WIC Hematology
Modules 1, 2 & 3

December 2013

(Disclaimer)

This text is intended to be used in conjunction with the online portion of these modules.

Module 1

Introduction

In this lesson, you'll learn how to:

- Define hematology
- Understand the importance of hemoglobin in red blood cells
- Define anemia
- Explain the symptoms and consequences of anemia
- Describe the steps to take if a client's hemoglobin value puts him or her at nutritional risk
- Describe how to take a blood sample using safe procedures

Hematology

What exactly is hematology? Hematology is the study and assessment of blood.

In WIC, most participants will qualify for screening with a device called the Masimo Pronto, and you won't have to do the finger stick. This device reads the participant's hemoglobin levels through a sensor you place on their finger. If a finger stick is necessary, then you will use a cuvette, which is a small container, to collect a sample of your client's blood. You'll then put the cuvette in a machine called a HemoCue, which will provide you with a value for hemoglobin levels in the blood. By checking hemoglobin levels, you will be able to assess whether or not your client is a risk for a condition known as iron-deficiency anemia.

Later on we will discuss iron-deficiency anemia, symptoms, consequences, causes and how to perform the test in more detail.

The Importance of Testing Hemoglobin

Why is the hemoglobin test so important?

- The hemoglobin test is part of certification.
- The hemoglobin test helps WIC reach goal of preventing iron-deficiency anemia.
- You will NOT be making a diagnosis of iron-deficiency anemia, just testing for hemoglobin levels.
- It's important to perform this test accurately.

What is Hemoglobin?

- We need oxygen to survive.
- Blood carries oxygen from the lungs to tissues and organs.
- Hemoglobin = "heme" iron containing, "globin" transport protein.
- Iron in the blood picks up oxygen from the air we breathe and delivers it everywhere in the body.

- After delivering oxygen, hemoglobin picks up carbon dioxide (a waste product) and carries it back to the lungs where it leaves the body when we exhale.
- Hemoglobin gives red blood cells the characteristic red color we see.

Anemia &Iron-Deficiency Anemia

Anemia - Anemia is a condition where the body has a reduced number of healthy red blood cells circulating in the body. With a reduced number of healthy red blood cells, the body doesn't have enough oxygen to deliver to its tissues and organs.

- The body needs iron from iron-rich foods to make iron-rich hemoglobin.
- Lack of iron lead to unhealthy red blood cells.
- A red blood cell lives about 120 days before it's replaced.

Iron deficiency anemia – a condition where not enough iron is in the body to form healthy red blood cells with hemoglobin.

Symptoms of Anemia

Possible symptoms of anemia include:

- Tiredness, weakness, or fatigue
- Headache
- Poor appetite
- Pale skin (also known as pallor)

Possible consequences of anemia include:

- Increased susceptibility to infections, especially respiratory infections
- Decreased work performance
- Difficulty learning or poor intellectual development
- Growth retardation, if prolonged
- For prenatal women – increased risk of prematurity or low birth weight infants, and even infant mortality

Possible Causes of Anemia

There are many different types of anemia. Since all of them have to do with red blood cells and red blood cell formation, the symptoms end up being similar.

Inadequate Diet or Low Dietary Intake

A possible cause is due to:

- Not eating enough iron-rich foods like beef, chicken, beans and lentils
- Inadequate intake of folic acid, vitamin B12

Poor Iron Absorption

A possible cause is due to:

- High intake of caffeinated drinks which block iron absorption.
- High intake of calcium which prevents iron absorption.

Important Facts on Iron Absorption

- Iron from meat, poultry, and fish is absorbed two to three times more efficiently than iron from plants.
- The amount of iron absorbed from plant foods depends on the other types of foods eaten at the same meal.
- Foods containing vitamin C, such as from plants, also enhance iron absorption when eaten at the same meal.
- Some other factors (such as taking antacids beyond the recommended dose or medicine used to treat peptic ulcer disease and acid reflux) can reduce the amount of iron absorbed.

