretic by asking, "How are you feeling?" Provide a tissue or towel for comfort, but avoid bringing attention to their condition. Do not leave the patient alone until they stop sweating. Provide a washcloth or tissue for the patient to wipe their face. Observe for other signs of potential complications, and notify the nurse or provider.

With every patient complication, provide privacy and do not draw attention to the condition. Do not tease or make fun of a patient who has had complications. Advise the patient to alert future phlebotomists about the complication so they can be prepared and take necessary actions. It is important to remember what to do in the case of every complication and keep calm. Keeping calm helps you and the patient move toward a better outcome.

When performing a venipuncture on a child or an adult, first palpate the veins in the antecubital area. The first choice for a vein is usually the ***median cubital***. The median cubital is firmly anchored in the middle of the arm on the anterior surface and is most often the least painful to access for the patient. The second choice is often the ***cephalic vein***, which is found toward the outside (lateral) surface of the arm. Accessing the cephalic vein might be a little more painful for the patient, but is the next best choice after the median cubital. In patients who are obese, the cephalic vein tends to be the easiest vessel to locate for a venipuncture. If you cannot locate the cephalic or median cubital vein in a patient, the next choice is to check for an accessible hand vein. If a vein cannot be found in any of the previous choices, the ***basilic vein*** can be attempted. The basilic vein—very prominent in some patient's arms—should be the last choice for a blood collection. The radial nerve and brachial artery are very close to the basilic vein; the risk of accidentally disrupting the nerve or artery increases with this vessel choice. If an attempt to collect blood from the basilic vein is not successful, never reposition the needle. The ideal vein to choose is well anchored, feels spongy and bouncy to the touch, is straight, and is easy to access with a needle.

When performing a blood collection from an infant, the first choice is the heel. Infants up until 12 months of age have blood collection obtained from the heel. Do not perform a heel blood collection on an area that has a hematoma, has recently been accessed for another collection, or has any cuts or scratches.

When performing a dermal puncture on a child or adult, the middle and ring fingers on the nondominant hand are the best choices. The nondominant hand is preferred because the patient uses it less than their dominant hand. Observe the finger for any factors that can affect the blood collection (scarring, cuts, extreme calluses). Avoid these areas because they will make the blood collection difficult and can increase pain to the patient. Choose a site on the finger that is the least callused and away from the bone and nail bed.

median cubital vein. Vein located near the middle of the antecubital area. First choice for a venipuncture collection.

cephalic vein. Vein that runs along the lateral side of the antecubital region. The second choice for venipuncture and can result in slight pain for the patient due to the location.

basilic vein. Vein that runs medially and is located in the upper arm and forearm. Last choice for venipuncture because of proximity to nerves and arteries.

CHALLENGE

When performing a venipuncture, which of the following scenarios demonstrates the best vein to choose?

A. Left arm, median cubital vein, for a patient who had a mastectomy on the left side
B. Right arm, basilic vein that is visible and palpable
C. Left arm, cephalic vein for a patient who is obese
D. Right arm, dorsal hand vein above the IV

Answer: C is correct. The cephalic vein is often more pronounced than other vessels on obese patients. You cannot collect above an IV or on the same side as a mastectomy. Even if the vein is very developed and easy to find, the basilic should be the last choice because of the proximity to nerves and the brachial artery

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BLOOD DONATIONS

Blood donations are another type of special collection that phlebotomists perform. Blood donations can be collected for submission to a ***blood bank*** for use as needed by hospitals and other facilities. In some situations, patients donate their own blood to use for a transfusion or upcoming surgery. This type of blood donation is an ***autologous transfusion***.

Most of the blood used in blood donations is handled in blood banks. These facilities are responsible for the collection, processing, and storing of blood for transfusions and other purposes. The blood bank department in a hospital is usually part of the laboratory. It serves as the screening and release point for donor units and other blood products that patients might need. Blood bank departments work closely with regional blood centers that provide blood and blood products to hospitals for dispensing to patients upon provider request. In larger facilities, the hospital blood bank might draw donor units; but increasingly, these duties reside in the regional blood centers that serve a community or region.

Blood banks can also perform ***therapeutic phlebotomy***, which is the intentional removal of blood to lower red blood cells (***polycythemia vera***) or lower iron levels (***hemochromatosis***). How facilities assign this procedure varies by organization.

As with any blood collection, it is critical to avoid misidentification of the patient during blood bank collections in order to prevent fatal transfusion errors. The collection process is as follows.

1. Wash hands and don gloves.
2. Properly identify the patient as you would with any blood collection, using at least two patient identifiers.
3. Perform the venipuncture procedure, and collect the appropriate tubes. This is often a plain red-top tube and an EDTA tube. (Some ETS tube stoppers are pink. Confirm additive on the label before use.)
4. Label the specimens with specific blood bank labels in the presence of the patient. (Follow the procedure required by the laboratory.)
5. Recheck information by comparing the labels on the tubes with the patient armband or specific blood bank identification band.
6. Perform post-venipuncture patient care.
7. Deliver the specimens and blood bank requisition to the blood bank or the facility's transfusion service as soon as possible.
8. Gravity helps fill the blood collection bags. Make sure bags are hung lower than the patient's arm during collection. If a blood collection bag only fills partially before the procedure is complete, the blood collection might have to begin again. Do not combine two bags. Monitor the patient during and after the procedure to keep them safe and prevent injury from any complications during the donation process.

blood bank. A place where blood is collected from donors, typed, separated into components, stored, and prepared for transfusion to recipients; a blood bank may be a separate free-standing facility, or part of a larger laboratory in a hospital.

autologous transfusion. When a patient donates blood to be used for their own needs for future use.

therapeutic phlebotomy. A form of phlebotomy prescribed as treatment for patients who have polycythemia vera or hemochromatosis.

polycythemia vera. High red blood cell count.

hemochromatosis. High iron count.

Collecting donor blood

Donated blood can be processed into various blood products (red blood cells, plasma, platelets). ***Apheresis*** techniques allow the removal of one or more blood products during blood collection via special equipment. ***Plasmapheresis*** is the removal of blood plasma from whole blood.

apheresis. Removal of blood plasma from a patient's body without withdrawing the blood itself. The process separates the blood into plasma and cells, returning the cells to the patient's blood. Also known as Power Red.

plasmapheresis. Removal of blood plasma from whole blood.

Some parameters for blood donation have been established to help keep the donor as safe and healthy as possible. General requirements for blood donation include the following.

- Age at least 17 years old (16 years old in some states with parental permission)
- Weight at least 110 pounds
- Donations at least 56 days apart

When apheresis will be performed, the requirements change slightly.

- For males donating via apheresis, the following criteria are recommended.
  - Age 17 or older
  - Weight 130 pounds or greater
  - Height 61 inches or greater
- For females wishing to donate via apheresis, the following criteria are recommended.
  - Age 17 or older
  - Weight 150 or greater
  - Height 65 inches or greater

It is important that each donor is healthy and feeling well. A complete medical history must be provided. A mini physical examination is done, including temperature, pulse, and blood pressure. The potential donor's hemoglobin (or hematocrit) levels are also measured. The blood specimen is tested for HIV, AIDS, and hepatitis. If any of these levels are out of range, the person will not be allowed to donate blood. The medical history includes questions about sexual activity, recent out-of-country travel, and use of medications.

CHALLENGE

A patient can donate blood if they meet which of the following criteria?

A. 13 years old, with parent permission
B. Weight less than 110 pounds
C. Donated blood 9 weeks ago
D. Negative for AIDS but positive for HIV

Answer: C is correct. A healthy person, 17 years or older (16 with parental permission), weighing at least 110 pounds, without HIV/AIDS or any other transmissible disease, can donate blood after 8 weeks.

