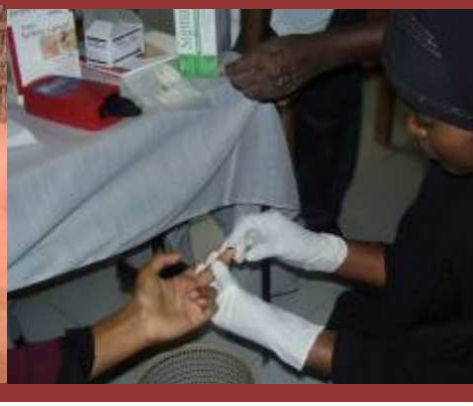
UNHCR STANDARDISED EXPANDED NUTRITION SURVEY (SENS) GUIDELINES FOR REFUGEE POPULATIONS

MODULE 2: ANAEMIA





A PRACTICAL STEP-BY-STEP GUIDE

VERSION 2 (2013)

UNHCR
The UN Refugee Agency

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KEY MESSAGES

- Data on the prevalence of anaemia is essential to collect in refugee settings for monitoring purposes. This module is only intended to be used for assessing anaemia status of population through nutrition surveys and is distinct from assessment in a clinic or hospital.

- Data should be collected on the prevalence of anaemia among children aged 6-59 months and non-pregnant women of reproductive age (15-49 years). Although rare, other age groups are sometimes also included when justified.

- Standard questionnaires should be used for the collection of anaemia data.

- Standard methods should be followed for measuring haemoglobin (Hb) using the HemoCue machine and for standardising the process to maintain the quality, reliability and usability of the results.

- Providing good quality training to survey teams collecting Hb data, supervising them well, and checking the quality of the equipment and measurements on a regular basis throughout the survey will help ensure that the anaemia data are reliable.

- There are standard ways of reporting anaemia results that should be followed in all nutrition survey reports produced in refugee contexts.

DEFINITION OF SOME KEY TERMS

Haemoglobin: the oxygen-carrying part of red blood cells. The amount of haemoglobin (Hb) in blood is typically expressed in g/dL (grams of Hb per decilitre of blood). It is also sometimes expressed in g/L (grams of Hb per litre of blood).

Anaemia: a condition caused by a reduced Hb concentration in the blood (i.e. decrease in number of red blood cells). This results in reduced oxygen-carrying capacity, and may lead to reduced aerobic activity in the body's cells.

Antenatal Care Clinic: commonly referred to as ANC. Those clinics provide care and follow-up for pregnant and lactating women.

Iron deficiency: not enough iron in the body can result in iron deficiency anaemia because iron is necessary to make Hb. Iron deficiency is due to inadequate dietary iron and blood loss.

HemoCue: portable device used to measure Hb concentration in the blood.

Iron-folic acid pills: supplements provided to pregnant and lactating women where anaemia or iron deficiency prevalence is high. WHO recommends that supplements contain 60 mg of iron and 400 µg of folic acid.

OBJECTIVES AND TARGET GROUPS

– The standard target groups to routinely include in an anaemia assessment in refugee contexts are: children aged 6-59 months and non-pregnant women of reproductive age between 15-49 years (including lactating women[1]).

– Collect anaemia data on other age groups if necessary and if feasible, as outline in **Table 1**. **Contact UNHCR HQ / Regional Offices for further guidance on assessing these groups**.

Objectives should be worded as follows in the survey protocol and report:

Primary objective:

– To measure the prevalence of anaemia in children aged 6-59 months *and* in women of reproductive age between 15-49 years (non-pregnant).

Secondary objective:

– To determine enrolment into Antenatal Care Clinic and coverage of iron-folic acid supplementation in pregnant women.

Things to note:

- There will be Antenatal Care Clinic (ANC) in most refugee settings to take care of and follow-up on pregnant and lactating women. A nutrition survey is a good opportunity to ask about enrolment of the surveyed pregnant women into the ANC running in the area and ask if they are receiving iron-folic acid supplementation. This will only provide a rough estimation of the coverage of such programmes due to the small sample size of pregnant women found during nutrition surveys, but can still highlight problems. This is why this objective should always be worded as a secondary objective.

[1] Anaemia cut-offs for pregnant women should be adjusted depending on the stage of pregnancy. In surveys, gestational age is difficult to ascertain and rarely collected. Because of these difficulties and the small sample size, pregnant women are not included in nutrition surveys for the assessment of anaemia in refugee settings.

TABLE 1 SAMPLING ADDITIONAL, OPTIONAL AGE GROUPS

Target group	When	Advantages	Challenges
School-aged children	- if an iron intervention is planned to be targeted at school-aged children and needs and / or impact have to be assessed Or - if there are good reasons to believe there may be a widespread problem in this age group.	-knowledge about the prevalence to target prevention activities.	-may be difficult to find enough eligible children if school attendance is high. In this situation, consider sampling from schools.
Adolescents 13-18 years	-if an iron intervention is planned to be targeted at adolescent girls and needs and / or impact have to be assessed Or - if there are good reasons to believe there may be a widespread problem in this age group.	-knowledge about the prevalence to target prevention activities.	-may be difficult to find enough adolescent girls if school attendance is high.
Pregnant women	-if the prevalence of anaemia in pregnant women needs to be known for advocacy purposes for example to initiate or improve ANC services such as iron and folic acid supplementation.	- knowledge about the prevalence to target prevention activities.	-the appropriate cut-offs for anaemia depend on the gestational age of the pregnancy so calculating an accurate prevalence is not straightforward. -may be difficult to find enough pregnant women to reach the minimum required sample size. -in some cultures, some women may be reluctant to admit that they are pregnant; some women may not know that they are pregnant early in pregnancy.

DATA COLLECTION

MEASUREMENT METHODS

Haemoglobin concentration in children 6-59 months and women 15-49 years: Hb concentration is taken from a capillary blood sample from the fingertip and recorded to the closest gram per decilitre (g/dL) or gram per litre (g/L) by using the portable HemoCue machine. If severe anaemia is detected, the measurement may be repeated for confirmation purpose.

Age of children 6-59 months and women 15-49 years: exact date of birth or month and year of birth calculated using local events calendar should be recorded for children. Refer to **Module 1** (Anthropometry and health) for information on collecting children's age. For women, the exact date of birth is not recorded; reported age is recorded in years.

Pregnancy status: Hb concentration is affected by pregnancy and therefore it is necessary to know whether the surveyed woman is pregnant or not. In addition, this information is linked to the household information on mosquito net utilisation (see **Module 6** on mosquito net coverage). A verbal confirmation is sufficient for the purpose of the nutrition survey.

ANC enrolment and iron-folic acid pills coverage: it is standard to enrol a pregnant woman in an ANC programme and to distribute iron and folic acid supplements to women in the second and third trimester of pregnancy. Women may also receive supplements during lactation in many refugee operations. Verbal confirmation is sought on whether the woman is currently enrolled in the ANC programme and is receiving any iron-folic acid pills.

MATERIAL NEEDED

– A supplies planning tool is provided to help in calculating the amount of equipment and supplies needed and to estimate the overall cost. See SENS Pre-Module tool: [**Tool 8**-Survey Supplies Planning Tool].

– A list of international suppliers is provided in **Annex 1**.

– The SENS questionnaires for children 6-59 and for women are shown in **Annex 2** or see SENS Pre-Module tool: [**Tool 9**-Full SENS Questionnaire].

Haemoglobin concentration measurements:

– HemoCue Hb 301 Analyser and Analyser cases
– Safety lancets (sizing of at least 2.25mm)
– HemoCue microcuvettes
– HemoCue cleaning spatula (for cleaning interior of HemoCue machine)
– Eurotrol Hb 301 Control solutions: high, low, normal (for quality control of the entire HemoCue system i.e. both HemoCue machine and microcuvettes; this check is different than the internal electronic self test)
– Cotton balls, antiseptic or alcohol swabs
– Latex gloves
– Sticking plasters / band aids (optional)
– Gauze pad or tissue paper (for wiping blood drop)
– Biohazard waste containers (for sharps and contaminated supplies)
– Spare batteries (for HemoCue machine)
– Questionnaires (always carry extra copies)
– Referral forms to refer severely anaemic children and women for treatment[2].

[2] Referral and treatment for anaemia should follow local treatment standards.

CASE DEFINITION

– Anaemia is said to exist when the level of circulating Hb in the patient is lower than that of healthy persons of the same age group and sex in the same environment. The most common type of anaemia is due to iron deficiency resulting from inadequate iron intake from foods.

– Hb levels should be categorised according to WHO recommended cut-offs (shown in **Table 2**) to determine the prevalence of anaemia.

TABLE 2 DEFINITION OF ANAEMIA

Age/Sex groups	**Categories of Anaemia* (Hb g/dL)**			
	Total	Mild	Moderate	Severe
Children 6 - 59 months	<11.0	10.0-10.9	7.0-9.9	< 7.0
Non-pregnant adult females 15-49 years **	<12.0	11.0-11.9	8.0-10.9	< 8.0
Pregnant Women***	<11.0	10.0-10.9	7.0-9.9	< 7.0

Source: WHO (2000) The Management of Nutrition in Major Emergencies. Values are given for a population living at sea level.

*These categories are for people living at sea level. At elevations above 1000m, Hb concentrations increase as an adaptive response to the lower partial pressure of oxygen and reduced oxygen saturation of blood. The compensatory increase in red cell production ensures that sufficient oxygen is supplied to tissues.