Four important points to keep in mind:

- Iron from meat, poultry, and fish is absorbed two to three times more efficiently than iron from plants
- The amount of iron absorbed from plant foods depends on the other types of foods eaten at the same meal.
- Foods containing vitamin C, such as from plants, also enhance iron absorption when eaten at the same meal.
- Some other factors, such as taking antacids beyond the recommended dose or medicine used to treat peptic ulcer disease and acid reflux, can reduce the amount of iron absorbed.

Malabsorption of Nutrients

A possible cause is due to:

- Missing factors needed for absorption, such as intrinsic factor, a protein made in the stomach that helps absorb vitamin B12 (could lead to B12 deficiency anemia).
- Factors such as disease, genetic disorders, or medications.

Disease

A possible cause is due to:

- Chronic disease of kidney and bones.
- Genetic disorders such as thalassemia and sickle cell disease (both blood disorders).
- Recent or current infection/chronic inflammation.

Blood Loss

A possible cause is due to:

- Accidents, surgery or burns.
- Heavy menstrual bleeding.
- Childbirth.
- Parasites (hookworms, roundworms).

- Intestinal bleeding from cow's milk (if fed to young infants).
- Ulcers and long-term intake of aspirin.
- Malaria.
- Cancer (certain types)

Rapid Growth

A possible cause is due to:

- Children who go through rapid growth spurt cannot keep up with the body's need for red blood cells.
- Pregnant women with a growing fetus creates demand for more iron to form red blood cells.

Lead

A possible cause is due to:

- Lead can exist in paint chips, soil, dust.
- Lead can exist old pipes, lead-glazed pottery, even folk remedies.
- Lead competes with iron for absorption in the body.

Iron-Deficiency Anemia & WIC Clients

- Iron-deficiency anemia is the most common form of anemia.
- Low dietary intake of iron-rich foods and blood loss are the two most common causes of anemia.
- Both iron-deficiency anemia and low dietary intake of iron-rich foods are found among WIC clients.

Hyperhemoglobinemia

- A condition of elevated levels of hemoglobin in the blood.
- The opposite of iron-deficiency anemia.
- Not as common, but must check for in WIC clients.

Causes: Smoking and Living at High Altutude

- Smoking – decreases the oxygen-carrying capacity of red blood cells. Causes the body to create more red blood cells to provide oxygen.
- Living at high altitude – the body creates more red blood cells to make up for a limited oxygen supply in the air.

Causes: Dehydration

- Dehydration – the depletion of body fluids
- Can be life threatening
- Common causes – vomiting (pregnancy, illness, medication, stress, head injury).
- Symptoms – unusual thirst, sunken eyes, dry mouth, cracked lips.
- Hemoglobin will return to normal when person hydrated again.

Causes: Build-up of Iron in the Body

May be due to:

- Poor elimination system.
- High dietary intake of iron.
- Increased absorption of iron
- Increased breakdown of red blood cells (may come from repeated transfusions).
- Hemochromatosis – genetic disorder of the metabolism that causes the body to absorb too much iron from the intestinal tract.

Additional Requirements for Testing Blood

Additional information for:

- Infants: WIC Federal Regulations require this test be done by 12 months of age (ideally between 9-12 months) because infants are born with enough iron stores to last until they are six months of age.
- Children: done once between 12 and 24 months. If the value is normal, the test can be done annually. If below normal, the test must be done every six months.
- Pregnant women: bloodwork is required at the pregnancy certification. Another blood test is required when they are certified again after the pregnancy ends.
- Postpartum and breastfeeding women: bloodwork is required after the end of pregnancy. Typically, this will be done at their certification after delivery, unless the result is coming from an outside source.

Blood Testing Exemptions

Some instances when blood work is not required are:

- Individuals whose religious beliefs prohibit the taking of blood.
- Participants with chronic medical conditions such as hemophilia.
- Blood work exemptions MUST be documented in the participant's record.