Autologous blood donation

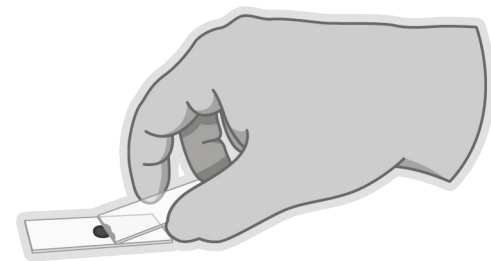
Autologous refers to self. Many individuals donate blood for their own future use. This type of donation has become popular due to increased concern of the transmission of bloodborne pathogens. When a patient donates blood before a surgical procedure, they must have a written order from a provider and must be in good health so the donation does not stress their body before surgery. The hemoglobin must be at least 11 g/dL, and the surgical procedure must be scheduled for more than 72 hr after the autologous blood donation. Autologous blood is collected in the same manner as donor blood collection but is labeled strictly for the donor's use and may not cross over to the general blood supply. If the blood is not used during surgery, the patient may have the blood transfused back after any procedure is performed.

PERIPHERAL BLOOD SMEARS

A ***blood smear*** is a thin film of blood spread onto a microscopic glass slide. Blood smears are used to microscopically examine blood. Either venous blood in a tube or capillary blood collected by ***capillary puncture*** (also called a dermal puncture) may be used. Blood smears can also be prepared by applying blood directly from a finger onto the slide. It is important to prepare these blood slides properly to ensure accurate diagnoses for patients.

Depending on your facility, you might prepare blood smears yourself or assist laboratory personnel in preparing them. If a smear is needed to confirm abnormal findings, it must be prepared within 1 hr of collection when the specimen is obtained in an EDTA tube.

To prepare blood smears, the wedge method is used. This is the touching of two slides at an angle, which forms a wedge shape. Most large laboratories use an automated slide-maker, which creates a perfect thin smear with the push of a button. These are available in fixed and portable versions and produce consistent, high-quality smears that stain well and support high-quality results. Both techniques—automated and by hand—produce thin smears from fresh, anticoagulated drops of blood.



blood smear. A blood test procedure performed on microscopic slides that gives information about the number and shape of blood cells.

capillary puncture. Also known as a dermal puncture or finger stick, used to collect small samples of blood composed of capillary, venous or arterial blood.

Steps to perform a manual slide smear

1. Wash hands and don gloves.
2. Assemble the equipment needed for the dermal puncture, or obtain a tube of uncoagulated blood (usually containing EDTA).
3. Make sure you have at least two clean microscopic glass slides.
4. If performing a dermal puncture
   a. Perform the finger puncture using a semi-automated lancet device.
   b. Wipe away the first drop of blood with a piece of gauze.
   c. Apply pressure to the first finger joint to obtain a free-flowing drop of blood.
   d. Allow the drop of blood to fall onto the glass slide toward one end.
   e. If preparing smears using tubes of blood, check the specimen for proper labeling.
5. Use a safety device to access the blood. If no safety device is available, carefully uncap the specimen tube behind a safety shield and use a disposable pipette or plastic dropper to remove some of the blood. You may also use applicator sticks or a capillary tube to place the drop on the slide.
6. Place the slide on a flat work surface, and apply a drop of blood onto the slide approximately ½ to 1 inch from the end of the slide.
7. Discard the applicator stick or capillary tube into a sharps container.
8. Pick up the spreader slide with your dominant hand, holding it at a 30° to 35° angle.
9. Place the edge of the spreader slide on the smear slide in front of the drop of blood.
10. Pull or back up the spreader slide toward the frosted end of the slide until the spreader slide touches the blood drop.
11. Let the blood drop spread almost to the edges of the spreader slide.
12. Push the spreader slide toward the clear end of the slide (with one light, smooth, fluid motion) until you come off the end. Maintain the 30° to 35° angle.
13. Label with the patient information using a permanent marker or aliquot label.
14. Allow the smear to air dry before staining. Do not blow on it.

REMINDER

Make sure the frosted side of the microscopic glass slide is facing up when using slides that have a frosted end. Do not place the drop of blood directly on the frosted end; it is used to write the patient information or to affix an aliquot label. Make sure that all slides are properly labeled and double-checked to ensure they match the patient information exactly.

NOTE

Most of the drop of blood should spread out onto the glass slide. It will be thicker at the drop and thinner at the opposite end. If properly made, there will be a critical area used for performing the differential, and a tail with a feathered edge that is slightly rounded. Blood smears should not touch the edges of the microscopic glass slide. They should appear smooth and without irregularities, streaks, or holes.

VOLUME REQUIREMENT CALCULATIONS

Iatrogenic anemia is caused by blood loss due to repeated venipunctures in a short period of time. Older adult patients, pediatric patients, and patients who are underweight are most susceptible to phlebotomy–induced iatrogenic anemia. Older adult patients can be at higher risk due to medications that can suppress bone marrow production, which increases the risk of anemia. They can also be at risk due to decreases in nutritional intake, especially if they have experienced extreme weight loss. Because many older adult patients see several medical professionals, they can have a significant amount of blood collected by each professional, which can increase the risk of iatrogenic anemia. For patients who have cancer, both the cancer treatments and the effect of the disease on the body can increase the risk for iatrogenic anemia. Infants—especially those who are premature or had a low birth weight—have a risk of iatrogenic anemia due to a lower volume of blood.

To help prevent iatrogenic anemia, it is important to understand the implications of collecting too much blood in a short period of time. Be willing to communicate any concerns with the appropriate health care professional. If you have a venipuncture request that seems excessive, check with the nurse or provider to ensure that the patient will not be put at risk. Contact the provider if the medical requisition requires blood tests that will collect more than the recommended amount. The provider can order different tests, reduce the number of tests, or order only the most essential tests.

For infants, no more than 10% of blood volume should be collected in a short period of time. For adults, collecting more than 100 mL can result in decreased hemoglobin or hematocrit.

To calculate infant blood volume, perform the following calculation.

- Convert the infant's weight from pounds to kilograms.
- Divide pounds by 2.2. (For example, $6.2 \text{ lb} \div 2.2 = 2.82 \text{ kg}$.)
- Multiply the number of kilograms by 100. (For example, $2.82 \times 100 = 282 \text{ mL}$.)
- Convert blood volume in milliliters to liters. (For example, $282 \text{ mL} \div 1{,}000 = 0.28 \text{ L}$.)

Document the amount of blood collected in each tube so the total amount of blood removed over time can be calculated.

Collect only the minimum required amount of blood to avoid causing iatrogenic anemia, which can lead to shortness of breath, fatigue, and the need for blood transfusions.

Communicate regularly with the supervisor or laboratory manager to provide the best care for all patients. Discuss any concerns you have about provider ordering patterns or the timing of a patient's collection requests with your supervisor or the laboratory supervisor.

CHALLENGE

For patients who are hospitalized, blood can be drawn every day or every few hours. Which of the following types of anemia often results?

A. Hemolytic B. Sickle cell C. Iatrogenic D. Pernicious

Answer: Option C is correct. Iatrogenic anemia is caused by blood loss due to repeated venipunctures, which is common in hospitalized patients whose blood is drawn regularly. Hemolytic anemia, sickle cell anemia, and pernicious anemia are not caused by repeated venipuncture.

BLOOD CULTURES

Blood cultures are laboratory tests used to check for bacteria or other micro-organisms in a blood sample. Providers order this test to assist in diagnosing conditions in patients who have a fever of unknown origin (FUO).

If you work in a hospital—especially one with a busy emergency department—you might receive several blood culture requisitions. The blood sample is sent to a laboratory, where it is processed, placed into a specialized dish, and observed to see whether micro-organisms grow. (This is the actual culture process.) If this occurs, further tests will be done to identify the specific micro-organisms present in the blood sample.

blood culture. A laboratory test used to check for bacteria or other micro-organisms in a blood sample.