** This category includes lactating women.

***Anaemia cut-offs for pregnant women should be adjusted depending on the stage of pregnancy. In surveys, gestational age is difficult to ascertain and rarely collected. Because of these difficulties and the small sample size, pregnant women are not included in nutrition surveys for the assessment of anaemia in refugee settings.

ETHICAL CONSIDERATIONS

Referral process for severely anaemic individuals should be done as follows:

- A standard questionnaire will be administered with the consent of the householder. Refer to **SENS Pre-Module Step 13** for guidance on approaching households and seeking informed consent.

- The participants should be referred for treatment if found to be severely anaemic according to the local treatment standards (if treatment facilities are available). If referring patients, the agreement of the health facilities should be obtained before the survey starts (**severe anaemia cases need urgent follow-up**).

- Severely anaemic participants should be given a paper referral slip to take with them to the health facility. Refer to **Annex 3** for an example of a referral slip to use during the survey.

STANDARD PROCEDURE AND QUALITY ASSURANCE

- Use the **HemoCue Hb 301 Analyser**, instead of the HemoCue B-Haemoglobin or HemoCue 201, as it is more suited for field conditions.
- Once the seal of the microcuvette container is broken, the microcuvettes are stable for three months *only*.
- Do not use microcuvettes if the container has been opened for more than three months. (Tip: write the date of opening on the container)
- Record the Hb results according to the unit given by the HemoCue machine; it will be either grams per litre (g/L) or grams per decilitre (g/dL).
- Use g/dL as the unit for reporting Hb measurement results in the final SENS report.
- Equipment and supplies should be carried in a back pack with great care (similar to a laptop computer). The HemoCue machine should be carried in its hard-cover case to ensure safe transport and protection from dust and moisture. (Tip: an Analyser case can be ordered from the manufacturer of HemoCue)

FIGURE 1 HEMOCUE HB 301 ANALYSER, MICROCUVETTES, CARRY CASE, AND SAFETY LANCETS

Things to watch out for:

- Even if left unopened, HemoCue microcuvettes have a short shelf life after time of manufacturing. When placing the order, be sure to ask the manufacturer the expiry date of the boxes that will be shipped.

- Use only one type of HemoCue machine in a survey to avoid any confusion and mixing up of microcuvettes that are not compatible (microcuvettes for HemoCue 201 cannot be used in a HemoCue 301 machine).

- Ensure to use an Analyser carry case to transport the HemoCue machines and the supplies. This will ensure the supplies are well protected from dust.

The following procedures need to be followed during the survey by the coordinator:

- **Check microcuvette container daily**: check the microcuvette containers of each team to ensure that enough are left for conducting the Hb tests for the day. If not, ensure the survey team carries an additional microcuvette container with them.
- **Inspect HemoCue machine daily**: visually inspect the HemoCue machine of each team to ensure that it is clean. If not, follow the cleaning procedures described in **Box 1**.
- **Clean microcuvette holder (when needed)**: visually inspect the HemoCue microcuvette holder of each team to ensure that it is clean. If not, follow the cleaning procedures described in **Box 2**.
- **Check function of HemoCue machine at least twice during the survey (baseline and mid-point)**: a control of the total system i.e. both photometer and microcuvette, should be performed with liquid control solutions before the survey and at mid-point; this check is different than the self test of the machine itself mentioned below. Control solution (Eurotrol Hb 301 Control) results should fall within assigned ranges. Record the results in a Quality Assurance Logsheet for each HemoCue machine used in the survey. For an example of a form to use for this purpose, see **Annex 4** or see SENS Anaemia Module tool: [**Tool 1**-Anaemia Quality Assurance Logsheet]. If there is a problem, replace the HemoCue machine for the rest of the survey and contact your HemoCue distributor.
- **Understand error codes:** the HemoCue 301 Analyser has an internal electronic self test; this self test is automatic and is only done on the machine (and not on the microcuvette) and is meant to complement the check with the control solutions. Every time the analyser is turned on, it will automatically verify the measurement performance. This test is performed at regular intervals if the analyser remains switched on. Upon passing the self test, the display will show the HemoCue symbol and three flashing dashes, indicating that the analyser is ready to perform a measurement. An error code will be displayed if this self test fails. Refer to the troubleshooting guide in **Annex 5** to see a description of error codes and action to be undertaken in case of problem or see SENS Anaemia Module tool: [**Tool 2**-Troubleshooting Guide HemoCue 301]. If you are unable to resolve the problem by following the guide, replace the HemoCue machine for the rest of the survey and contact your HemoCue distributor.

BOX 1: CLEANING PROCEDURES FOR HEMOCUE MACHINE

- Wipe the exterior of the HemoCue machine with a damp cloth that has been rinsed in
  soap and water. Ensure the cloth is not too wet before wiping the machine.
- **Never** use soap and water on the interior of the HemoCue machine. Use the HemoCue cleaner (spatula[3]) for cleaning the interior of the machine.
- Record that the HemoCue machine was cleaned in the Quality Assurance Logsheet.

FIGURE 2 HEMOCUE CLEANER (SPATULA)

BOX 2: CLEANING PROCEDURES FOR MICROCUVETTE HOLDER

- Wear gloves and gently remove the microcuvette holder from the machine.
- Wipe the microcuvette holder with an alcohol swab or a disinfectant solution.
- Allow it to air dry completely or dry it completely with gauze if necessary before re-inserting it in the HemoCue machine.
- Record that the HemoCue machine was cleaned in the Quality Assurance Logsheet.

[3] Note that the HemoCue Cleaner (spatula) should not be used on HemoCue B-Hemoglobin photometers produced earlier than July 1992. Read the relevant Operating Manual to make sure that the cleaner may be used.

TRAINING

- The training needs to contain a mix of theory, practical exercises, a standardisation exercise, as well as a written test.

- Each survey team should have ***at least*** one member who has been trained and tested to take Hb measurements.

- It is crucial that the coordinator(s) refresh their skills before beginning the training.

- The training will last at least one full day with half a day on theory and practice, and half a day on the standardisation exercise.

THEORETICAL COMPONENT

The theoretical component on haemoglobin measurement should include the following information:

- Responsibilities of team members
- Equipment and supplies needed
- Standard procedures to follow (standard protocol, informed consent, ethical considerations and referral)
- Safety measures to follow
- Maintenance and transport of equipment
- Common errors and ways to avoid them
- A written test is provided in **Annex 6**. For answers, see SENS Anaemia tool: [**Tool 3**-Anaemia Test Surveyors Answers].

*The following procedure needs to be followed to **stick a finger**:*

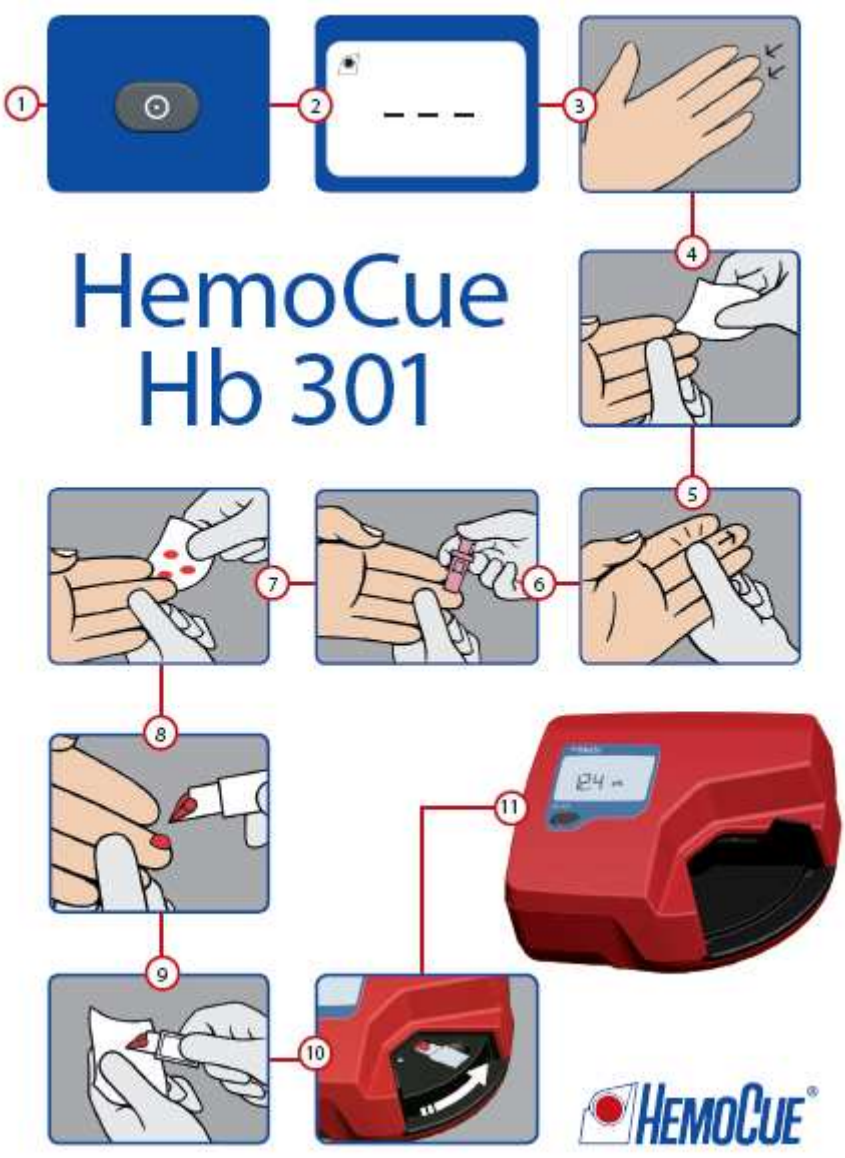
- **Explain procedure**: briefly explain the procedure and explain that they may experience a little pain from the finger prick. Explain that the benefits to participants will be that their anaemia status will be known and that they will be referred to the health clinic if they are found to be severely anaemic. If the participant is uncomfortable with the procedure, answer any questions s/he may have. Ensure that the participant knows that s/he is free to withdraw from the survey at any time and that nothing bad will happen if s/he does.
- **Prepare workstation**: put on a new pair of gloves and layout all the supplies to be used for the measurement on a piece of paper roll. Close the microcuvette container immediately after taking out the microcuvette. In very hot climates (more than 40 °C), do ***not*** leave the microcuvette out of the container for longer than five minutes and transport the HemoCue machine and microcuvettes in cool boxes whenever available.
- **Ensure correct position of participant**: face the participant and, if you are right-handed, position yourself to be able to comfortably hold the participant's finger with your left hand while using your right hand to hold the lancet or microcuvette (reverse if you are left-handed). A young child who is tested should be seated on the mother's or caregiver's lap, and be provided with reassurance and distracted during testing.
- **Hold participant's hand**: do not hold the participant's hand so tightly so as to obstruct blood flow.
- **Select finger**: choose the participant's middle or ring finger for the finger stick. The selected finger should not be callused or swollen. Remove any rings that are on this finger because the ring might interfere with blood flow. Rings on other fingers do not have to be removed unless they are in the way of the tester.
- **Check finger**: feel the participant's fingers for warmth. If the fingers are cold, rub the fingers vigorously. If warm water is available, you can also warm them by washing them in the warm water.
- **Massage finger**: hold the participant's finger for the finger stick. Use a rolling motion to gently massage the finger from the top of knuckle towards the finger tip to increase blood flow.
- **Disinfect finger**: clean the participant's fingertip with an antiseptic alcohol swab and allow to air dry.
- **Hold finger**: hold the participant's finger and apply gentle pressure to firm the skin so that the lancet will go deeper into the finger.
- **Place lancet**: hold the lancet between two fingers and rest the thumb on the needle trigger. Place the lancet on the side of the fingertip rather than on the pad of the fingertip.
- **Stick finger**: use a rolling motion to massage the participant's finger even more from the top of knuckle towards the finger tip to increase blood flow. Push the lancet against the participant's skin before triggering the needle with your thumb. Dispose of the lancet immediately after use in a biohazard waste container.
- **Initiate blood flow**: apply gentle pressure to the wrist, palm and top of knuckle to initiate blood flow. Do **not** squeeze or rub the tip of the finger because you may dilute the blood drop with interstitial fluid.