Summary

- Hemoglobin picks up oxygen and gives red blood cells their color.
- Iron-deficiency anemia is the most common form of anemia.
- Blood loss and low-dietary intake of iron-rich foods are common causes of iron-deficiency anemia among WIC clients.
- WIC's goal is to prevent iron-deficiency anemia.

Module 2

Masimo Pronto Introduction

In this module, you'll learn how to use the Masimo Pronto to obtain hemoglobin level readings ... without a finger poke.

What We Will Learn

As I'm sure you're aware, the finger poke can cause discomfort and anxiety in many participants, especially children. To address this, WIC has adopted the Masimo Pronto, a non-invasive testing device that can measure hemoglobin levels through the skin using a sensor instead of drawing blood. The Masimo Pronto is Food and Drug Administration (FDA) cleared for non-invasive spot checking of hemoglobin. Using the Pronto machine offers a safe and painless way to screen participants for the risk of anemia.

Taking a hemoglobin reading with the Pronto can be done in four simple steps:

1. Select a sensor size
2. Place the sensor on the finger
3. Press the SpHb button
4. Obtain the results!

Objectives

In this lesson, you will learn:

- Which participants may be tested using the Masimo Pronto
- How to choose the correct sensor and prepare the unit and participant for the test
- How to conduct the test
- Strategies to keep children still and calm during the test
- How to recognize and solve common problems encountered while using the Pronto

Remember, WIC is screening for the risk of anemia, NOT diagnosing anemia. The accuracy of the Pronto and HemoCue is compared with the standard method used for hospital laboratory tests. But, may give readings that are higher or lower than the true value. Although they are less accurate than the testing method that requires blood to be drawn directly from a vein, they are reliable screening devices.

Since the FDA has approved the device, you can trust the result you get from the Pronto. If you get a low or high reading, we do not expect you to retest using HemoCue.

Who can use the Pronto?

The Pronto can be used for adults and can be used with -children whose finger size is big enough to fit in the sensor, which is usually around age 2. Children with very small

fingers or children who cannot sit still long enough to obtain a reading will need to be tested using a finger poke.

When it comes to finger size, you can use any finger for the test except the little finger\pinky. The finger must reach the end of the sensor, and the sensor should fit snugly. The finger should not slide around in the sensor. You may find that the thumb or middle finger is a better candidate for testing children. But if none of the child's finders are large enough, you will need to do a finger poke, even if the child is older than two years old.

The Pronto test requires the participant to have their hands remain still while the readings are being taken. This can be challenging for small children!

Features of the Masimo Pronto

Most clinics have existing Pronto units which have been set up according to the procedure in the lab manual. If you believe your Pronto is in need of service, or has not been set up correctly, please inform your supervisor. If you are asked to set up a new Pronto, you may refer to the lab manual.

The Pronto requires cleaning at least once daily, and should be cleaned immediately if you notice debris or grime. It is recommended to spray cleanser on a cloth and NOT directly on the Masimo. The outer surface of the Pronto can be cleaned with a soft cloth dampened with soap and a warm water solution. Other appropriate cleaning agents include commercial products such as:

- Cidex Plus (3.4% Glutaraldehyde)
- 0.25% Ammonium Chloride
- 70% Isopropyl Alcohol
- 10% Bleach solution.

Do not allow liquids to enter the interior of the Pronto. Do not autoclave, pressure sterilize, or gas sterilize the Pronto. Do not soak or immerse the Pronto in any liquid. Do not use petroleum based or acetone solutions, or other harsh solvents, to clean the Pronto.

Cable and Sensors

This is the "Patient Cable". It connects the Pronto to the sensors which are worn by the participant.

These are the "Rainbow" sensors you will use. The sensors should not be discarded with other disposable waste. When all the loaded tests have been used, sensors are considered electronic waste and should be treated like cell phones or other electronic devices. Please check with your agency about their policy for disposal of electronic waste.