Steps to perform a blood culture

1. Introduce yourself.
2. Properly identify the patient as you would with any blood collection, using at least two patient identifiers.
3. Wash hands, and don gloves.
4. Assemble supplies, including a winged infusion set or syringe needle, adapter, and blood culture collection bottles. You will need one set of blood culture bottles per collection (one ***aerobic*** and one ***anaerobic***).
5. Review the medical requisition form to determine how much blood needs to be collected.
6. Mark blood collection bottles with the level of blood required.
7. Remove the protective cap (making sure to avoid removing the entire cap), and cleanse the top of the blood collection bottles with an antiseptic (alcohol).
8. Apply a tourniquet.
9. Palpate to find an accessible blood vessel. Then remove the tourniquet while you prepare the skin.
10. Clean the intended area of venipuncture for 60 seconds with alcohol or ***chlorhexidine gluconate***. Apply light friction using an outward spiral technique from the site by placing the swab on the venipuncture site and moving outward, using concentric circles to a diameter of 2 to 2.5 inches.
11. Allow the area to dry completely.

anaerobic blood culture bottle. Type of blood culture bottle used to collect specimens to test for microbes that thrive in an airless environment.

aerobic blood culture bottle. Type of blood culture bottle used to collect specimens to test for microbes that thrive in air.

chlorhexidine gluconate. An antiseptic antibacterial agent used to help cleanse the patient's skin for blood collection.

12. Cleanse the area again, using the outward spiral, taking care to cover the entire 2- to 2.5-inch area, this time using povidone-iodine.
13. Do not touch this area after it has been cleansed. Allow it to dry completely.
14. Reapply the tourniquet after you are sure the area has dried.
15. Ask the patient to clench their hand into a fist.
16. Stretch the skin downward below the collection site, using the thumb of your nondominant hand to anchor the vein in place.
17. Quickly insert the needle into the vein at a 15° to 30° angle with the bevel facing up. Pop the blood culture bottle onto the double-pointed needle. (If the blood culture set includes aerobic and anaerobic and you are using a butterfly needle, collect the aerobic first.)
18. Have the patient unclench their fist as blood enters the tube or bottle.
19. As each tube is removed from the needle holder, gently invert to properly mix the specimen.
20. Remove the tourniquet before 1 min.
21. Monitor the patient's condition.
22. Make sure not to disturb the needle's position as tubes fill.
23. If there are more evacuated tube system (ETS) tubes to be collected, proceed to collect them in the proper order of draw.
24. Quickly remove the needle using the same angle as insertion.
25. Apply gauze, using pressure, to the puncture site.
26. Activate the safety device so that the needle is immediately covered.
27. Dispose of the entire needle assembly into a sharps container.
28. Make sure that the vein is not leaking by conducting a two-point check, observing the site for up to 10 seconds after releasing pressure and removing the gauze. If visible bleeding occurs (or if the surrounding tissue rises), keep applying pressure until bleeding stops.
29. Apply a bandage or tape clean gauze over the puncture site.
30. Label all blood collection bottles and tubes before leaving the patient.
31. Check the patient's status again.
32. Leave the room or dismiss the patient.

INBORN ERRORS OF METABOLISM

In the U.S., newborns are routinely screened for various metabolic and genetic defects by analyzing a blood sample collected on a specific filter paper. Screening newborns assists in the early detection of genetic, metabolic, and infectious diseases and disorders. Blood-spot testing for newborn screenings are performed before the newborn is 72 hr old. If the specimen is obtained before the newborn is 24 hr old, a second specimen should be obtained for screening up to 2 weeks of age. Screenings aid in the early detection, diagnosis, and treatment of the following conditions.

- *Cystic fibrosis*
- *Hypothyroidism*
- *Phenylketonuria (PKU)*
- *Galactosemia*
- Other genetic disorders (*biotinidase deficiency*, *sickle cell disease*)
- Infectious diseases (human immunodeficiency virus [HIV], toxoplasmosis)

Newborn screenings are state-required blood specimens that are collected onto specific forms or cards. These forms include absorbent areas called filter paper. Fill out the forms completely in ink with all required information, and check the forms for expiration dates; the substances within the absorbent areas can expire.

Double-check that the guardian's phone number is correct and included on the form. If any of the tests performed have positive results, the parent or guardian will be notified immediately so appropriate care and treatment can begin.

cystic fibrosis. Mucous secretions that accumulate in various organs.

hypothyroidism. Decreased thyroid function.

phenylketonuria (PKU). A metabolic genetic disorder characterized by a deficiency in the hepatic enzyme phenylalanine hydroxylase. Classic PKU causes permanent intellectual disability, seizures, delayed development, behavioral problems, psychiatric disorders, a mousy body odor, lightening of skin and hair, and eczema. Phenylalanine can be found in most foods; if not broken down, it can rise to toxic levels in infants. Brain damage can occur when phenylketone levels become toxic.

galactosemia. Lack of an enzyme that breaks down galactose (a milk sugar) into glucose. If untreated, the infant can slowly starve to death.

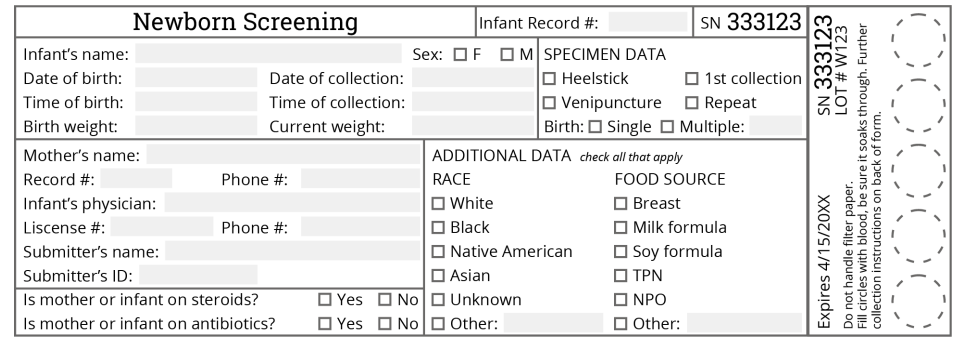
biotinidase deficiency. Deficiency of the enzyme that breaks down biotin.

sickle cell disease. Abnormal hemoglobin structure.

Newborn screenings are almost always performed as a capillary puncture on the infant's heel. To perform a heel stick on an infant, you must follow the procedures listed on the required state forms. Following is a common list of instructions used in the collection of these samples.

- Properly identify the infant.
- Ensure that the paperwork or card is filled out completely, including parent's/guardian's phone number.
- Avoid touching the filter paper part, even with gloved hands, to prevent contamination.
- Wash hands and don gloves.
- Check the temperature of the infant's heel, and warm it if necessary.
- Cleanse the infant's heel with an antiseptic, and allow the skin to dry.
- Puncture the heel, across the prints of the heel, with a semi-automated lancet device no deeper than 2 mm.
- Wipe off the first drop of blood.
- Allow a large blood droplet to form at the puncture site.
- Touch the filter paper to the drop of blood to soak through completely in each circle. The circles must be totally saturated. This is evident by viewing the paper from both sides.