*The following procedure needs to be followed to **fill the microcuvette** after the finger has been pricked:*

- **Wipe away 1st and 2nd blood drop**: using a clean **dry** gauze pad or tissue paper, wipe away the first two drops of blood. **Do not wipe away the drops with alcohol.**
- **Sample 3rd drop**: sample the third drop of blood. The drop of blood should be large enough to fill the microcuvette in one touch. Note that the HemoCue 301 instructional movie mentions sampling the 4th drop. **It is acceptable and recommended to sample the 3rd drop of blood unlike what is shown in the HemoCue 301 movie demonstration.**
- **Fill microcuvette**: hold the finger in one hand. Touch the tip of the microcuvette into the middle of the blood drop and fill the microcuvette completely with a single drop of blood in one step. The microcuvette fills itself by capillary action.
- **Inspect microcuvette**: inspect the microcuvette for air bubbles and check if it is completely filled by holding it up to the light. If you see air bubbles, discard the microcuvette. If you see that it is not completely filled, discard the microcuvette. **Never refill a partially filled microcuvette with the same drop of blood** because the blood may have started to clot and will give an incorrect reading. If a new microcuvette is needed, refill a new microcuvette from a new blood drop from the same finger puncture if feasible. Otherwise, you may have to make a new prick. If you do need to make another prick, you should use another finger.
- **Wipe off excess blood**: carefully wipe off any excess blood from the flat sides of the microcuvette with a clean dry gauze pad or tissue paper. Make sure that no blood is sucked out of the microcuvette while wiping it.
- **Place microcuvette in holder**: immediately place the filled microcuvette into the microcuvette holder and read the microcuvette within three minutes of sampling.
- **Slide holder**: gently slide the microcuvette holder into the machine until the stop point is reached. Do not 'slam' the holder into position for reading. This may spray blood droplets, which negatively affects the reading.
- **Apply a cotton ball or sticking plaster**: while the HemoCue machine is reading the sample, apply a cotton ball or a plaster to the puncture wound on the participant's finger.
- **Record reading**: after a few seconds, the Hb value will appear on the display. Record this value.
- **Dispose microcuvette**: dispose the microcuvette immediately in the biohazard waste container after reading it.

– **Dispose of gloves and contaminated material**: dispose of the gloves and contaminated supplies in the biohazard waste container. All blood samples and contaminated supplies should be handled with extreme care because blood is a potential source of infection with HIV, Hepatitis B and C Virus and other blood-borne pathogens.

FIGURE 3 STANDARD PROCEDURE USING THE HEMOCUE



*This checklist should be followed by survey workers to **protect themselves and the survey population from exposure to blood**:*

- **Wash your hands**: always wash hands with soap and water at the start and end of the workday (or before and after each break) and dry hands with a clean paper towel.
- **Cover your cuts**: cover all cuts with bandages to prevent any possibility of blood from survey population coming into contact with any cuts.
- **Wear gloves**: always wear well-fitting disposable latex gloves when sampling blood to protect against exposure to blood. Gloves must be worn during Hb measurement until all specimens and materials are disposed of. Gloves must be disposed of as bio hazardous waste. Gloves must be never reused! Always order large size for men and medium size for women. The sample collector must have the correct size of glove for them to use.
- **Use new pairs of gloves for each participant**: always change gloves after collecting blood from each participant and dispose of the gloves at the end of the testing in the biohazard waste container.
- **Avoid penetrating injuries**: although gloves can prevent blood contamination, they cannot prevent penetrating injuries caused by the instruments used for finger sticks. It is highly recommended to use self-retractable single-use lancet devices to reduce the risk of penetrating injuries. Lancets should not be used for purposes other than a single finger stick to collect blood for the anaemia testing. The lancets should not be broken or destroyed for curiosity or other purposes. Immediately after the testing is completed, the devices should be placed in a puncture-resistant container for further disposal.
- **Clean up blood spills**: immediately clean up any blood spills with antiseptic swabs so that survey workers and participants do not touch any blood.
- **Disposal in biohazard waste**: all materials coming in contact with blood must be placed in bio hazardous waste containers after use and disposed of according to standards. Immediately dispose of any tissue paper, gloves, gauze pads, used lancets, microcuvettes and other supplies that have been in contact with blood in the biohazard waste container.
- **Labelling of bio hazardous waste containers**: the bio hazardous waste containers must be labelled '*biohazard*'. Take precaution when storing and transporting the waste containers during the fieldwork, and establish procedures to ensure proper disposal of all waste products.
- **If an accident occurs**: any skin surfaces or mucous membranes that come in contact with blood must be immediately and thoroughly washed with a large amount of water and soap. The survey coordinator is to be contacted immediately.
- **No eating and drinking during blood collection**: eating and drinking may distract from the procedure and are not permitted during blood collection.

Things to watch out for:

- **Table 3** describes the most common errors experienced by survey workers in data collection.

TABLE 3 COMMON ERRORS EXPERIENCED IN DATA COLLECTION

Common error	Description	Solution
Improperly stored microcuvettes	Improperly stored microcuvettes should not be used for testing. Microcuvettes should not be kept in unsealed containers for longer than 3 months.	The containers must be kept closed when not in use to avoid exposure to moisture.
Not setting-up properly	Not preparing all needed materials before testing a participant may affect the quality of the reading.	Place a microcuvette, alcohol swab, gauze pad or tissue paper, and lancet on work station; turn on HemoCue machine; pull out microcuvette holder to 'locked' position so that digital screen reads 'ready'; put on latex gloves.
Removing microcuvette from container with fingers wet with alcohol	This can result in alcohol coming into contact with the microcuvette; thus the selected microcuvette as well as others inside the container can be destroyed.	Take the microcuvette out of its container before handling a wet alcohol swab.
Underfilling the microcuvette	**The microcuvette is only partially filled or only the red circle of the microcuvette is filled with blood. Never** use an under filled microcuvette and never refill a partially filled microcuvette with same drop of blood because the blood may have started to clot and will give an incorrect reading. 	Refill a new microcuvette from a new blood drop from the same finger puncture if feasible. Otherwise, you may have to make a new prick. If you do need to make another prick, you should use another finger.