There are adult sensors and pediatric/slender digit sensors, but either type can be used on adults and children as long as the finger fits in the sensor snugly as described. On

the top of each sensor, there are raised lines that correspond to the sensor inside. You can use these lines to line up the finger and ensure it is long enough for a successful reading.

To connect the sensor, properly orient the sensor connector and insert it completely into the “Patient Cable” connector. Completely close the protective cover. When you connect the sensor, the Pronto will tell you how many uses you have left. Each sensor can be used for the specific number of tests purchased. The tests do not expire.

When you connect the cable and sensor, ensure that there are no kinks or twists. If the cable isn’t kept straight, it may interfere with the reading.

To disconnect the sensor, lift the protective cover and pull firmly on the sensor connector. Do not pull on the cable, or you could damage it.

It is important to clean sensors at least once a day, and anytime you notice debris or grime. Remove the sensor from the participant and disconnect from the patient cable. Disconnect the patient cable from the device. Wipe the entire sensor and / or patient cable clean with a 70% Isopropyl alcohol pad. Allow to air dry thoroughly before returning it to operation. To prevent damage, do not soak or immerse in any liquid solution. And do not attempt to sterilize by irradiation, steam, autoclave, or ethylene oxide.

Choosing a Sensor

It is important to choose the appropriate sensor for the participant’s finger size. The pediatric sensor will be used for children, and many women will also have fingers small enough to use the pediatric sensor. In a moment we will discuss how to assess whether women should use the pediatric or adult sensor. Children may be measured if their fingers or thumbs are long enough to reach the end of the sensor and fit snugly against the sides of the sensor.

Each sensor comes with a Slender Digit Gauge that will help you determine if it is the appropriate size.

To measure a participant’s finger using the slender digit gauge, slide the gauge circle onto the finger as shown in the image. If the gauge circle stops at any point of the nail bed before the cuticle, the sensor can be used on that finger. If the gauge slides past the cuticle, the digit is too slender for that sensor. You will need to choose another sensor or use the pediatric sensor. If the participant’s fingers are too small for the pediatric sensor, you cannot use the Pronto and will need to do a finger poke.

Choosing a Test Site

Choose a site that will restrict the participant’s movements as little as possible. For this reason, it’s a good idea to try the ring or middle finger of the non-dominant hand first. The thumb may also be used, provided the thumb reaches to the end of the sensor. Clean the site with an alcohol wipe, and be sure the site is dry and free of debris before placing the sensor.

Use the image of the finger on top of the sensor to correctly position the participant's finger. The pad of the finger or thumb should completely cover the detector window in the lower half of the sensor. If the detector window is not covered, the Pronto will not take a reading.

The tip of the finger should reach the end of the sensor, at the vertical finger stop. If the fingernail is long, it may extend and pass over the vertical finger stop. The cord should run straight to the back of the hand. Try to keep the cord as straight as possible to avoid signal interference.

Do not place the sensor on an anatomically disfigured finger or a finger with a tight ring. You may also want to avoid fingers with nail polish or acrylic nails, as this can disrupt the test. However, if the Pronto recognizes that the sensor is connected and takes a reading, you can trust the reading even if the site is less than ideal. A few times a day, check the sensors to make sure they are free of debris and grime. Use an alcohol wipe to clean the sensors when needed.

Performing the Test

Before taking a blood sample, make sure the client or Authorized Representative has signed the Rights & Obligations form giving you permission to perform bloodwork. Without permission, you cannot perform the hemoglobin test. This paperwork is often signed when the client checks in at the time of the appointment. Once you have chosen the appropriate sensor and connected it to the "Patient Cable" on the Pronto device, place it on the participant's finger or thumb as appropriate. Turn the device on. It will go through a self-test and verify all front panel indicators light up and a tone will be heard indicating it is ready to use. The display will show the sensor uses remaining.
Be sure the participant is seated, calm, and breathing normally. Changes in heart rate can cause problems with the test, so choose a relaxed setting where participants are less likely to be stressed. Pronto tests do not have to be conducted in a lab. If the sensor is not placed correctly, the display will show "SENS OFF". When the sensor is placed correctly, it will automatically begin to take the reading. You will see circling zeros that indicate the Pronto is initializing the sensor. Then, dashes will flash and the Perfusion Index (PI) will display.