5.1 Newborn screening


Newborn Screening | Infant Record #: | SN 333123

Infant's name: | Sex: ☐ F ☐ M | SPECIMEN DATA
Date of birth: | Date of collection: | ☐ Heelstick ☐ 1st collection
Time of birth: | Time of collection: | ☐ Venipuncture ☐ Repeat
Birth weight: | Current weight: | Birth: ☐ Single ☐ Multiple:

Mother's name:
Record #: | Phone #:
Infant's physician:
Liscense #: | Phone #:
Submitter's name:
Submitter's ID:
Is mother or infant on steroids? ☐ Yes ☐ No
Is mother or infant on antibiotics? ☐ Yes ☐ No

ADDITIONAL DATA *check all that apply*

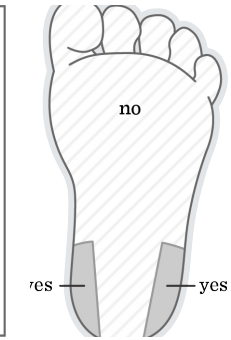
RACE	FOOD SOURCE
☐ White	☐ Breast
☐ Black	☐ Milk formula
☐ Native American	☐ Soy formula
☐ Asian	☐ TPN
☐ Unknown	☐ NPO
☐ Other:	☐ Other:

SN 333123
LOT # W123
Expires 4/15/20XX
Do not handle filter paper.
Fill circles with blood, be sure it soaks through. Further collection instructions on back of form.

Note: Blood is applied to only one side of the form. Avoid touching the skin with the card. Avoid blotting or attempting to color in the circle with several blood drops, this can cause serum rings and alter test results.

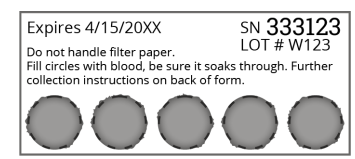
- Do not use capillary tubes because they often make the filter paper rough and cause overabsorption.
- Air-dry the blood spots thoroughly for 3 hr at room temperature. Keep them away from direct sunlight and heat.
- Wet filter papers should not touch each other because they are sticky and will adhere to other forms.

5.2 Heel stick

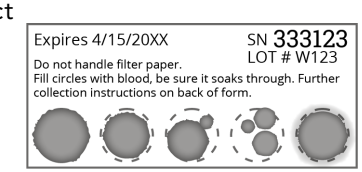


5.3 Blood spots

Correct



Incorrect



These specimens can be unusable and rejected if any of the following occur.

- A circle is oversaturated.
- All circles are not completely filled.
- An expired form is used.
- The form is not received within 14 days of collection.
- The specimen is contaminated with a foreign substance.
- The specimen is not allowed to dry thoroughly.
- The circles have serum rings.

Once thoroughly dried, mail state collection forms to the appropriate state laboratories for testing. Send the cards with all other required paperwork. It is important that infants who test positive for these conditions are treated quickly. Do not postpone submitting completed collection cards.

NONBLOOD SPECIMEN COLLECTION

Urine specimens

One of the most commonly performed diagnostic tests involves urine specimens. Many providers order a urinalysis because it is low-cost, low-risk, and can provide valuable information about a patient's condition (glucose levels, hormone levels). Providers order a variety of urine tests (routine, 24-hour, ***culture and sensitivity*** [C&S], drug testing) to aid in diagnosing conditions. Urine specimens are collected using various methods (***random***, first morning urine, fasting, ***clean-catch midstream***, catheter, suprapubic). Following the proper steps when performing each method of collection helps provide the most accurate test results. For example, some hormone levels are higher in the morning. Therefore, to achieve the most accurate results, this is when these specimens should be obtained.

culture and sensitivity. A urine test performed to test for urinary tract infections.

random. A urine specimen that may be collected at any time without the restrictions of fasting, timing or aseptic condition.

clean-catch midstream. A method of performing a urine collection that helps prevent bacterial contamination.

With every urine specimen collection, provide all information possible to help the patient perform the collection properly. Allow the patient to ask questions, and repeat information when necessary. Provide written information if the patient needs or requests it. When performing urine testing, wear gloves and change gloves between specimens. Perform the tests on a flat surface, and keep the specimen as stable as possible to prevent accidental spilling.

Random collection

The most commonly performed urine test is the routine or random collection, which means there are no preparations or time restrictions. However, the time of the collection must still be documented. The facility will provide guidelines on the method to perform a routine urine collection. Common instructions that can be used for all urine specimen collections include the following.

- Wash hands before and after handling urine specimens.
- Wear gloves at all times, and change gloves between specimens.
- Confirm patient identification by using at least two patient identifiers.
- Always use a sterile specimen container.
- Label all specimens on the side of the container (not the lid).
- Label all specimens in front of the patient.
- Promptly test or transport specimens.
- Dispose of urine per facility guidelines (unless contaminated with blood, which needs to be disposed of as biohazard waste per OSHA).

The patient performs urine specimen collection through detailed instruction provided by medical personnel. Each urine test has specific collection requirements to ensure the best results. Special urine tests requiring more detailed urine specimen collection processes include ***glucose tolerance test (GTT)***, ***postprandial***, 24-hour urine collection, and drug testing.

glucose tolerance test (GTT). A test performed to determine how well a patient's body metabolizes sugar.

postprandial. After a meal.

Glucose tolerance test

Follow the basic recommendations for a urine specimen collection, with the special instructions required for the tests. When performing a GTT, confirm that the patient is fasting (usually for 12 hr). Blood and urine tests should be performed at the same time in the order recommended by the facility. The collections must occur together, usually every 1 or 2 hr. Make sure the collections are performed on time and the time is accurately documented. If the specimens are not collected on time, document the reason and the actual time of collection.

Postprandial test

A postprandial urine test requires a patient to void and then eat a meal. A urine specimen is collected 2 hr after a patient eats a prescribed amount of carbohydrates or glucose solution. For patients who have diabetes mellitus, this test monitors the effects of a prescribed insulin dosage. For patients who do not have diabetes mellitus, this test is a screening tool.

24-hour urine collection

For 24-hour urine collection, the patient receives a container (with a lid) large enough to hold 3 to 4 liters of fluid. Instruct the patient to void and discard the first morning urine specimen, then initiate the collection process after discarding that morning specimen. Inform the patient if there are any special handling instructions—such as when the specimen is expected to be returned, and if refrigeration is necessary.

Drug testing

When performing a urine test that determines what nonprescription drugs a patient has in their system, both privacy of the patient and accuracy of the results are very important. Some urine tests performed for drug screenings may be monitored. A chain of custody form can accompany the collection process. Confirm that the form is completely filled out. Everyone who handles the specimen must sign and date the form. The facility can have other instructions for performing this type of collection. Because these tests may be used in legal situations, make sure to understand and perform all steps required.

Clean-catch midstream collection

A clean-catch midstream urine specimen collection requires collection of the middle volume of urine. Inform the patient to void a small amount of urine into the toilet, and then begin the collection. Stop collecting the urine before the urine flow is complete by moving the container. Then finish voiding into the toilet.

Culture and sensitivity. To perform a clean-catch midstream urine specimen collection for C&S testing, provide the patient with additional instructions. To help prevent contamination from bacteria on the surface of the labia or penis, use an antiseptic wipe to cleanse the genitals prior to the collection. The wipes are an antiseptic of choice of the facility. Never use alcohol, peroxide, or iodine to cleanse the area; these harsh antiseptics can hurt the patient or damage delicate tissue.

With most tests, the urine is collected into a sterile container that has a lid placed on it, and then the urine is transported into another vessel. Another method of performing a urine test is by chemical analysis using the reagent strip method. Urine is collected in a sterile container. A reagent strip is dipped into the urine for the time ordered by the type of test, removed, and analyzed. Wear gloves when dipping the reagent strip and throughout the duration of test. The absorbent pads for each chemical test on the reagent strip will change colors depending on the level of the substance in the patient's urine. Use the analysis chart provided with the reagent strips to determine the level of substance by matching colors as closely as possible. Perform this test in adequate lighting to help match colors correctly. Dispose of the used reagent strip in a biohazard bag.

Other nonblood specimens

You may perform other nonblood collections (saliva, sputum, fecal, semen specimens) or perform buccal or throat swabs.