Common error	Description	Solution
Mixing alcohol with blood drop	Not letting finger to dry completely after disinfecting with alcohol will give a faulty reading. Even a trace of alcohol getting into the microcuvette will affect the reading.	Allow finger to air dry after wiping with alcohol.
Shallow finger puncture	A finger puncture that is too shallow because lancet was not properly placed or not enough pressure was placed while releasing the lancet will restrict blood flow.	A deep puncture done with a quick stab will result in better blood flow and more rapid completion of the test.
Obstructing blood flow	Restricting blood flow to the participant's fingertip following the finger stick because the finger is held tightly will affect testing.	Release the participant's finger after the stick to allow blood flow; also hold the participant's hand without squeezing and restricting blood flow to the finger tip.
'Milking' the finger	Excessive massaging or squeezing of the finger will cause tissue juice (interstitial fluid) to mix with and dilute the blood. This will result in erroneous test results, particularly in yielding low levels of Hb concentration in the blood.	A good finger stick should result in spontaneous blood flow, negating the need to apply pressure to the finger. If stimulating blood flow is needed, apply ***gentle*** pressure with your thumb on the opposite side of the participant's finger from the puncture site.
Using the wrong drop of blood	Not appropriately wiping off the first two drops may result in an unrepresentative blood sample being tested.	Firmly wipe off the first two large blood drops. Firm wiping will stimulate blood flow. Discarding the first two large drops will allow flow of a representative blood sample.
Air bubbles in microcuvette	Holding the microcuvette in inverted position (slit facing down) during filling can lead to air bubbles being trapped resulting in erroneous reading.	Hold the microcuvette with the slit facing up and the pointed tip touching the blood drop.
'Topping off' the microcuvette	'Topping off' a partially filled microcuvette with repeated blood collection will result in erroneous measurement. Red cells of blood introduced later will not be adequately analysed.	Allow a large blood drop to form on the participant's finger so that it will completely fill the microcuvette in one motion. Once filled, hold the microcuvette in place for about 2-3 seconds longer to ensure complete filling.

Common error	Description	Solution
Blood on outside of microcuvette	Not cleaning off blood on outside of microcuvette before testing can result in erroneously high reading.	Wipe off excess blood from sides of microcuvette using a 'butter knife' motion to ensure that blood from inside the microcuvette is not removed.
Inadequate placement of the microcuvette	'Slamming' the microcuvette holder into place can lead to blood drops spattering inside the reading chamber. This action can damage the reader.	Push the microcuvette holder gently into position. Clean the microcuvette holder with an alcohol swab or disinfectant solution, and completely dry before testing. Periodically clean the interior of the HemoCue machine with a spatula.
Not referring the severely anaemic participants according to local treatment standards	The participant is diagnosed as severely anaemic and the surveyors do not refer the participant according to the local treatment standards when a facility is available.	Participants should be referred for treatment if found to be severely anaemic according to the local treatment standards and should be given a paper referral slip to take with them to the health facility.

PRACTICAL COMPONENT

The practical training on haemoglobin measurement should include the following activities:

- The coordinator conducts a demonstration and the trainees practice on each other, taking at least one measurement from two different fingers.

- An exercise to standardise the trainees' Hb measurements should be conducted. For instructions on the recommended exercise see **Annex 7** or see SENS Anaemia tool: [**Tool 4**-Anaemia Standardisation Exercise].

DATA ENTRY

- The recommended names and descriptions of the standard variables (as shown in SENS Children 6-59 and Women questionnaires shown in **Annex 2**), and the range of correct values and correct codes are shown in **Tables 4-5**.

- A standard Epi Info View for data entry of the women anaemia data is shown in **Annex 8**. Free guidance on the use of Epi Info for Windows and training material on Epi Info can be found at the following site: http://www.cdc.gov/EpiInfo

Children 6-59 months

TABLE 4 DATA DICTIONARY FOR ANAEMIA ASSESSMENT IN CHILDREN 6-59 MONTHS OF AGE (WITH INSTRUCTIONS ON THE USE OF ENA FOR SMART)

Question number	Suggested variable name	Description	Conditions	Special Instructions
CH1	ID	Child number in the household	As many eligible children as there are in the surveyed household	See **Module 1** for more details and information on ENA for SMART.
CH2	HH	Household number	The number of households should equal to the total number of households surveyed	See **Module 1** for more details and information on ENA for SMART.
CH3	CHCONST	Consent given by the caregiver for the child measurements	Valid values are: 1=Yes 2=No 3=Absent (this variable does not necessarily need to be entered into ENA for SMART; see **Module 1** for more details)	For consent, follow instructions described in **SENS Pre-Module Step 13.** An individual will be marked as 'absent' only after at least two re-visits to the household have been made. This does not necessarily need to be entered onto database. This column is to ensure that consent is asked and obtained; and that absent individuals are recorded and followed-up on.
CH15	CHHB	Hb concentration measurement in g/L or g/dL	Ranges[4] from 2.0 to 22.0 (users need to add variable in ENA for SMART Data View and set range values in Variable View; see **Module 1** for more details)	This variable needs to be created in ENA for SMART software (see **Module 1** for more details). Record the data according to the unit given by the HemoCue machine (g/L or g/dL). For analysis, always use or convert the value to g/dL.

[4] This feasible range is wider than the one recommended by others (Sullivan et al. 2008 recommend 4.0-18.0 g/dL) for the following reasons: (1) an Hb value of 2 g/dL is biologically plausible although it has only been reported in rare conditions; (2) an Hb value of 22 g/dL would account for populations living at high altitudes; and (3) this range is meant to be used globally. KM Sullivan et al. Haemoglobin adjustments to define anaemia. Tropical Medicine and International Health. Vol 13 no 10 pp 1267-1271 October 2008

Women 15-49 years

TABLE 5 DATA DICTIONARY FOR ANAEMIA ASSESSMENT IN WOMEN OF REPRODUCTIVE AGE (NOTE THAT ENA FOR SMART CANNOT CURRENTLY BE USED FOR ENTERING AND ANALYSING DATA ON WOMEN; EPI INFO IS RECOMMENDED TO BE USED FOR THE WOMEN'S DATA)

Question number	Suggested variable name	Description	Conditions	Special Instructions
WM1	WMID	Woman number in the household	As many eligible women as there are in the surveyed household.	-
WM2	HH	Household number	The number of households should equal to half the total number of households surveyed.	-
WM3	WMCONST	Consent given by the woman herself	Valid values are: 1=Yes 2=No 3=Absent (this variable does not necessarily need to be entered in the database)	For consent, follow instructions described in **SENS Pre-Module Step 13**. An individual will be marked as 'absent' only after at least a few re-visits to the household have been made. This column is to ensure that consent is asked and obtained; and that absent individuals are recorded and followed-up on.
WM4	WMAGE	Age in years	Ranges from 15-49 years	Reported age is recorded.
WM5	PREGNANT	Pregnancy status	Valid values are: 1=Yes 2=No 8=Don't know	Make sure to adapt the question to the context to ensure that it is asked in a culturally acceptable manner. If the answer is 'yes', you will only answer the remaining questions WM6-WM7 and not measure Hb. If the answer is 'no' or 'don't know', the woman should be assessed for anaemia and it will be assumed that she is not pregnant.

Question number	Suggested variable name	Description	Conditions	Special Instructions
WM6	ANC	Women currently enrolled in ANC programme	Valid values are: 1=Yes 2=No 8=Don't know	-
WM7	FEREC	Women currently receiving iron-folic acid pills	Valid values are: 1=Yes 2=No 8=Don't know	-
WM8	WMHB	Hb concentration measurement in g/L or g/dL	Ranges[5] from 2.0 to 22.0	Record the data according to the unit given by the HemoCue machine (g/L or g/dL). For analysis, always use or convert the value to g/dL.

[5] This feasible range is wider than the one recommended by others (Sullivan et al. 2008 recommend 4.0-18.0 g/dL) for the following reasons: (1) an Hb value of 2 g/dL is biologically plausible although it has only been reported in rare conditions; (2) an Hb value of 22 g/dL would account for populations living at high altitudes; and (3) this range is meant to be used globally. KM Sullivan et al. Haemoglobin adjustments to define anaemia. Tropical Medicine and International Health. Vol 13 no 10 pp 1267-1271 October 2008

DATA CLEANING

DAILY QUESTIONNAIRE CHECK- FOR CONSISTENCY, COMPLETENESS AND READABILITY

At the end of each field work day, look at the filled questionnaires from each team and follow the procedure described below:

- Check that consent was given for the measurements (questions CH3 and WM3). If consent was not given, ask the surveyors if they know the reasons. If there are many refusals, knowing this information will help clarify any misunderstandings, concerns or misconceptions with the community being surveyed.
- Check that the age of children is between 6 and 59 months (questions CH5-CH6) and the age of women is between 15 and 49 years (question WM4).
- Check that the Hb value (questions CH15 and WM8) can be read clearly and is recorded with the correct units and decimal point i.e. g/L or g/dL depending on the HemoCue machine setting used in the survey.
- Check that referral was done appropriately in case severe anaemia was detected (check data collection control sheet for that information).
- Check that if the woman is pregnant (question WM5), no Hb is recorded (question WM8).

DATABASE CHECK- FOR DATA ENTRY ERRORS, DATA OUT OF REQUIRED RANGE AND MISSING DATA

- Brief guidance on the data cleaning process is provided below. Refer to **Annex 9** for standard data cleaning commands using Epi Info (version 3.5.4 July 2012). Free guidance on the use of Epi Info for Windows and training material on Epi Info can be found at the following site: http://www.cdc.gov/EpiInfo

Haemoglobin

- Look at mean Hb or sort the Hb variable in your dataset (variables CHHB and WMHB).
- Screen for outliers. Check that the 'minimum' and 'maximum' values are not outside of the plausible ranges for the data as defined in the data dictionary, **Tables 4-5** (children and women: not less than 2.0 and more than 22.0): if there are no invalid values for Hb then you can assume that the data has been correctly entered. If there are invalid values, find out the corresponding participant(s) and check the value with the original questionnaire. If it was a data entry error, correct it. If it was not a data entry error, delete the Hb value and consider that the child or woman will have a missing value for Hb.
- Screen for missing Hb values and check with the original questionnaire to ensure that this was not a data entry oversight.
- If the Hb value is missing, the child or woman cannot be included in the anaemia analysis.