Press the SpHb button to switch the display to show the total hemoglobin reading. If you need to monitor the Perfusion Index (PI) during the test, you may press the Up or Down arrows to switch between the two readings. The participant must be still long enough for a successful reading. The spot check progress indicator will light up to show you the test progress. When the meter is completely lit, a tone will sound and the test is over!
The time to complete a test will vary depending on the Perfusion Index and interactions discussed in the Troubleshooting section that follows. The time for readings may be affected by the quality of the signal and by brightly light rooms (shielding the sensor with hand or a sheet of paper is recommended). If the display shows "SENS OFF" at any time during the reading, you must start over.

Once the test has completed, the total hemoglobin reading will display while you have the sensor connected. After you disconnect the sensor, you may still view the result for 5 minutes by pressing the SpHb button. The machine does not save the readings, so be

sure to record the reading right away. If the yellow light is on, or if there is no hemoglobin result, then the test was not successful and you will have to repeat it. If you get a value that is outside the “normal” range, make a referral per your agency policy.

Please note that bright light may not allow the Pronto to get a reading. If the sensor shield does not completely cover the finger due to finger size, cover the sensor with a hand or other shield.

You can use the Pronto on sites with nail polish and/or acrylic nails. Some types of nail polish may interfere with the test and prevent a reading, but it is advised to attempt tests with nail polish. Warnings in the Pronto Operator's Manual alert users that nail polish and acrylics can cause the test to fail due to low SIQ, this results in a test incomplete message. If the Pronto displays a result from a site with nail polish, the result is as accurate as if the site had no nail polish. If a reading fails, it does not reduce the number of tests left on the sensor.

Troubleshooting

Now we’ll go over some common errors and troubleshooting steps for the Masimo Pronto.

- [SpHb Error] Here are some factors which may prevent a reading due to low SiQ.
- [Low Signal IQ TOS] A low signal IQ is used to indicate low confidence in the readings. The total hemoglobin level will not display with Low SiQ present. The value may be checked again without decreasing the tests available on the sensor. Here are some common causes and solutions for a Low SiQ error.
- [Low PI] The participant’s perfusion index should be greater than 1.0 to obtain a successful reading. Here are some common causes and solutions for low PI.

Tips for Testing Children

One of the benefits of using the Masimo Pronto is that children can be tested without a finger poke. However, it can be challenging to keep a child calm and still for the time it takes to get a reading. A simple thing you can do is conduct the test in your office instead of in the lab. Since you will not be dealing with blood, you do not need a lab setting.

Here are a number of things you can do to help keep children calm and still:

- Put stickers on their hands to give them something to look at.
- When you are conducting the test, direct their attention to the lights and displays.
- Engage them in distracting conversation about cartoons, toys, or their family or friends.
- Have toys they can play with using their free hand.
- Ask the parent to help out by covering the child’s hand and applying gentle pressure during the reading.

Summary

In this lesson, you learned about the Masimo Pronto, a non-invasive testing device that can measure hemoglobin levels through the skin using a sensor instead of drawing blood.

You learned which participants may be tested using the Masimo Pronto, how to choose the correct sensor and prepare the unit and participant for the test, how to conduct the test, strategies to keep children still and calm during the test, and how to recognize and solve common problems encountered while using the Pronto.

Module 3

Introduction – Taking Blood Samples

In this lesson, you'll get to see how to do a hemoglobin blood test for participants who are not eligible for a Pronto screening. Steps will be broken down one by one including how to do a finger stick on an adult. We will also cover:

- Universal precautions.
- Exposure control plan.