Saliva specimens

Performing specimen collection for a ***saliva test*** begins with many of the same requirements of collecting blood and urine: introducing yourself, confirming you have the correct patient using at least two patient identifiers, washing your hands and donning gloves. These specimens are used to test for hormone, alcohol, and drug levels. Usually kits are available with instructions on how to perform the test. If instructions are not available, check with the facility for proper procedures. Make sure that all specimens are labeled in front of the patient and brought to the laboratory promptly.

saliva test. A collection of the fluids from the patient's oral cavity to help monitor hormone, drug, and alcohol levels.

Sputum specimens

Not to be confused with saliva (fluid from the oral cavity), a sample for a sputum test is collected from the lungs, trachea, and bronchi. Instruct the patient to take a deep breath and expectorate by coughing deeply and spitting the thick matter from their lungs into the specimen container. Follow the instructions at the facility for the procedures for collecting this specimen. Make sure to introduce yourself, identify your patient, wash your hands, and don gloves. It is better to collect this test before or several hours after a patient eats to prevent vomiting. A larger volume of sputum is available in the morning after it has accumulated throughout the night. Make sure that all specimens are labeled in front of the patient and brought to the laboratory promptly.

Fecal specimens

You may also be asked to obtain a fecal specimen. ***Fecal tests*** are performed to determine if a patient has a possible bacterial infection, parasites, and occult blood. Specific dietary instructions may be necessary prior to the patient collecting a specimen. Make sure to know these requirements and be able to instruct your patient on the proper preparation for the test. To help make sure that the test is as accurate as possible, use a clean container with a lid. Place labels on the specimens in front of the patient, and on the container (not the lid—a label on the lid can be misplaced when the lid is removed). Placing the label on the container helps keep the specimen properly identified.

fecal test. A collection of stool or feces to test for the presence of parasites, blood, or an infection.

Semen specimens

Semen specimens are used to perform sperm counts to help assess fertility. They can also be used to help prove identity in rape cases. Like urine and blood specimen collections, introduce yourself and confirm patient identity with at least two patient identifiers. Wash hands and don gloves before handling semen specimens. Patients should be instructed on how long to refrain from ejaculation prior to specimen collection. Check with the facility for exact requirements. Handling instructions include collection into a sterile container. Do not use a condom; many condoms contain spermicides, which will adversely affect test results. Keep the specimen warm, and protect it from light. To help ensure accurate test results, the specimen should be brought to the laboratory for testing within 1 hr. All specimens must be labeled.

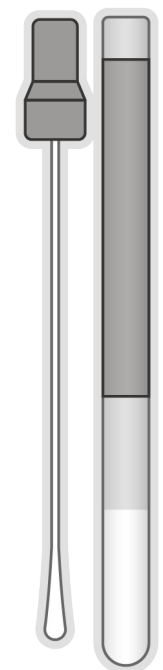
Throat swab

A throat swab is a culture specimen usually obtained to test for strep throat. You will perform the test with a kit that has instructions for proper procedures. If there are no instructions, review facility requirements for the test. For throat swab collections, wipe both tonsils, the throat, and all areas that look inflamed or infected with the swab. Wash hands before and after performing the test. Wear gloves, and change them between patients. Stand to the side of the patient when performing the test, or wear a mask to protect yourself from airborne contamination. Label all specimens in front of the patient, and test the collection or take to the laboratory promptly.

Buccal swab

A buccal swab differs from a throat swab in where the specimen is collected. A buccal swab is collected from the inside of the cheek in the mouth to collect a patient's DNA. When performing a buccal test, introduce yourself, properly identify the patient with at least two patient identifiers, wash hands, and don gloves. Perform the specimen collection per the facility's instructions. Commonly the collection is performed by gently rubbing a sterile swab against the inside of the patient's cheek. Place the used swab in an appropriate container, labeled in front of the patient and transport accordingly.

5.4 Throat swab test kit



SPECIMEN HANDLING

In many settings, the phlebotomy team accepts and accessions (checks in) all specimens that come into the laboratory for testing. Therefore, it is important to know how to handle and process these specimens correctly. Handling requirements also include pre-collection specifics (time, temperature, light). When tests require specific timing, heat, cold, or protection from light, your role in transporting specimens to the laboratory after collection is as important as the venipuncture for securing a high-quality test result.

For timed tests when patients are taking a specific medication or drinking a liquid preparation (such as for a glucose tolerance test) make sure they have satisfied the testing requirements. Examples include a 2-hour postprandial blood glucose level, which requires a fasting blood glucose level plus a blood glucose test at exactly 2 hours after patients started eating their meal or consumed the liquid preparation. Other timed tests include peak and trough values for antibiotics like gentamicin or vancomycin, for which the phlebotomist collects blood samples at a specific time after the administration of the antibiotics. Coordinate these procedures with the clinical staff—including nurses and medical assistants—to ensure accurate results.

Label every type of collection container immediately after collection with the patient's name, the date and time of collection, and the specimen type. Position it correctly on the tube or container. If the facility requires it, sign or initial the specimen. Then compare the information on the label with the patient's wristband, or verbally verify it with the patient. If the container has a lid, make sure that the label is on the container, not on the lid.

Wear gloves when handling patient-collected, nonblood specimens. Change gloves between each specimen. Correct handling is essential, because incorrect handling can affect the quality of the specimen. For example, components of urine change if the specimen stands at room temperature for an extended period of time. If the specimen will not be tested immediately, refrigerate urine specimens and process them within 1 hour of collection. Some urine tests are best performed at room temperature. Be aware of what the specimen is being tested for to ensure proper handling. Use evacuated transport tubes containing preservatives for transporting urine specimens to reference laboratories. To transfer urine from a collection container to the transport container, use a disposable pipette, or pour the urine into the tube after removing the stopper. Preservatives in these tubes prevent bacterial overgrowth and prevent changes in the urine that can affect test results.

When handling preserved urine specimens, keep the tubes at room temperature no longer than 72 hours before performing a ***urinalysis*** with ***chemical reagent strip testing***. Keep tubes for culture and sensitivity (C&S) tests at room temperature for up to 72 hours. Otherwise, if not preserved, refrigerate them if there is any delay in transferring the urine to the culture medium. Complete the laboratory requisition forms for all specimens for transportation to other sites for analysis. This form should include the patient's name, date, type of test, ordering provider's name, ICD-10-CM code for diagnosis (if the form requires it), and a line where the provider can sign after reviewing the results. When sending specimens to the laboratory, use plastic biohazard bags with zipper seals. These bags feature an outside pocket in which to place the laboratory request. They also protect those who transport the specimen from any pathogens in the specimen. Ideally, blood tubes should remain upright during transportation to prevent unnecessary agitation (which could cause hemolysis) and to promote effective clotting in specimens that do not have anticoagulant additives.

urinalysis. An evaluation of urine by physical, chemical, and microscopic testing methods.

reagent. A chemical substance that reacts in specific, predictable ways to detect or synthesize other substances in chemical reactions.

chemical reagent strip testing. A method of urinalysis involving the use of plastic strips with pads containing a substance that causes a specific chemical reaction.

CHALLENGE

A phlebotomist is preparing to mail laboratory specimens to a reference laboratory. Which of the following information must be listed on the labels of the individual specimens?

A. Patient's health insurance policy number
B. Specific tests and their procedure codes
C. Type of specimen and its source

Answer: C is correct. When labeling the individual specimens, include the patient's full name and date of birth, time and date of collection, and source and type of specimen. Additional information (insurance numbers, tests) should be on the laboratory requisition or order form.

