

UPDATED AUGUST 11, 2023

# Introduction to Hematological Assessment

## Objectives

After completing this lesson, you will be able to:

- State the main purposes of a hematological assessment.
- Explain the procedures for collecting and processing a blood sample.
- Understand the importance of hand washing.
- Understand the importance of preventing blood borne pathogen transmission.
- Describe and follow the hemoglobin test procedure using the HemoCue Hemoglobin Analyzer.

## Overview

The most common form of nutritional deficiency is “iron deficiency”. It is observed more frequently among children and women of childbearing age (particularly pregnant women). Iron deficiency can result in developmental delays and behavioral disturbance in children, as well as increased risk for a preterm delivery in pregnant women.

Iron status can be determined using several different types of laboratory tests. The two tests most commonly used to screen for iron deficiency are hemoglobin (Hgb) concentration and hematocrit (Hct). Proper screening for iron deficiency requires sound laboratory methods and procedures. Often, CPAs will hear the following questions:

- “Do you have to stick my finger? “
- “What does this have to do with my WIC foods anyway?”
- “Will it hurt?”

For most of us, the thought of having blood taken, even from a finger, is not pleasant. However, evaluating the results of a blood test is a part of screening for nutritional risk.

## Why Does WIC Require Hematological Assessment?

WIC requires that each applicant be screened for risk of a medical condition known as iron deficiency anemia. Anemia is a condition of the blood in which the amount of hemoglobin falls

below a level considered desirable for good health. It is often due to a deficiency of the nutrient, iron. Iron is important in the formation of healthy red blood cells. It combines with protein to form hemoglobin, the red substance in the blood that carries oxygen to the cells. Oxygen is used by the cells for energy production. Energy needs increase during times of growth, as in pregnancy, infancy, and childhood. A supply of iron is essential for proper growth to occur. Studies have shown that women, infants, and children that WIC serves are at risk for the type of anemia that is due to iron deficiency.

Iron deficiency anemia in an infant or child can lead to poor growth as well as learning and behavior problems. In a pregnant participant, it can cause the infant to be born prematurely or at a low birth weight. Iron deficiency anemia may also weaken the immune system, causing more frequent illnesses. It can also increase vulnerability to lead poisoning.

Iron deficiency anemia is a preventable public health problem. WIC as a public health nutrition program screens applicants who may be at risk for iron deficiency anemia. Those who are found to be at risk receive nutrition education to help them lower their risk of iron deficiency as well as foods that are high in iron and other important nutrients. When appropriate, WIC also refers participants to their medical provider for more thorough follow-up.

## Types of Blood Tests used in WIC

A blood test that measures the amount of hemoglobin in the red blood cells or determines hematocrit is required in WIC. A small sample of blood is needed for either test. These tests are considered to be “screening tests” for iron deficiency anemia. They are not used to diagnose iron deficiency anemia. A diagnosis of iron deficiency anemia can **only** be made by a health care provider, using more sensitive tests.

The two blood tests used to check for iron deficiency anemia are a **hemoglobin test** and a **hematocrit test**. A hemoglobin (Hgb) test measures the amount of hemoglobin in the blood. (Hemoglobin is the iron-containing molecule that carries oxygen to the cells of the body). Hemoglobin is measured as grams per deciliter of blood or gm/dl, such as a value of 12 gm/dl. This is the test performed in the Minnesota WIC Program.

A hematocrit (hct) test measures what part of the total blood is made up of red blood cells. Hematocrit is measured as a percentage, such as a value of 36%. Sometimes a hematocrit value is given as referral information from a medical clinic.

**Lead Test:** A blood lead test gives information about the amount of lead in the person’s body. It helps show if a person has lead poisoning. A child has lead poisoning if they have a blood lead level  $\geq 3.5$  mcg/dl. WIC should assure that participants with elevated lead levels receive follow up medical care for this condition.

## Preventing Blood Borne Pathogens

Blood is the most important body fluid for potential transmission of blood borne pathogens such as hepatitis B Virus (HBV) and human immunodeficiency virus (HIV) in the occupational setting.

All Local Agencies are required to have a written Exposure Control Plan. The Exposure Control Plan establishes guidelines, precautions, laboratory rules and standard operating procedures that will limit occupational exposure to blood borne pathogens and other infectious agents. These procedures and precautions need to be consistent with the Centers for Disease Control guidelines. In general, these procedures include:

- **Hand washing:** The single most important procedure to guard against transmitting infections is hand washing. Hand washing is defined as vigorous, brief rubbing together of all surfaces of lathered hands, followed by rinsing under a stream of water. CDC recommends a vigorous washing of at least 20 seconds.
- **Gloves:** Wear gloves (clean, non-sterile gloves are adequate) when touching blood, body fluids, secretions, excretions, or contaminated items. Wash hands immediately after glove removal to avoid the transfer of microorganisms to other people or environments.