Universal Precautions

Certain precautions are needed when taking a blood sample. These precautions are called “universal precautions” by the Centers for Disease Control and Prevention and are defined as:

> ”*A set of precautions designed to prevent transmission of **human immunodeficiency virus (HIV)**, **hepatitis B virus (HBV)**, **hepatitis C virus (HCV)**, and other blood borne pathogens, when providing first aid or health care*."

- Universal precautions are an approach to infection control.
- All human blood and certain human bodily fluids are treated as if they are infectious.
- Universal means everyone could be infected, whether they appear sick or not.
- Universal means taking precaution with members of the same family too.

Gloves:

Follow these precautions when taking blood samples in the lab.

- Gloves should be worn when touching blood, handling items or surfaces soiled with blood, and when performing finger or heel sticks.
- Change gloves after each participant's test. Do not use the same gloves, even if the participants are members of the same family.
- Gloves reduce exposure to blood contact, but they do not provide protection in the case of accidental needle sticks.
- Gloves also protect the participant from exposure to any cuts you have on your own hands, as well as protecting you from contact with the participant’s blood during the stick. Your unbroken skin provides a natural barrier against infections; however, broken skin does not. If you have any open cuts, rashes, or sores, be sure they are appropriately covered.
- Gloves also provide protection when cleaning blood that may have dripped on nearby surfaces.
- Wash hands immediately after gloves are removed. Use antibacterial soap or approved antiseptic wipes or antimicrobial gel.

Lancets

A “lancet” is a needle used to puncture the skin for a blood test. Many WIC agencies use safe, retractable lancets which are spring loaded. By pressing down a button the lancet punctures the finger, then retracts inward so there is less chance for accidental sticks. Older style lancets have a twist-off cap that exposes the needle.
After use:

- Dispose of lancets immediately in an approved puncture-resistant Sharps container.
- Never attempt to open a Sharps container to retrieve anything inside of it.
- Never force items into a full container.

Cleaning Lab Surfaces

- Clean work surfaces routinely.
- Clean spills immediately and use approved disinfectants.
- Caution caregivers to the potential hazards of choking on the bandage if they want to put a bandage on a small child.
- Children may pull off their bandages and contaminate surfaces if their finger is still bleeding.
- Do not eat or drink in the lab where finger sticks are performed.

Exposure Control Plan

Since you will be exposed to blood and sharp objects in the lab, your agency should have an “exposure control plan” in place. Familiarize yourself with this plan which instructs you on what to do if you’re exposed to blood and bodily fluid at work.
This plan contains information such as:

- How to minimize the chance of exposure.
- How to dispose of used items (such as lancets, dirty gloves and gauze/wipes).
- How to report an exposure or injury to yourself or a participant.
- The cleaning schedule and approved disinfectants to use.
- Any exposure training you may attend.
- Whether your agency provides Hepatitis B vaccines. These may be offered, depending on your position and level of exposure risk.

Hemoglobin Testing Using the HemoCue

The machine you'll be using in WIC when the Masimo Pronto cannot be used is called the HemoCue.

- Can plug into the wall or run on batteries.
- To make sure the HemoCue is functioning properly
  - Open the cuvette tray and press the “on” button once.
  - The analyzer will run a self-test which lasts about 10 seconds.
  - When flashing bars appear on the screen, the machine is ready for use.
- On each cuvette (plastic blood vial) is printed the manufacturers expiration date. The cuvette should not be used if it is beyond its expiration date.