Delivery of specimens from clinics or blood-collection stations to reference laboratories should be as prompt as possible. With delays between collection and processing, glucose in blood cells can break down and interfere with results of various tests (phosphorus, glucose, aldosterone, calcitonin, enzymes). It is also essential to transport microbiology specimens quickly so that the laboratory technicians can transfer the specimens to the culture media or incubator. These samples include blood, urine, sputum, wound exudate, stool, and other body substances. The sooner they get to the environment where micro-organisms can grow, the sooner the technicians can identify them and generate the results so that the patients can receive proper treatment.

The delivery process must include adequate specimen handling, packaging, and communication with the courier or other delivery services. Coordinate the schedule of pickups, including the process for delivering stat specimens, where to place the specimens for pickup, and how to document the delivery process accurately and completely.

Specimen delivery methods include the following.

- ***Hand delivery*** directly to a reference laboratory, following timeliness of delivery guidelines, completing log-in processes, and using necessary carrying devices (trays, carts, tube racks, leakproof containers).
- ***Pneumatic tube systems***, usually in an inpatient setting. These systems have enhanced mechanical reliability, increased transport distance and speed, specific control mechanisms, and shock-absorbing features to help prevent hemolysis of blood samples. There is an inner padding that lines the canister and separates the blood tubes. Use caution when choosing this type of transport for tests for potassium, plasma hemoglobin, lactate dehydrogenase, and acid phosphatase, because of the increased chance of disrupting red blood cells, which can affect the test results. Coagulation specimens also need protection from shock and vibration to prevent platelet activation. For most other tests, this is an efficient means of transport that does not interfere with analysis.
- ***Automated carrier*** using a transport vehicle, such as a motorized container car that travels on a network of tracks to various destinations within the facility. This includes some of the same features of pneumatic tube systems.

pneumatic tube system. A method of transportation and distribution of laboratory test results and other documents.

CHALLENGE

A phlebotomist is working with the clinical team to incorporate an automated carrier system into the facility's newly renovated laboratory. Which of the following actions must be taken to avoid hemolysis of blood samples?

A. Use plastic liners in case of a leak.
B. Protect specimens from vibration or shock.
C. Send one specimen at a time.

Answer: B is correct. Automated carrier systems must have minimal vibration or shock to prevent hemolysis of blood samples. Shock-absorbent padding and separating tubes from one another can help prevent this.

PREPARING LABORATORY SPECIMENS FOR STORAGE OR TESTING

After ensuring the patient's safety and completing the venipuncture procedure accurately, the next step is to process the specimen and properly transport it to the laboratory. Laboratories face challenges with time management, test accuracy, specimen rejection, and specimen transportation processes. Abide by any specific handling requirements for the requested test in a timely manner to ensure accurate results. The time it takes for the entire process—including ordering, specimen collection, transportation, processing, analysis, and reporting—is the turnaround time.

In a hospital or a large laboratory facility, you will handle specimens and perform testing on-site. Whether you are performing tests on-site, working in a reference laboratory, or performing POC testing, it is imperative to follow specimen-handling processes with accuracy. Prior to processing, important steps in handling and transporting include mixing the sample, creating ***aliquots***, adding ***diluents***, ***centrifuging***, packaging the labeled specimen in a ***biohazard*** bag, and following thermal and light-sensitivity procedures.

When tubes contain an additive, invert them gently to mix the additive with the blood and to distribute the additive evenly throughout the sample. Mix it as soon as possible after the collection. Shaking the tube can result in a hemolyzed specimen. Not mixing it enough can result in the formation of clots, which can alter the test results. It is not necessary to mix blood samples in tubes that do not contain additives.

aliquot. To divide specimens into smaller portions.

diluent. A solution (such as water or saline) that reduces the concentration of a specimen.

centrifuge. A device that spins laboratory specimens at high speeds to separate the samples into their components for testing purposes.

biologic hazard. Also known as biohazard; any biological risk to organisms.

Special handling

Special handling is a requirement for transporting some specimens.

- ***Thermolabile*** specimens
  - Use a heat source or heat blocks to regulate temperature.
  - Use ice slurries, refrigerators, or freezers for chilling purposes. Do not use cold or ice packs.
  - Avoid fluctuating temperatures.
- ***Photosensitive*** specimens
  - Protect these from light.

thermolabile. Sensitive to high temperatures.

photosensitivity. An abnormal reaction to or a change resulting from exposure to light.

Tests that require special handling of specimens include ammonia and lactic acid, for which the blood tube must sit in an ice slurry (a thick mixture of water and ice) immediately after collection. For cold agglutinins, the sample must remain at body temperature—37° C (98.6° F). Protect blood samples for bilirubin and folate levels by wrapping the blood tube in foil. Blood gas tests can be stored at room temperature for 15 to 30 minutes or in an ice slurry for up to 1 hour. Delivery speed is crucial to prevent the loss of gases from the blood prior to analysis. For coagulation tests, analysis should take place within 1 hour of collection. Prothrombin time (PT) is an exception. A delay up to 24 hours at room temperature will not affect the results. Room temperature for laboratory purposes is 22° C (71.6° F).

CHALLENGE

A phlebotomist is preparing a blood specimen for a bilirubin test. Which of the following special handling requirements is necessary for this specimen?

A. Protect it from light by wrapping it in foil.
B. Immediately immerse it in an ice slurry.
C. Create an aliquot from the specimen.

Answer: A is correct. Blood samples for bilirubin levels require protection from light, which the phlebotomist can achieve by wrapping the blood tube in foil

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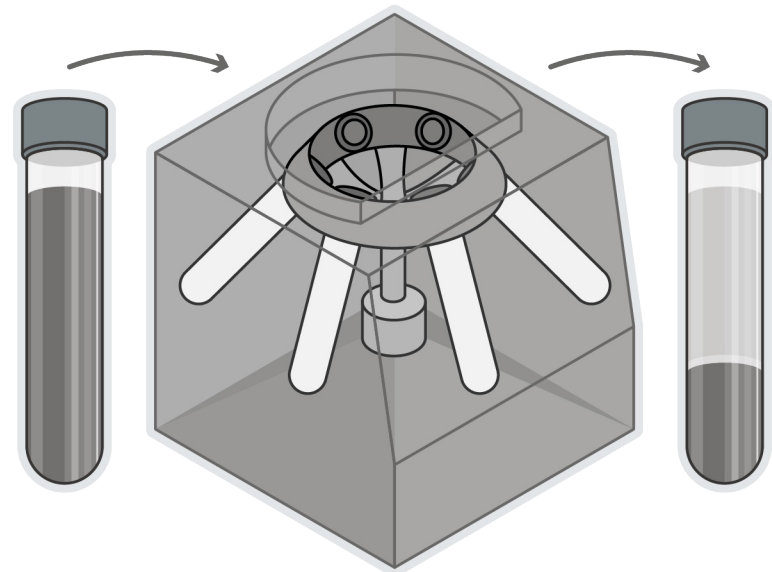
Centrifuging



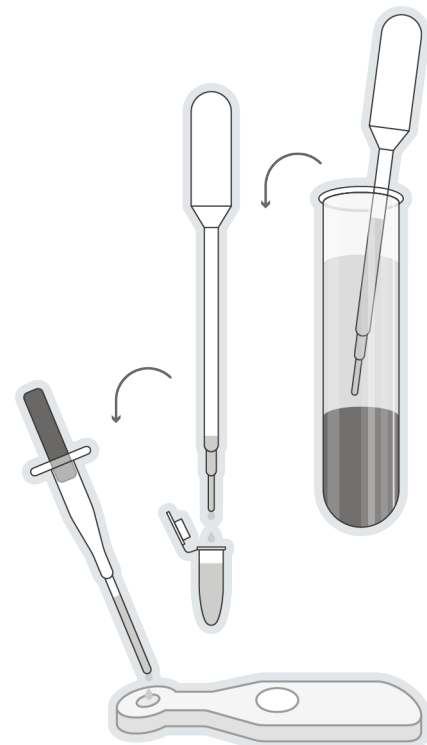
Some specimens require centrifuging or other additional processing prior to transporting them to the reference laboratory. Specimens that require separating the serum or plasma from the cells require centrifuging. To use the correct centrifuge, be aware of the tube type, rotor, spin time, capacity, noise level, and proximity to other equipment. Some centrifuges accommodate only a few tube sizes, while others have adapters for various sizes. The type of rotor can produce either a flat gel barrier (which is best for immunoassay and chemistry tests) or an angled gel barrier (which can be problematic for some chemistry tests).