Age

- Look at mean age or sort the age variable in your dataset (variables MONTHS and WMAGE).
- Screen for errors. Check that the 'minimum' and 'maximum' values are not outside of the correct ranges for the data as defined in the data dictionary, **Tables 4-5** (children: not less than 6.0 and more than 59.99; women: not less than 15 and more than 49): if there are no values outside the range then you can assume that the data has been correctly entered. If there are incorrect values, find out the corresponding participant(s) and check the value with the original questionnaire. If it was a data entry error, correct it. If it was not a data entry error, delete the participant from the dataset (the participant is not eligible for the survey).
- Screen for missing age values and check with the original questionnaire to ensure that this was not a data entry oversight.
- If age is missing for the child, the child can still be included in the anaemia analysis. You will need to ensure the child is eligible to be in the survey based on the height/length (i.e. in the required height range of 65-110cm).
- If age is missing for the woman, the woman can still be included in the analysis.

Pregnancy status, ANC enrolment and iron-folic acid pill coverage

- Perform frequency of or sort the variables in your dataset (variables PREGNANT, ANC and FEREC).
- Screen for errors. Check for invalid values for the variables (i.e. anything other than '1', '2' or '8' as defined in **Table 5**): if there are no invalid values then you can assume that the data has been correctly entered. If there are incorrect values, find out the corresponding participant(s) and check the value with the original questionnaire. If it was a data entry error, correct it. If it was not a data entry error, delete the invalid value and consider that the specific variable will have a missing value.
- Screen for missing values and check with the original questionnaire to ensure that this was not a data entry oversight.
- If the variable is missing for a woman, the woman cannot be included in the analysis of that specific variable.

PRESENTATION OF RESULTS

- Anaemia results should be descriptive and presented as proportions (with 95% CI) and means for the overall sample and according to age-specific criteria.

- When presenting the results from several camps with a representative sample drawn from each camp into one report, it is recommended to present results from each camp separately. See SENS Pre-Module tools: [**Tool 4b**-Dolo SENS Survey Report 2013] and [**Tool 5**-Dadaab Survey Report 2011].

- When several camps are surveyed with a representative sample drawn from each camp, it is not necessary to report combined results for each indicators; see **Annex 10** for the recommended combined indicators to report. See the SENS Pre-Module tool that will automatically generate weighed prevalence results: [**Tool 14**-Weighting Data Tool].

- All survey reports should present results the tables and figures shown below.

- Where an exhaustive methodology is used, confidence intervals should not be presented.

RESULTS TABLES AND FIGURES

- There are several trend figures that are recommended to be included in the final SENS report that are not automatically generated by ENA for SMART. Refer to **SENS Pre-Module Step 15** for a description on constructing trend graphs and on how to interpret trends and differences. For a tool that will automatically generate trend graphs, see SENS Pre-Module tool: [**Tool 12**-Trends and Graphs].

- Showing the recommended figures will allow for the assessment of trends. Note that, to identify a trend, it is advised that prevalence data from at least three time points are obtained from nutrition surveys carried out at similar times of the year.

Children 6-59 months

TABLE 6 PREVALENCE OF TOTAL ANAEMIA, ANAEMIA CATEGORIES, AND MEAN HAEMOGLOBIN CONCENTRATION IN CHILDREN 6-59 MONTHS OF AGE AND BY AGE GROUP

	6-59 months n =	**6-23 months** n=	**24-59 months** n=
Total Anaemia (Hb<11.0 g/dL)	(n) % (95% CI)	(n) % (95% CI)	(n) % (95% CI)
Mild Anaemia (Hb 10.0-10.9 g/dL)	(n) % (95% CI)	(n) % (95% CI)	(n) % (95% CI)
Moderate Anaemia (7.0-9.9 g/dL)	(n) % (95% CI)	(n) % (95% CI)	(n) % (95% CI)
Severe Anaemia (<7.0 g/dL)	(n) % (95% CI)	(n) % (95% CI)	(n) % (95% CI)
Mean Hb (g/dL) (SD / 95% CI) [range]	g/dL (SD or 95% CI) [min, max]	g/dL (SD or 95% CI) [min, max]	g/dL (SD or 95% CI) [min, max]

TABLE 7 PREVALENCE OF MODERATE AND SEVERE ANAEMIA IN CHILDREN 6-59 MONTHS OF AGE AND BY AGE GROUP

	6-59 months n =	**6-23 months** n=	**24-59 months** n=
Moderate and Severe Anaemia (Hb<10.0 g/dL)	(n) % (95% CI)	(n) % (95% CI)	(n) % (95% CI)

– Anaemia prevalence (mild, moderate and severe) and mean Hb results in children 6-59 months should be presented from year to year as shown in the example figures below.

FIGURE 4 TRENDS IN ANAEMIA CATEGORIES IN CHILDREN 6-59 MONTHS FROM 2009-2012. **NOTE THAT A TREND CAN ONLY BE IDENTIFIED WHEN THERE ARE AT LEAST THREE TIME POINTS. IT IS ADVISED THAT PREVALENCE DATA ARE OBTAINED FROM NUTRITION SURVEYS CARRIED OUT AT SIMILAR TIMES OF THE YEAR.** *(THIS FIGURE CAN BE AUTOMATICALLY GENERATED BY USING SENS PRE-MODULE TOOL 12 – TRENDS AND GRAPHS)*

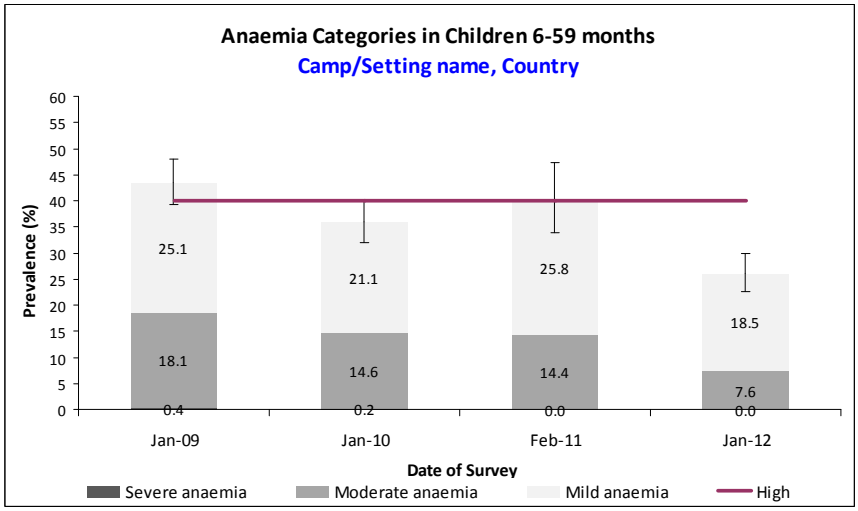


FIGURE 5 TREND IN TOTAL ANAEMIA (<11 G/DL), AND MODERATE AND SEVERE ANAEMIA (<10 G/DL) WITH 95% CI IN CHILDREN 6-59 MONTHS FROM 2009-2012. **NOTE THAT A TREND CAN ONLY BE IDENTIFIED WHEN THERE ARE AT LEAST THREE TIME POINTS. IT IS ADVISED THAT DATA ARE OBTAINED FROM NUTRITION SURVEYS CARRIED OUT AT SIMILAR TIMES OF THE YEAR.** *(THIS FIGURE CAN BE AUTOMATICALLY GENERATED BY USING SENS PRE-MODULE TOOL 12 – TRENDS AND GRAPHS)*

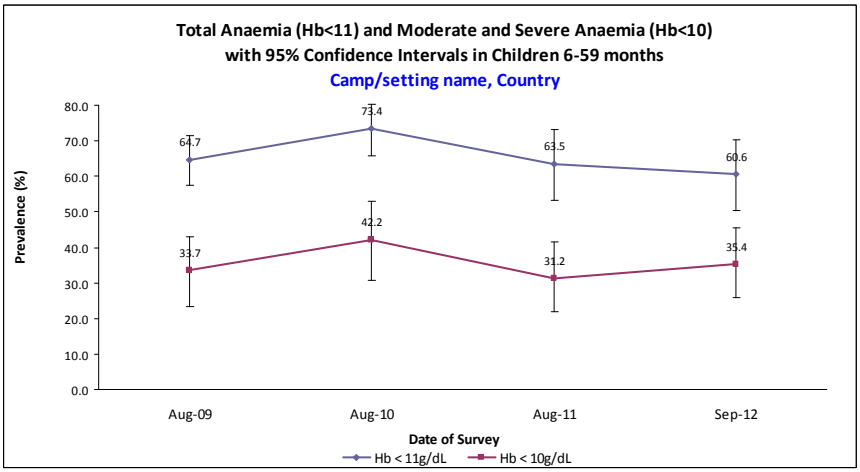
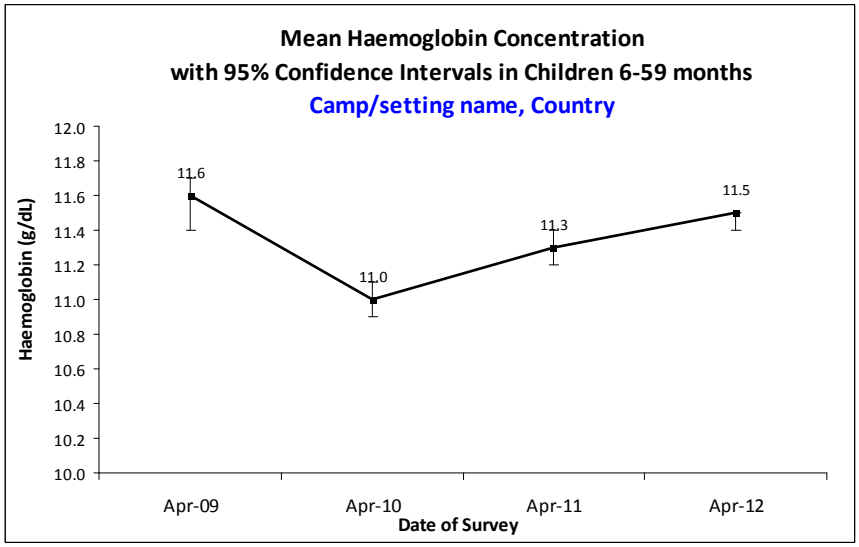