- If opening a new container, make sure to pull on the tear-away plastic strip. Immediately write the date on the opened container as the cuvettes expire 90 days from this date. (Never leave the cuvette container open as moisture and light can ruin them).
- To open, put your finger through the loop and in the direction of the arrow, plant your thumb and rock back so the lid opens. If closed properly, you should hear a popping sound.
- Grab the cuvette at its base when taking it out of the container. Only take out one cuvette at a time even if performing multiple tests on the same family members. Once removed, the cuvette should be quickly used as it is sensitive to moisture and light.
- Never handle cuvettes with bare hands as finger prints can give inaccurate readings.
- To obtain an adequate blood sample, use the client's middle finger. Hold the finger between your thumb and index finger at the first knuckle and rock it forward a few times. This is called priming the site. You'll then cleanse the area with and alcohol prep pad and wipe it dry with gauze or a lint-free wipe.
- Puncture the site with the lancet, then rock the finger and wipe away 2-3 pea-size drops of blood.
- Fill the cuvette completely. (If an air bubble gets into the sample, you will have to re-test).
- Wipe off the excess blood and put the cuvette in the HemoCue machine. The machine will then provide the hemoglobin value of the sample.
- Write down the value once it is displayed, dispose of the used cuvette and lancet in the Sharps container and turn off the machine. You can now clean and dispose of your supplies according to your agency's policy.
- For more information on how to use the HemoCue, refer to your supervisor.

Steps for Hemoglobin Testing – Step One: Signing the Rights and Obligations Form

Step one of the hemoglobin test has to do with paperwork. Before taking a blood sample, make sure the client or authorized representative has a signed "Rights & Obligations" form giving you permission to perform blood work.

- Take the signed form or the Health Data card form from the ID folder to the lab area to record results.
- Check with your supervisor regarding documentation required at your agency.

Step Two: Washing Hands

- Wash your hands with antimicrobial soap and water.
- Hand cleaner, antimicrobial gel, or hand wipes can be used, if soap and water aren't available.
- Wash AND change gloves between every test, even between family members.

Step Three: Assembling Supplies

The following supplies are needed for the test:

- Disposable gloves.
- Sterile lancets.
- Alcohol prep pads.
- Antimicrobial soap (or alcohol-based/gel cleanser in situations where sink and soap are not available).
- Cuvettes in closed vial (only take out one cuvette at a time).
- Bandages (Some agencies do not bandage children under age 2, check with your supervisor for your policy).
- Lint Free wipes® or gauze (not tissue or cotton balls as these can leave pieces of cotton behind).
- Sharps container (or biohazard bag).
- HemoCue Machine.
- 10% bleach solution or disinfectant spray.

Step Four: Turning on the HemoCue Machine

Turn on the HemoCue machine and ensure it's working properly.

- The HemoCue is powered by an electric adapter or by batteries.
- The batteries will run down if the unit is plugged in.
- To run a self-test, pull the tray out, and turn the unit on.
- Three flashing bars indicate the HemoCue is functioning properly.

Step Five: If Error Messages are Displayed

If the HemoCue displays error messages:

- Clean the machine if you receive an 'E01' or E02' code.
- Never use alcohol to clean, only mild soap and water.
- If the machine continues to show an error code, follow your agency's troubleshooting procedures.

Cleaning the HemoCue

The analyzer needs to be cleaned on a regular basis, preferably weekly, but this time period may be determined by your local agency.

To clean the unit, turn the machine off. No part of the machine should be cleaned with alcohol or alcohol wipes, even though the HemoCue manual suggests using alcohol. Only mild soap and water are to be used on all parts of the machine.

The cuvette holder can be taken out by using a pen/pencil tip or fingernail to depress the groove, which will allow the holder to slide out and be cleaned. The cuvette holder can then be cleaned with soap and water to remove any dirt or blood. Do not insert it into the machine wet; allow it to air dry for 15 minutes.

The outside of the analyzer can be cleaned, if it is visibly dirty. Use mild soap and water and allow to air dry for 15 minutes, as well.

If an error message appears such as ‘E01’ or ‘E02,’ you will need to clean the sensor inside the unit. To do this, start by turning off the machine.

You can then use a cotton swab moistened with water or a HemoCue cleaner. Squeeze out the excess water. Remove the cuvette tray. Insert the swab into the machine; angle it up and down to get at the sensor.

