

# **WIC Hematology Modules 1 & 2**

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

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## 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, you will be performing a finger stick to draw a small container of sample blood using a lancet. Then using a cuvette (a small container), you'll 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 participant is at risk for a condition known as iron-deficient anemia.

Later on we will discuss iron-deficient 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?

- Hemoglobin = "heme" iron containing, "globin" transport protein.
- It is found in the red blood cells
- Iron in the hemoglobin allows the blood to pick 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 their color.

## **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 leads 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 infant, and even infant mortality

## **Screening for Anemia**

A hematocrit is another way to screen for anemia. The hematocrit test measures the percent of red blood cells in a sample of blood.

Most WIC agencies collect hemoglobin values, however, you may receive a documented hemoglobin or hematocrit value from a health care provider.

## **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. Polyphenols in coffee and tannins in tea can make iron in food harder to absorb.
- 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.

### 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 deficient anemia).
- Factors such as disease, infections, 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.
- A pregnant woman's 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, and dust.
- Lead can exist in old pipes, lead-glazed pottery, even folk remedies.

Lead competes with iron for absorption in the body.

## **Iron-Deficiency Anemia & WIC Participants**

- 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-deficient anemia.
- Not as common as low hemoglobin levels.

### Causes:

- Smoking
- Living at High Altitude
- Dehydration
- Build-up of Iron in the Body

## **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: test every 6 months until a normal value is obtained; test annually thereafter. One exception is that a second test should be performed 6 months after the very first test on a child no matter what the value is. For example, typically the first test is done at the 1 year certification for a child around 12 months of age; the next required test is 6 months later, at around 18 months of age.

- 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. The CDC recommends that the bloodwork is taken at least 4 weeks after the pregnancy ends. However, in Oregon we do not require that you wait until 4 weeks postpartum to schedule certification and bloodwork.

### **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

### Introduction – Taking Blood Samples

In this lesson, you'll learn how a hemoglobin blood test is performed. 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.
- Wash hands before putting gloves on. Use antibacterial soap or approved antiseptic wipes or antimicrobial gel.
- 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.

## 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, and 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 used by WIC for testing hemoglobin levels 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) container 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 an alcohol prep pad and wipe it dry with gauze, cotton, or tissue.
- 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 Participant Signature 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 "Participant Signature" form giving you permission to perform blood work.

- 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
- Wipes or gauze Sharps container
- 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 participant can put her hands under her arms to warm them (preferred method).
- Your participant can wash her hands with soap and warm water to warm her hands.
- Never have your participant 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**

- Wipe the site to remove excess alcohol which prevents hemolizing (breaking) of the red blood cells.

### **Step Eight: Holding the Finger**

- Prime the participant'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 a split pea.

#### **Puncture Site for Infants/Children**

The steps for performing a finger stick on a child (1-5 years) are the same as for an adult. Puncturing the finger of infants younger than 1 year of age is not recommended. Puncturing the heel or big toe is more suitable for infants. Also consider using the heel or toe for premature infants until their adjusted age is one year.

### **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 participant to apply light pressure to the puncture to stop bleeding using gauze or a wipe.
- Wipe off the excess blood from the cuvette using gauze or a 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 in the participant's record.

### **Step Twelve: Bandaging the Finger**

- Place gauze or tissue over the puncture site (do not use the alcohol swab) and apply gentle pressure.
- Apply the bandage.

### **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, 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 other supplies saturated with blood in the biohazard bag.

### **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 may be posted in your lab for you to evaluate your participant's test results.

- If your participant's value is outside of the CDC cutoff values, you may want to recheck it in one or two months and make a referral to a Health Care Provider.

- Check with your Training Supervisor to find out your agency's procedure for rechecking low or high hemoglobin levels.

## **Summary**

In this lesson you learned:

- The Center for Disease Control and Prevention defines a set of Universal Precautions that are used when dealing with bodily fluids
- Review your agency's Exposure Control Plan
- Steps involved in a hemoglobin test
- When to perform a second test

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