FIGURE 6 TREND IN MEAN HAEMOGLOBIN CONCENTRATION WITH 95% CI IN CHILDREN 6-59 MONTHS FROM 2009-2012. **NOTE THAT A TREND CAN ONLY BE IDENTIFIED WHEN THERE ARE AT LEAST THREE TIME POINTS. IT IS ADVISED THAT DATA ARE OBTAINED FROM NUTRITION SURVEYS CARRIED OUT AT SIMILAR TIMES OF THE YEAR.** *(THIS FIGURE CAN BE AUTOMATICALLY GENERATED BY USING SENS PRE-MODULE TOOL 12 – TRENDS AND GRAPHS)*



Women 15-49 years

TABLE 8 WOMEN PHYSIOLOGICAL STATUS AND AGE

Physiological status	Number/total	% of sample
Non-pregnant		
Pregnant		
Mean age (range)		

TABLE 9 PREVALENCE OF ANAEMIA AND HAEMOGLOBIN CONCENTRATION IN NON-PREGNANT WOMEN OF REPRODUCTIVE AGE (15-49 YEARS)

Anaemia in non-pregnant women of reproductive age (15-49 years)	**All** n =
Total Anaemia (<12.0 g/dL)	(n) % (95% CI)
Mild Anaemia (11.0-11.9 g/dL)	(n) % (95% CI)
Moderate Anaemia (8.0-10.9 g/dL)	(n) % (95% CI)
Severe Anaemia (<8.0 g/dL)	(n) % (95% CI)
Mean Hb (g/dL) **(SD / 95% CI)** **[range]**	g/dL (SD or 95% CI) [min, max]

– Anaemia prevalence (mild, moderate and severe) and mean Hb results in women of reproductive age (non-pregnant) should be presented from year to year as shown in the example figures below.

FIGURE 7 TRENDS IN ANAEMIA CATEGORIES IN WOMEN OF REPRODUCTIVE AGE (NON-PREGNANT) FROM 2009-2012. **NOTE THAT A TREND CAN ONLY BE IDENTIFIED WHEN THERE ARE AT LEAST THREE TIME POINTS. IT IS ADVISED THAT PREVALENCE DATA ARE OBTAINED FROM NUTRITION SURVEYS CARRIED OUT AT SIMILAR TIMES OF THE YEAR.** *(THIS FIGURE CAN BE AUTOMATICALLY GENERATED BY USING SENS PRE-MODULE TOOL 12 – TRENDS AND GRAPHS)*

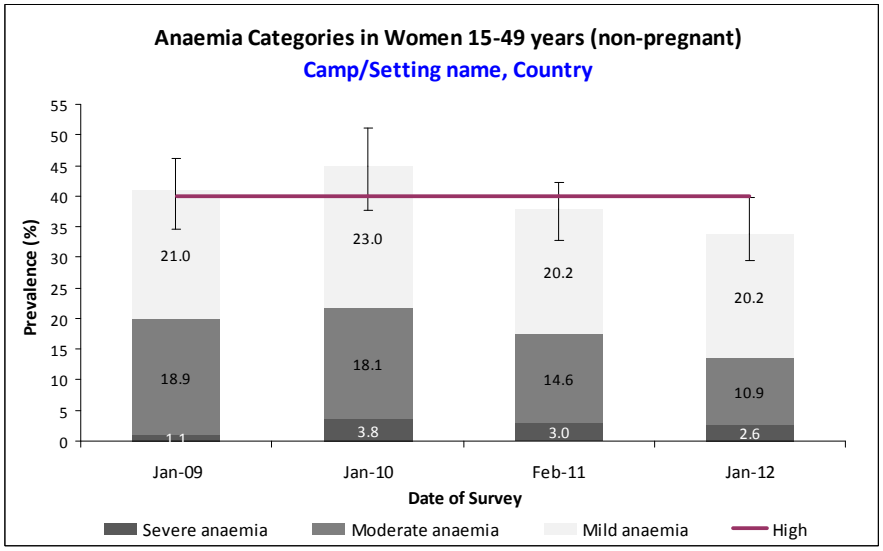


FIGURE 8 TREND IN MEAN HAEMOGLOBIN CONCENTRATION WITH 95% CI IN WOMEN OF REPRODUCTIVE AGE (NON-PREGNANT) FROM 2009-2012. **NOTE THAT A TREND CAN ONLY BE IDENTIFIED WHEN THERE ARE AT LEAST THREE TIME POINTS. IT IS ADVISED THAT DATA ARE OBTAINED FROM NUTRITION SURVEYS CARRIED OUT AT SIMILAR TIMES OF THE YEAR.** *(THIS FIGURE CAN BE AUTOMATICALLY GENERATED BY USING SENS PRE-MODULE TOOL 12 – TRENDS AND GRAPHS)*

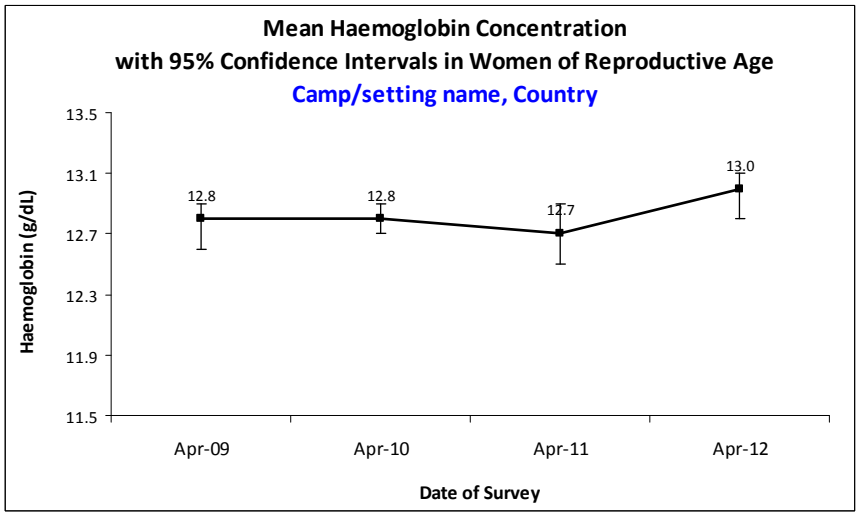


TABLE 10 ANC ENROLMENT AND IRON-FOLIC ACID PILLS COVERAGE AMONG PREGNANT WOMEN (15-49 YEARS)

	Number /total	% (95% CI)
Currently enrolled in ANC programme		
Currently receiving iron-folic acid pills		

DATA ANALYSIS

- Make sure that the data has been cleaned before starting the analysis process.

- Brief guidance on using Epi Info software for analysis is provided below. Refer to **Annex 9** for standard analysis commands using Epi Info (version 3.5.4 July 2012). Free guidance on the use of Epi Info for Windows and training material on Epi Info can be found at the following site: http://www.cdc.gov/EpiInfo

- Refer to SENS Anaemia tool for instructions on how to adjust haemoglobin for altitude: [**Tool 5**-Hb Adjustment for altitude]. Refer to the model report SENS Anaemia tool where haemoglobin was adjusted for altitude: [**Tool 6**-Rwanda Report]. Adjustment of haemoglobin values should be done for any survey conducted at an altitude higher than 1000 meters above sea level. A list of camps where haemoglobin adjustment needs to be done is provided in **Tool 5**.

ANALYSIS PROCEDURES

Total anaemia in children 6-59 months and women 15-49 years (non-pregnant)

- Define a new variable for total anaemia, i.e. ANAEMIA.
- Recode the CHHB and WMHB variables to ANAEMIA using the cut-offs shown in **Table 2**.
- The ANAEMIA variable should equal “0”, “ no anaemia” or “no” if the child / woman has no anaemia and should equal “1”, “anaemia” or “yes” if the child / woman is anaemic.
- If the survey design was simple or systematic random sampling, use Epi Info ‘Frequencies’ command to fill out **Tables 6 and 9**.
- If the survey design was cluster sampling, use Epi Info ‘Complex Sample Frequencies’ command (PSU is the CLUSTER variable) to fill out **Tables 6 and 9**.
- For the children’s data, ENA for SMART statistical calculator may be used for analysis of the Hb data. Refer to **SMART initiative documentation** for detailed guidance.

Anaemia categories in children 6-59 months and women 15-49 years (non-pregnant)

- Define a new variable for anaemia categories, i.e. ANAEMIA_c.
- Recode the CHHB and WMHB variable to ANAEMIA_c using the cut-offs shown in **Table 2**. The ANAEMIA_c variable should equal “0” or “normal” if the child / woman has no anaemia, should equal “1” or ”mild” if the child / woman is mildly anaemic, “2” or “moderate” if the child / woman is moderately anaemic and “3” or “severe” if the child / women is severely anaemic.