**NOTE:** It is very important to follow your local agency’s Exposure Control Plan. Ask your WIC Coordinator for this plan.

## Who Must be Screened and How Often?

Federal regulations require that the blood test be performed and/or documented for applicants at certification. The test must be performed and/or documented for each participant category according to the following schedule:

- |                             |   |
|-----------------------------|---|
| <b>Pregnant Woman:</b>      | <b>At least once during the current pregnancy.</b> Bloodwork should be done at certification unless referral data is available.   |
| <b>Breastfeeding Woman:</b> | <b>Once, following the termination of pregnancy.</b> Not required at mid-certification at 6 to 9 months postpartum if the initial hgb/hct value was within normal range.  |
| <b>Postpartum Women:</b>    | <b>Once, following the termination of pregnancy.</b> Blood work should be done at certification unless referral data is available.  |
| <b>Infant:</b>              | <b>Once, between the ages of 9 and 12 months.</b>   |
| <b>Children:</b>            | <p><b>At least once a year for all children certified in WIC:</b></p> <ul style="list-style-type: none"> <li>▪ <b>Child certified as infant &amp; hematologic data entered between 9 &amp; 12 months:</b> Hematologic test at least once between 12 &amp; 24 months of age, ideally at the 15–19-month certification.</li> <li>▪ <b>Child first certified at or around 12 months:</b> At certification and again at the following mid-certification.</li> <li>▪ <b>Children <math>\geq</math> 2 years old at recertification:</b> Once each year. If the hgb/hct value was low at the previous certification or mid-certification, blood work must always be done.</li> </ul> |

## Procedure to Collect and Assess Hemoglobin Samples

### Equipment, Reagents, and Supplies

- HemoCue® photometer: Hb201+ model
- HemoCue® photometer: Hb301+ model
- HemoCue® microcuvettes (store at room temperature)
- Blood lancets single use, spring-loaded and retractable
- Gloves
- Alcohol
- Gauze or tissues
- Bandages

### Microcuvette Care

Microcuvettes contain a special chemical that mixes with the sample of blood. This chemical deteriorates over time, especially when exposed to air and moisture and can affect the results of your test. For this reason, you must follow special procedures for using the cuvettes.

Take a look at the bottle. The label contains a printed expiration date. This date should not have expired. When you open a new bottle of microcuvettes, you must write the date that it was opened on the label. Once the bottle is opened, the cuvettes **must be used within 90 days**. Before using a microcuvette, check both dates. If either date has expired, discard the bottle of microcuvettes.

Keep the bottle of cuvettes closed to protect them from air and moisture. Remove only what you will use **immediately**. Do not expose the cuvettes to air for more than a few minutes.

### Calibration Check for the HemoCue® Hb201+

During start-up of the Hb201+ photometer, the analyzer will automatically verify the performance of the optronic unit by performing an automatic SELFTEST. After 10 seconds, the display will show three flashing dashes and the HemoCue symbol. This indicates that the HemoCue Hb201+ has passed the SELFTEST and is ready for use. If the SELFTEST fails, an error code will be displayed.

### Calibration Check for the HemoCue® Hb301+

The Hb301+ photometer analyzer has an internal quality control, the self-test. It automatically verifies the performance of the analyzer every time it is turned on and at regular intervals if the analyzer remains switched on. The system is factory calibrated against international reference method for hemoglobin determination, ICSH. No further calibration is needed.

## Hemoglobin Testing

Remember to follow your local agency's Exposure Control Plan. Gloves should be worn throughout the procedure and disposed of after the procedure is completed.

1. Blood may be obtained from capillaries in the finger or toe of an infant. For an infant, obtaining the capillary blood sample from the toe may be easier. The most common sample for women and children is obtained from a finger.
2. Remove a cuvette from the vial and immediately replace the cap tightly to avoid humidity damage to the remaining cuvettes.
3. It is important that blood circulate freely in the sample finger, so fingers with rings on should not be used. The patient's fingers should be straight but not tense, to avoid the stasis effect which occurs when the fingers are bent.
4. Using your thumb in a gentle rocking movement, lightly press the finger from the top knuckle to the tip. This stimulates the flow of blood to the sampling point. Circulation can be stimulated by having the applicant hold her/his hand down below the heart and make a fist several times.
5. Clean the skin with an alcohol swab and dry the finger before making the puncture. Drying the finger prior to the stick is important because alcohol is painful in a cut, and it could mix with and dilute the blood giving a low reading or it could cause clotting of the sample.
6. Using gentle pressure, hold the finger at the top knuckle with your thumb. Make the puncture at the side of the fingertip with a lancet. Make the puncture deep enough so blood will FLOW FREELY from the puncture. Do NOT 'milk' or squeeze the finger because this forces tissue fluid into the sample resulting in an incorrectly low reading.
7. Using dry gauze, wipe away the first 2-3 drops of blood. This stimulates blood flow and 'clears' tissue fluid from the site which could dilute the specimen. Do not use cotton balls. Cotton fibers may hinder the flow of blood.
8. Apply light pressure until another drop of blood appears but avoid squeezing the finger near the puncture site. Make sure that the drop of blood is big enough to fill the cuvette completely. Place the cuvette tip in the middle of the drop of blood. The cuvette should fill in a continuous process. Do not refill!
9. Wipe off any excess blood from the outside of the cuvette, being careful not to touch the curved edge. Check for the presence of air bubbles in the center of the cuvette. If present, a new sample should be tested. Small bubbles around the edge don't influence the result.
10. Place the filled cuvette in the holder and insert to the 'measuring' position. The results will display in about 15-60 seconds.
11. Discard the cuvette into an appropriate bio-hazard container.