There may be dried blood that needs to be removed, which will make the swab reddish brown. Use additional cotton swabs to clean the unit until they come out clean.

Let the unit air dry for 15 minutes. Insert the tray back into the machine, and turn it on. The three bars will display. If not, it may be time to refer to your agency's troubleshooting procedures.

Step Six: Choosing / Warming the Finger

- Your client can put her hands under her arms to warm them (preferred method).
- Your client can wash her hands with soap and warm water to warm her hands.
- Never have your client shake her hands to warm them.
- The middle finger has the best circulation and is the preferred finger to use.

Step Seven: Cleansing the Finger

- Remove excess alcohol to prevent hemolizing (breaking) of the red blood cells.
- If the client has washed her hands in the lab, do not use alcohol as it will cool and constrict the flow of blood.

Step Eight: Holding the Finger

- Prime the client's finger by placing your thumb and index finger at their last knuckle.
- Rock back and forth to get blood into the tip of the finger.

Step Nine: Puncturing the Finger

- Use the top of the finger, between the finger pad and the nail bed.
- Puncture the side of the finger in one continuous motion.
- Rock your finger back and forth to produce 2-3 drops.
- The drops should be the size of half a pea.

Step Ten: Filling the Cuvette

- Wipe away the first 2-3 drops of blood.
- Rock the finger to get split pea-sized drops of blood.
- Touch the cuvette to the skin – the cuvette will fill itself automatically (never top-off the cuvette by dipping it back into the blood sample).

- A yellow substance inside the cuvette reacts with the blood.
- Ask your client to apply light pressure to the puncture to stop bleeding using a lint-free wipe.
- Wipe off the excess blood from the cuvette using a lint-free wipe.
- If the cuvette does not fill completely or if air bubbles are visible, discard the cuvette. Wipe the puncture site and allow a new, larger bead of blood to form to collect in a new cuvette. If a bead does not form, start a new test using another finger.

Step Eleven: Measuring Hemoglobin Levels

- Place the cuvette into the HemoCue machine within 10 minutes.
- Record the value on the Rights and Obligations form, Health Data card or other appropriate form.

Step Twelve: Bandaging the Finger

- Place gauze or lint-free tissue over the puncture site (do not use the alcohol swab) and apply gentle pressure.
- Apply the bandage. Never remove the sterile tabs of the bandage before putting it on the client.
- Never bandage a child under 2 years of age.

Step Thirteen: Cleansing the Work Area

- If any blood spills on the work surface, cleanse with a 10% bleach solution or approved disinfectant spray immediately.
- The lab counter must be cleaned daily.
- Clean the HemoCue at the end of the day using mild soap and water.

Step Fourteen: Disposing of Supplies

After the blood test, make sure to throw away any paper wrappers, alcohol prep pads, gauze, lint-free tissues, gloves and any other supplies which are not saturated with blood, in the wastebasket.

- Dispose of lancet in Sharps container.
- Dispose of other supplies in trash, unless saturated with blood.
- Dispose of supplies saturated with blood in the biohazard bag or Sharps container.

Performing a Second Test

The Centers for Disease Control and Prevention has established hemoglobin cutoff values below which someone is considered at risk for anemia. These tables should be posted in your lab for you to evaluate your client's test results.

- Normal and at-risk hemoglobin values are posted in your lab area
- These tables are broken down by category, and, in some states, by elevation and smoking status.

- If your client's value is outside of the ‘nutritionist’ range, it's important to run a second test, preferably, by another WIC staff member.
- If the hemoglobin value remains outside the ‘nutritionist’ range on their next certification, they are to be referred immediately to their healthcare provider.

Summary

In this lesson you learned:

- The Center for Disease Control and Prevention defines a set of Universal Precautions as Universal Precautions when dealing with bodily fluids
- Review your agency's Exposure Control Plan
- You also learned about the steps involved in performing a hemoglobin test for participants who are not eligible for a Pronto test, and when to run a second test

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