- Use the 'Select' command in Epi Info to proceed with analysis of anaemia in non-pregnant women only. E.g.: Select pregnant equal to '2' or '8'.
- If the survey design was simple or systematic random sampling, use Epi Info 'Frequencies' command to fill out **Tables 6 and 9**.
- If the survey design was cluster sampling, use Epi Info 'Complex Sample Frequencies' command (PSU is the CLUSTER variable) to fill out **Tables 6 and 9**.
- For the children's data, ENA for SMART statistical calculator may be used for analysis of the Hb data. Refer to **SMART initiative documentation** for detailed guidance.

Mean haemoglobin in children 6-59 months and women 15-49 years (non-pregnant)

- If the survey design was simple or systematic random sampling, use Epi Info 'Means' command on the CHHB and WMHB variables to fill out **Tables 6 and 9**.
- If the survey design was cluster sampling, use Epi Info 'Complex Sample Means' command on the CHHB and WMHB variables (PSU is the CLUSTER variable) to fill out **Tables 6 and 9**.

Total anaemia and anaemia categories by age in children 6-23 and 24-59 months

- Define a new variable for anaemia age group, i.e. AGEGROUP.
- Recode the MONTHS variable into AGEGROUP. The AGEGROUP variable should equal "1" or "6-23" if the child is between 6-23.99 months of age and should equal "2" or "24-59" if the child is between 24-59.99 months of age.
- If the survey design was simple or systematic random sampling, use Epi Info 'Frequencies' command on the newly defined ANAEMIA and ANAEMIA_c variables, and use the 'Stratify by' option to disaggregate analysis by age group to fill out **Table 6.**
- With cluster surveys, first use the 'Select' command in Epi Info to proceed with analysis by age group (note that the 'Stratify by' option in the 'Complex Sample Frequencies' command differs from the one in the 'Frequencies' command; with complex sampling this option is to be used in stratified surveys *only*). Then, use the 'Complex Sample Frequencies' command on the newly defined ANAEMIA and ANAEMIA_c variables with each age group breakdown (PSU is the CLUSTER variable) to fill out **Table 6**.
- For the children's data, ENA for SMART statistical calculator may be used for analysis of the Hb data. Refer to **SMART initiative documentation** for detailed guidance

Mean haemoglobin by age in children 6-23 and 24-59 months

- If the survey design was simple or systematic random sampling, use Epi Info 'Means' commands on the CHHB variable, and use the 'Stratify by' option to disaggregate analysis by age group to fill out **Table 6.**
- With cluster surveys, first use the 'Select' command in Epi Info to proceed with analysis by age group. Then, use the 'Complex Sample Means' command on the CHHB variable with each age group breakdown (PSU is the CLUSTER variable) to fill out **Table 6**.

Moderate and severe anaemia (Hb<10 g/dL) in children 6-59 months and by age

- Define a new variable for moderate and severe anaemia, i.e. HBLESS10.
- Recode the CHHB variable to HBLESS10 using the cut-offs shown in **Table 2**. The HBLESS10 variable should equal "0" or "high Hb" if the child has an Hb≥10 g/dL and should equal "1" or "low Hb" if the child has an Hb<10 g/dL.
- If the survey design was simple or systematic random sampling, use Epi Info 'Frequencies' command to fill out **Table 7.** Then use the 'Stratify by' option to disaggregate analysis by age group**.**
- If the survey design was cluster sampling, use the 'Complex Sample Frequencies' command (PSU is the CLUSTER variable) to fill out **Table 7**. Then use the 'Select' command in Epi Info to proceed with analysis by age group.
- ENA for SMART statistical calculator may be used for analysis of the Hb data. Refer to **SMART initiative documentation** for detailed guidance.

ANC enrolment and iron-folic acid pills coverage in pregnant women

- ANC enrolment and iron-folic acid pill coverage are calculated for pregnant women only.
- Use the 'Select' command in Epi Info to proceed with analysis of pregnant women *only* and exclude from analysis women with answer '8' ('Don't know').
- If the survey design was simple or systematic random sampling, use Epi Info 'Frequencies' command to fill out **Table 10**.
- If the survey design was cluster sampling, use Epi Info 'Complex Sample Frequencies' command (PSU is the CLUSTER variable) to fill out **Table 10**.

COMMON ERRORS AND CHALLENGES IN DATA ANALYSIS

Table 11 describes the most common errors experienced by survey coordinators and supervisors when conducting the final data analysis.

TABLE 11 COMMON ERRORS EXPERIENCED IN DATA ANALYSIS

Common errors	Examples	Solution
Reporting the wrong unit for Hb	Use of g/dL when the HemoCue machine actually gave results in g/L, or vice versa.	Use g/dL for reporting all survey results, as shown in **Tables 6, 7 and 9.**
Using the wrong cut-off for defining categories of anaemia in different age groups	Defining moderate anaemia in children as Hb 7.0-10.9 g/dL. Defining moderate anaemia in women of reproductive age as Hb 8.0-11.9 g/dL.	Ensure you use the WHO classification shown in **Table 2**.
Not reporting confidence intervals around the anaemia prevalence estimate	Only reporting the point estimate in the final report. Often, this is because the procedure for the analysis function that takes into account cluster sampling to adjust for confidence intervals is not known by the user.	If cluster sampling is used, use the Complex Sample module in Epi Info (Advanced statistics) for analysis of anaemia results.
Reporting an incorrect confidence interval for the anaemia prevalence	In a cluster survey, reporting the confidence interval not taking into account the complex sampling. This will be misleading and will give you the impression that your survey is more precise that it actually is. With complex sampling, confidence intervals are usually wider than when using simple or systematic random sampling.	If cluster sampling is used, use the Complex Sample module in Epi Info (Advanced statistics) for analysis of anaemia results.
Not taking into consideration a weighting factor when combining anaemia prevalence estimates from several camps	When surveying several camps with a representative sample drawn from each camp, combining the samples from all camps to calculate the overall prevalence without taking into consideration a weighting factor.	For a tool that will automatically generate weighed prevalence results, see SENS Pre-Module tool: [**Tool 14**-Weighting Data Tool]. 

Common errors	Examples	Solution
Reporting anaemia results according to certain aggregates of clusters	Reporting the anaemia results per group of clusters or per camp section / block.	Do not disaggregate cluster surveys according to clusters in the presentation of results. All clusters merged together from all sections / blocks of the camp are representative of the camp as a whole and should not be disaggregated.
Reporting a change in the anaemia situation without any evaluation of whether the observed change is statistically significant or real	Using the point estimate results of two surveys (e.g. 36% vs. 39%) and concluding that there has been a change in anaemia prevalence without looking at the confidence intervals or conducting a statistical test.	Assess whether the confidence intervals overlap and conduct a statistical test using the CDC IERHB calculator. See SENS Pre-Module tool: [**Tool 13**-CDC Calculator twosurveys]. 

USE OF RESULTS

CLASSIFICATION OF PUBLIC HEALTH PROBLEM AND TARGETS

Anaemia data

- UNHCR Strategic Plan for Nutrition and Food Security (2008-2010) states that the target for the prevalence of anaemia in children 6-59 months of age and in women 15-49 years of age should be < 20%.

- The severity of the public health situation should be classified according to WHO criteria as shown in **Table 12**.

TABLE 12 CLASSIFICATION OF PUBLIC HEALTH SIGNIFICANCE

Prevalence %	High	Medium	Low
Anaemia	≥40	20-39	5-19

Source: WHO (2000) The Management of Nutrition in Major Emergencies

POSSIBLE CAUSES OF ANAEMIA

- In the context of refugee (and displaced) populations, the most important cause of anaemia is usually inadequate dietary intake of micronutrients (especially iron, folic acid, vitamin B12), and a lack of appropriate complementary foods given the dependency on food aid.

- There are also often high rates of infections given crowded refugee environments and poor access to water and sanitation, thus the high prevalence of anaemia in refugees may stem from infections such as malaria, hookworm or schistosomiasis.

- If the causes of anaemia need to be investigated (**Table 13**) as part of the nutrition survey, specialist support will be needed for the assessment. Contact UNHCR HQ / Regional Offices for assistance in seeking support.

TABLE 13 INVESTIGATING THE CAUSES OF ANAEMIA

Objective	Indicator	Recommended age group(s)	Recommended methods of measurements	Response option(s) if survey results indicate a public health problem
Determine prevalence of iron deficiency as a risk factor for anaemia	Iron deficiency	1. Children 6-59 months 2. Women of reproductive age (15-49 years)	sTfR, and/or Serum ferritin and CRP/AGP; and/or; transferrin saturation; and/or free erythrocyte protoporphyrin. Measurement requires a blood sample.	-Improvement of micronutrient contents of food ration. -Food security activities. -Interventions using special nutritional products in target group(s). -BCC on iron-rich foods and prevention.
Determine prevalence of malaria infection as a risk factor for anaemia	Malaria infection	1. Children 6-59 months 2. Women of reproductive age (15-49 years)	Rapid Diagnostic Test or thick/thin blood smear using a capillary or venous blood sample.	-Distribution of mosquito nets. -BCC on mosquito net use and prevention. -Spraying campaign. -Provision of treatment.
Determine prevalence of hookworm / whipworm as a risk factor for anaemia	Helminth: hookworm or whipworm	Children 6-59 months of age	Stool sample microscopy.	-Deworming activities in target group(s). -BCC on prevention of infection.
Determine prevalence of schistosomiasis as a risk factor for anaemia	Helminth: schistosomiasis	Women of reproductive age (15-49 years)	Prevalence of haematuria or egg counts from a urine sample.	-Deworming activities in target group(s). -BCC on prevention of infection.
Determine prevalence of sickle cell anaemia as a risk factor for anaemia	Sickle cell anaemia	1. Children 6-59 months 2. Women of reproductive age (15-49 years)	Sickling test conducted on a blood sample.	-BCC on disease management. -Treatment.
Determine prevalence of thalassemia as a risk factor for anaemia	Thalassemia	1. Children 6-59 months 2. Women of reproductive age (15-49 years)	Blood microscopy, gel electrophoresis, and/or DNA analysis.	-BCC on disease management.