## Helpful Hints

- Increase blood circulation by having the participant hold their hand under warm water for a few minutes.
- Have the participant open and close the hand or rub the participant's hand between your two hands to increase blood circulation.

## Sources of Error

- Excess squeezing of the finger. This dilutes the blood sample.
- Failure to dry puncture site after wiping with an alcohol pad. Blood will not form a drop at a wet puncture site.
- Failure to wipe off the first 2 – 3 drops of blood. These drops may be mixed with alcohol or contain broken red blood cells and extra plasma.
- Reading the sample incorrectly.
- Recording errors.

## HemoCue Training Resource

[Welcome to HemoCue OnCue™ Education](#)– HemoCue OnCue™ Support is a comprehensive training designed to meet your needs as quickly and conveniently as possible. There are two machine modules for Public Health and WIC Programs to choose from (201 or 301).

- **Log on** to the HemoCue online education system: [Welcome to HemoCue OnCue™ Education](#)
- **Register and select** the HemoCue training module that correlates to the machine used in your clinic. The modules provide detailed instructions on HemoCue use.
- **Complete** the training and download your certificate of completion.

**Continue to the next page for a Practice Activity**

## Practice Activity

1. Review your agency’s Exposure Control Plan with your WIC Coordinator.
2. Observe several co-workers as they conduct the hematological assessment in the WIC clinic. Use the following table to monitor the procedure.

### Observation of Correct Procedure for Blood Collection & Assessment

Name of Observed Staff \_\_\_\_\_

KEY: A = Appropriate

NA = Not Appropriate

A

NA

Located proper puncture site:		
Finger site cleaned with alcohol:		
Quick firm puncture with lancet:		
First 3 drops of blood wiped away:		
Finger not squeezed, or milked, to increase flow:		
Cuvette filled correctly:		
Outside of cuvette free of blood:		
Cuvette disposed of properly:		
Gloves worn throughout entire procedure:		
Gloves disposed of properly:		

Continue to the next page for the Final Skills Check

## Final Skills Check

The most commonly known form of nutritional deficiency is “iron deficiency”.

T F

Iron deficiency is observed more frequently in postpartum women.

T F

The two tests most commonly used to screen for iron deficiency are hemoglobin (Hgb) concentration and hematocrit (Hct).

T F

It isn't necessary to wear protective gloves.

T F

Hematocrit is the amount of whole blood that is red blood cells and is an indicator of the amount of iron in the body.

T F

CDC recommends a vigorous rubbing together of all lathered surfaces during hand washing for at least 20 seconds.

T F

Excessive squeezing of the punctured finger to get a drop of blood will not alter the blood sample.

T F

It is not necessary to dry the puncture site after wiping with the alcohol pad.

T F

After puncturing, only the first drop of blood must be wiped off.

T F

Microcuvettes contain a special chemical that deteriorates over time.

T F

Once a bottle of cuvettes is opened, the cuvettes must be used within 100 days.

T F

The bottle of cuvettes must be kept closed to protect them from air and moisture.

T F

Small air bubbles in the center of the cuvette will not affect the results.

T F

Microcuvettes must be completely filled with blood.

T F

It is important to wipe off excess blood from the tip of the cuvette by gently touching both of the flat sides of the filled cuvette on a dry gauze pad.

T F

Hemoglobin carries iron and oxygen in the blood.

T F

### **Module Answer Keys**

## **Reference: A Complete Listing of Hyperlinks**

Welcome to HemoCue OnCue™ Education (<https://hemocueoncue.education/>)

Module Answer Keys

(<https://www.health.state.mn.us/people/wic/localagency/training/answerkeys.html>)

*Minnesota Department of Health - WIC Program, 25 Robert St N, PO BOX 64975, ST PAUL MN 55164-0975; 1-800-657-3942, [health.wic@state.mn.us](mailto:health.wic@state.mn.us), [www.health.state.mn.us](http://www.health.state.mn.us); to obtain this information in a different format, call: 1-800-657-3942.*

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