The steps of centrifuging include the following.

- ***Pre-centrifugation*** is the handling and processing of specimens after collection and before centrifugation. It is important that the process begins as soon as possible after collection; the delay in separating plasma from cells should not exceed 2 hours. If a specimen for centrifugation does not have an anticoagulant additive, it should clot before going into the centrifuge. Clotting usually takes 30 to 60 minutes at room temperature. Do not chill these samples, because that will delay clotting. If the patient is taking an anticoagulant, that will also delay clotting. Be sure to protect any photosensitive specimens from light, either by wrapping them in foil or placing them in an amber specimen container. Shield photosensitive specimens from light as much as possible during the process.
- ***Centrifugation*** is the processing of specimens by spinning them in a centrifuge at high speeds, forcing the heavy elements of the specimen (blood cells) to move to the bottom of the tube and the lighter substances (serum, plasma) to remain at the top. The time and speed of centrifugation are critical elements the laboratory and the centrifuge manufacturer establish. These procedures should be clear and available in every laboratory. If the time in the centrifuge is inadequate, portions of blood cells can remain in the serum or plasma and affect test results. It can also result in incomplete formation of the barrier gel. Place tubes in the centrifuge with their stoppers or caps on. Balance them so that tubes of the same size and that are holding the same volume of blood are opposite each other. Without that balance, they are at higher risk for breakage. Never open the lid of the centrifuge before it has completely stopped spinning. Do not centrifuge specimens more than once.

- ***Post-centrifugation*** is the handling and processing of specimens once the centrifugation process is complete and removal of the serum or plasma is necessary. Removal is best immediately after centrifugation and no longer than 2 hours later. Serum might require room temperature, refrigeration, freezing, or protection from light, depending on the test it will undergo. In general, serum and plasma should remain at room temperature no longer than 8 hours before testing. Otherwise, it needs refrigeration. If testing does not take place within 48 hours, then freezing is necessary.

Some specimens have time limits and temperature requirements after centrifuging—room temperature, refrigeration, storage in the dark, or freezing—depending on the testing requirements.



Aliquoting

Aliquot specimens right after completing the centrifugation process. To aliquot a sample, hold the empty tube adjacent to the specimen tube, use a disposable pipette to transfer the serum (without cells) from the specimen tube to the aliquot tube, and label the specimen accordingly.

Packaging

When transporting specimens via postal service mail or express delivery services, be sure to comply fully with local, state, and federal laws that govern their special packaging and biohazard identification. Complete shipping paperwork, including the patient's identification, specimen identification, and test information.

To prepare samples for transportation to a reference laboratory, package the specimens using the following supplies.

- Original specimen tubes or plastic screw-cap transfer tubes
- Absorbent materials
- Watertight primary containers
- Watertight secondary containers (resealable bags, plastic canisters, foam boxes)
- Strong outer packaging (fiberboard boxes or mailing tubes, wooden boxes, rigid plastic containers)
- Coolants (ice packs, dry ice), if necessary

Placing in biohazard bags

Prior to placing specimens in biohazard bags, be sure to label the specimen with the patient's full name, the date and time of the specimen collection, and the source and type of specimen. To prepare these samples correctly, place the labeled specimen into a biohazard bag and then into a primary container with absorbent material surrounding it and usually above any necessary coolants. Place all of these materials within the secondary container and place the specimen documentation above the secondary container. The documentation may have a separate bag. Make sure to use this bag and seal if required. Then place the secondary container and the documentation inside the shipping container.

REPORTING AND DISTRIBUTING LABORATORY RESULTS

Point-of-care (POC) tests are laboratory tests performed close to the site of patient care (such as the patient's bedside or the examination room of a provider's office). When performing POC testing, be aware of values that indicate a potentially life-threatening or health-endangering situation. A critical value is a test result that is significantly above or below the expected reference range. It could indicate a potentially life-threatening situation for the patient and requires an immediate response.

When a critical value occurs, report this result promptly and directly to the ordering provider. Not all laboratory values have a critical level, but each laboratory or facility has a list of tests that require monitoring patients' results for critical values. Learning the difference between an elevated or decreased value and a critical value is important. Depending on the nature of the test—from simple screening to complex profiles—a change in a patient's homeostasis will result in an abnormal test value in either a quantitative numeric value or a simple positive or negative outcome.

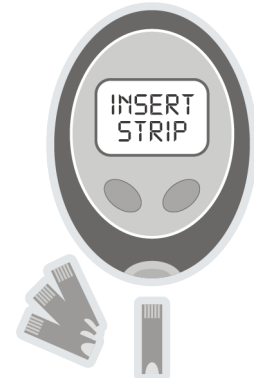
The specific critical values can differ by facility and can change over time. Become familiar with the general tests that providers monitor for critical values, and learn the values for your organization. For example, if the laboratory's expected reference range for a fasting blood glucose level is 70 to 100 mg/dL and a patient's result is 464 mg/dL, that is a critical value that warrants immediate reporting to the provider.

With POC and CLIA-waived testing, collect and prepare specimens to insert immediately into automated clinical analyzers for fast and accurate results. These tests include the following.

- Electrolytes (sodium, potassium, chloride, calcium, magnesium)
- Hematology (WBCs, RBCs, Hct, Hgb)
- Glucose, hemoglobin A1c
- Cholesterol (HDL, LDL, total cholesterol, triglycerides)
- Blood coagulation (PT, international normalized ratio [INR])

Microbiology and toxicology testing, including the rapid antigen detection test (for identifying streptococcal pharyngitis), fecal occult blood studies, chemical reagent strip testing, and urine pregnancy testing provide positive or negative results or—with reagent strip testing—a variety of numeric values or ranges for interpretation.

A common POC test is a blood glucose level. Patients who have diabetes mellitus routinely have results greater than the high limit of the reference range. Sometimes these results are within normal limits for those specific clients. You need to know when a high result is normal or expected for patients due to their condition, and when to notify the provider. When using a coded glucometer, compare the code on the glucometer with the code on the strips prior to each patient's testing. Complete quality controls with a ***control material*** when opening a new package of test strips, when several tests have been significantly out of range, or when changing the glucometer's batteries.



control material. Sample specimens with known laboratory values, used prior to processing a patient's sample.

CHALLENGE

A phlebotomist is performing point-of-care testing to monitor blood coagulation values. This testing is likely to involve which of the following tests?

A. PT and INR
B. Oxygen saturation
C. Sodium and potassium

Answer: A is correct. Blood coagulation monitoring involves measuring clotting times (PT and INR) to manage bleeding and clotting disorders.

You will collect and handle specimens, perform some POC and CLIA–waived tests, identify abnormal and critical values, and report results. However, a licensed health care professional must then review and evaluate those results.

Chain of custody

The process that maintains control of and accountability for each specimen from the time of collection to the time of disposal is the ***chain of custody***. All individuals who have handled a specimen must document their identity on the chain-of-custody form each time the specimen transfers. The form also requires the following components.

- Name and identifying information of the patient, body, subject, or object the specimen came from
- Name of the person who obtained and processed the specimen
- Date, location, and signature of the person attesting that the specimen is the correct one and matches its documentation
- Signature and date from every person who had possession of the specimen for any amount of time, even if only for transporting

chain of custody. The chronological documentation (paper trail) showing the acquisition, custody, control, transfer, analysis, and disposition of specimens that provide evidence.

Sample Lab
1234 Main Street
Example, KS 12345
800.555.1234

Chain of Custody Record

Organization:
Contact:
Address:
Phone #:

Sample ID #:
Collection date:
Collection time:
Sealed: ☐ Yes ☐ No

RELINQUISHED BY		RECEIVED BY	
Print name:		Print name:	
Signature:	Date:	Signature:	Date:
Organization:	Time:	Organization:	Time:

LABORATORY DESCRIPTION OF SAMPLE

Item #	Description of item *(container, marks, scratches, condition)*

CHAIN OF CUSTODY

	Signature	Print name	Date	Time
Relinquished by				
Received by				
Relinquished by				
Received by				
Relinquished by				
Received by				

EVIDENCE DISPOSAL

Disposition site: Performed by: Date:
Disposition #: Witnessed by: Date:
Method of disposition:

When transferring specimens during chain-of-custody processes, label the specimen correctly and place it in a biohazard bag with a permanent seal that verifies that no one has opened it until it is ready for analysis. These specimens are legal evidence; there must be no tampering with them until they reach their final destination. An intact seal provides evidence that there has been no tampering during the specimen's transfer to the laboratory.

CHALLENGE

Sealed or locked specimen transfer bags are used as part of which of the following?

A. Chain of custody
B. Plasma thawing
C. Centrifuging

Answer: A is correct. For chain of custody, phlebotomists place specimens into specimen transfer bags. These are sealed or locked until the laboratory technician opens them for specimen analysis. The seals on these bags ensure tamper-evident transfer.

Several situations require initiating and following a chain-of-custody process, including forensic analysis, workplace drug testing, drug testing of professional athletes, neonatal drug testing, and blood alcohol content (BAC) testing. Occasionally DNA analysis, rape test kits, and parentage testing require following chain-of-custody guidelines for legal purposes.

Forensic specimens

Forensic laboratory analysis involves various types of specimens, for example, from vaginal swabs after rape, blood and body fluids from crime scenes, and postmortem specimens from autopsies. Special handling of specimens is crucial, because the specimens might be decomposing, available in only trace amounts, or require analysis by a forensic scientist in extreme environments. ***Forensic specimens*** also involve toxicology testing of substances after poisoning or substance abuse. Collecting these specimens can require special training or experience and supervision. Unlike specimens collected in a clinical setting, forensic specimens can be in any condition, clotted, or in containers that would otherwise be unacceptable.

forensic specimens.
Samples of legal value in a civil or criminal case.

CHALLENGE

A phlebotomist is following handling and processing guidelines for a forensic specimen. Which of the following is a possible reason for this mandate for forensic specimen testing?

A. Crime scene investigation
B. Pre-employment physical examination
C. Employer's random drug screen

Answer: A is correct. Forensic specimens include vaginal swabs after rape, blood and body fluids from crime scenes, and specimens obtained during autopsies.

Drug testing

The Department of Health and Human Services initiated federal drug testing, which is mandatory for some government employees and many private-sector employees. Workplace drug testing often follows the U.S. Department of Transportation's mandated testing regulations, which have become an industry standard. Many employers require urine drug testing and use the Federal Drug Testing Custody and Control Form (CCF) for the process. This form must document the handling and storage information for specimens from the time they are obtained to their final disposal. Phlebotomists must undergo training and evaluation in the correct use of the CCF per federal guidelines. The process for collection has extremely specific guidelines to ensure that employees providing the specimen cannot tamper with it, such as adding water to dilute it or replacing it with urine they previously collected from someone else and concealed in clothing or a handbag.

Urine drug tests can usually detect marijuana use within the past week and the use of cocaine, heroin, and other illegal drugs within the past 2 days. However, they do not measure the degree of impairment or the frequency of use.

Workplace drug testing

- Ensures compliance with federal regulations, customer contracts, and insurance carrier requirements
- Reinforces a company's no-drug-use policy
- Minimizes the risk of hiring an employee who uses drugs illicitly
- Identifies employees who use drugs illicitly so that employers can enforce disciplinary action
- Improves the safety and health of employees

Sports-related drug testing

- Detects use of stimulants (amphetamines, anabolic steroids, alcohol, diuretics, street drugs, peptide hormones, anti-estrogens, $beta_2$ agonists) to enhance athletic performance
- Encourages regulation of nutritional and dietary supplements
- Analyzes blood and urine to detect ***blood doping*** or the use of ***erythropoietin***

blood doping. Injection of blood cells or blood substitutes to increase athletic endurance by boosting the bloodstream's oxygen-carrying capacity.

erythropoietin. A medication for patients who have had chemotherapy to treat cancer; also used illicitly by some athletes to boost production of red blood cells and thus increase endurance.

Neonatal drug testing

- Detects the use of cocaine, opiates, amphetamines, methamphetamines, and phencyclidine, which cause prenatal drug exposure and neonatal abstinence syndrome (withdrawal)
- Requires obtaining specimens for analysis within 24 hours after childbirth to detect recent drug use
- Confirms maternal drug use 24 to 72 hours prior to childbirth if the newborn's urine is positive for these substances

Law enforcement officers who detain individuals they suspect of driving under the influence might conduct various sobriety tests. Then, depending on state laws, they might request or require a urine, blood, or breath test. The most accurate of these methods for identifying alcohol levels is blood specimen analysis from a routine venipuncture or capillary stick procedure. In the U.S., the legal limit for BAC is 0.08%, or 80 mg/100 mL. Drivers younger than age 21 must have no detectable alcohol in their blood.

When collecting specimens for BAC testing, follow the chain-of-custody guidelines and special collection techniques. Clean the venipuncture site with an antiseptic that does not contain alcohol, such as chlorhexidine. Using alcohol for this purpose could lead to a false positive result. Do not use iodine swabs, because they contain alcohol.

COORDINATING COMMUNICATION WITH NON-LABORATORY PERSONNEL

As a phlebotomist, you will interact with many medical professionals, including physicians, nurses, laboratory technicians, respiratory therapists, and radiologic technologists. It is important to coordinate communication with non-laboratory personnel about processing and collection, and to monitor and adjust communication according to best practices and patients' needs.

Computer programs now manage workflows and communication specific to each provider of services. In addition, effective communication involves using standard terminology and abbreviations, and accurate documentation. Documentation includes recording contact notes on laboratory reports or laboratory logs. All computer interactions provide documentation that managers can monitor and review for HIPAA compliance and the quality of patient care.

Computers and networks play key roles in the scheduling, managing, and processing of patients, specimens, and clinical workflow. You must become familiar with the software, communication methods, and processes within your organization. Software that supports the ordering, processing, and routing of specimens helps streamline workflows that once were paper-intensive. Software that links test results to provider alerts depending on preset values contributes to an effective and efficient communication process. Each organization establishes policies and procedures for communication about specimen processing and collection.

The use of laboratory information systems requires knowledge of software and hardware components to communicate effectively with non-laboratory personnel. You will use these and other essential instruments for the following tasks.

- Transmitting test requisitions electronically or in print format
- Creating specimen labels, collection lists, and schedules
- Monitoring and updating necessary specimen records
- Storing, reporting, and sending results to non-laboratory personnel stations
- Submitting charges on patients' accounts to necessary departments
- Maintaining records of procedures, policies, and inventory details

Always follow HIPAA guidelines and policies. By enhancing security measures—such as creating passwords, firewalls, and back-up programs—health care facilities comply with HIPAA requirements for protecting the confidentiality of patients' records. HIPAA regulations also apply to the electronic communication of laboratory information, including scanning, faxing, and e-mail.