RECOMMENDATIONS

- The anaemia assessment results are to assist public health partners working in refugee settings to better plan their anaemia control programming.

- Preventing and treating anaemia among refugees and other persons of concern to UNHCR demands a multi dimensional and comprehensive approach in public health and nutrition. The specific anaemia activities encompass:

  - The reinforcement of existing activities (e.g. malaria control, deworming campaigns and antenatal activities);
  - Introduction of new activities such as use of lipid based nutrient supplements or micronutrient powders. Refer to **UNHCR Operational Guidance on the Use of Special Nutritional Products to Reduce Micronutrient Deficiencies and Malnutrition in Refugee Populations** http://www.unhcr.org/
  - Provision of micronutrients through improving the micronutrient content of the general food ration;
  - Strengthening and standardising assessment and monitoring / evaluation of anaemia control activities;
  - Providing information and education for the refugee community on anaemia and micronutrient deficiencies;
  - A multi-dimensional approach to food security among refugees including: use of cash, fresh food vouchers, income generating activities, cash and food for work programmes, and augmenting safety net programmes for vulnerable groups;
  - Strengthening of training of health staff for anaemia detection and treatment as well as investment in equipment for measuring anaemia and ensuring adequate quantities of appropriate treatment.

WHERE CAN THE SMART MANUAL AND TRAINING MATERIAL BE FOUND?

SMART (2006) ***Measuring Mortality, Nutritional Status, and Food Security in Crisis Situations - SMART Methodology version 1 April 2006***

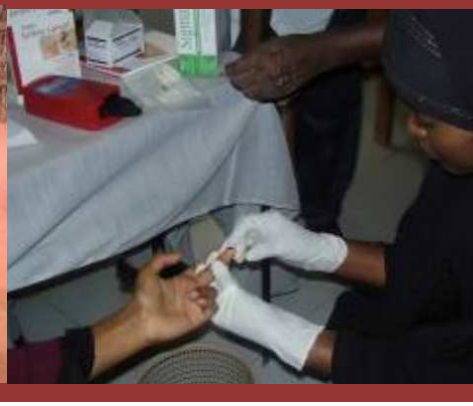
- A manual detailing a basic integrated method for assessing nutritional status and mortality rate in emergency situations. It includes details of how to use the ENA Software for analysing data. The manual is aimed at host government partners and humanitarian organisations as part of the SMART initiative enhancing capacity and draws from core elements of several existing methods and best practice. It includes an optional chapter of food security which is based on a simplified version of the Household Economy Approach.
- Availability: Free, downloadable in pdf form in English.
- Contact: www.smartmethodology.org

Standardized Training Package: SMART Methodology- ***ACF-Canada, 2010***

- The *Standardized Training Package* (STP) is a modular based training package for individuals and organisations interested in using SMART with a user-friendly and comprehensive tool when building capacity of survey teams. Following the survey process from start to finish, the STP provides the following information:
  1. Application to different contexts and different participant competency levels, allowing you to structure your training accordingly.
  2. Pedagogical approach with easy-to-follow presentations and trainer's tips
  3. Adult-education tools such as case studies, videos demonstrating practical techniques and helpful assessment tools.
- The annexes to these modules provide useful tools and guidance to teams when planning training events.
- Availability: free, package downloadable in English, French, Spanish.
- Contact: www.smartmethodology.org

ANNEXES





ANNEX 1 - ORDERING INFORMATION

Refer to SENS Pre-Module **Tool 06** (Survey Supplies Planning Sheet) for more details on quantity to be ordered based on the number of teams included in the survey.

HemoCue supplier information

Refer to **SENS Pre-Module Tool 8** for more details on quantity to be ordered based on the number of teams included in the survey.

The following HemoCue supplies should be available for each survey: HemoCue 301 Analysers, HemoCue 301 Analyser Cases, HemoCue cleaning spatula packs, safety lancets (sizing of at least 2.25mm), microcuvettes, Eurotrol Hb 301 Control solutions: High, Low and Normal.

Contact the following supplier or your local supplier to place your order. Give ample time (at least 8 weeks) between ordering of supplies and survey implementation.

HemoCue AB
Box 1204
262 23 Ängelholm
SWEDEN

Phone: +46 77 570 02 10
Fax: +46 77 570 02 12
E-mail: info@HemoCue.se
Website: http://www.HemoCue.com/

They have several offices around the world that can be found on the website.

Note: HemoCue machines need to be serviced regularly to ensure they are working accurately. Moreover, Eurotrol Hb 301 Control solutions are needed for each survey to perform a check of the entire HemoCue system, i.e. both HemoCue machine and microcuvettes; this check is different than the internal electronic self test and these must be purchased for each survey.

ANNEX 2 - SENS QUESTIONNAIRES

Children 6-59 months

See SENS Pre-Module **Tool 9** for the full SENS Questionnaire.

Date of interview (dd/mm/yyyy): |___|___|/|___|___|/|___|___||___|___| SURVDATE	**Cluster Number (*in cluster survey only*)** |___|___| CLUSTER	**Team number** |___| TEAM

CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH10	CH11	CH12	CH13	CH14	CH15
ID	**HH**	**Consent given** 1=Yes 2=No 3=Absent	**Sex** (m/f)	**Birthdate*** dd/mm/yyyy	**Age**** (months)	**Weight** (kg) ±100g	**Height** (cm) ±0.1cm	**Oedema** (y/n)	**MUAC** (mm)	**Child enrolled** 1=SFP 2=TFP 3=None	**Measles** 1=Yes card 2=Yes recall 3=No or don't know	**Vit. A in past 6 months** (SHOW CAPSULE) 1=Yes card 2=Yes recall 3=No or don't know	**Diarrhoea in past 2 weeks** 1=Yes 2=No 3=Don't know	**Hb** *(g/L or g/dL)*
ID	HH	CHCONST	SEX	BIRTHDAT	MONTHS	WEIGHT	HEIGHT	EDEMA	MUAC	ENROL	MEASLES	VITA	DIAR	CHHB
01				/ /										
02				/ /										
03				/ /										
…				/ /										

*The exact birth date should only be taken from an age documentation showing day, month and year of birth. It is only recorded if an official age documentation is available; if the mother recalls the exact date, this is not considered to be reliable enough. **Leave blank if no official age documentation is available.**

**If no age documentation is available, estimate age using local event calendar. If an official age documentation is available, record the age in months from the date of birth.

Women 15-49 years

See SENS Pre-Module **Tool 9** for the full SENS Questionnaire.

Date of interview (dd/mm/yyyy): |___|___|/|___|___|/|___|___||___|___| **SURVDATE**	**Cluster Number (*in cluster survey only*)** |___|___| **CLUSTER**	**Team number** |___| **TEAM**

WM1	**WM2**	**WM3**	**WM4**	**WM5**	**WM6**	**WM7**	**WM8**
ID	**HH**	**Consent given** 1=Yes 2=No 3=Absent	**Age** (years)	**Are you pregnant?** 1=Yes 2=No (GO TO HB) 8=Don't know (GO TO HB)	**Are you currently <u>enrolled</u> in the ANC programme?** 1=Yes 2=No 8=Don't know	**Are you currently <u>receiving</u> iron-folate pills (*SHOW PILL*)?** 1=Yes (STOP NOW) 2=No (STOP NOW) 8=Don't know (STOP NOW)	**Hb** (g/L or g/dL)
WMID	**HH**	**WMCONST**	**WMAGE**	**PREGNANT**	**ANC**	**FEREC**	**WMHB**
01							
02							
03							
04							
05							
…							

ANNEX 3 - REFERRAL FORM

REFERRAL FORM (CAREGIVER)	**REFERRAL FORM (DUPLICATE FOR HEALTH FACILITY)**
Woman ☐ Child 6-59 mo ☐ **Woman Full Name** : _____ **Child Full Name (if applicable):_____** **Block number**: _____ **Age**: _____ Months ☐ Years ☐ **Sex:** Female ☐ Male ☐ **Referred for**: Malnutrition ☐ Severe anaemia ☐ **Malnutrition** MUAC: _____ mm WHZ: _____ Oedema: ☐ Yes ☐ No **Severe anaemia** Hb: _____g/dL Nutrition Survey team number:_____ Date:_____ Signature of team leader:_____	Woman ☐ Child 6-59 mo ☐ **Woman Full Name** : _____ **Child Full Name (if applicable):_____** **Block number**: _____ **Age**: _____ Months ☐ Years ☐ **Sex:** Female ☐ Male ☐ **Referred for**: Malnutrition ☐ Severe anaemia ☐ **Malnutrition** MUAC: _____ mm WHZ:_____ Oedema: ☐ Yes ☐ No **Severe anaemia** Hb: _____g/dL Nutrition Survey team number:_____ Date:_____Signature of team leader:_____

ANNEX 4 - ANAEMIA QUALITY ASSURANCE LOGSHEET

This document is also available in SENS Anaemia tool: [**Tool 1**-Anaemia Quality Assurance Logsheet].

Model quality assurance Logsheet

HemoCue machine number	Date dd/mm /yyyy	When was microcuvette container opened dd/mm/yyyy	Visual inspection completed (Yes/No)	HemoCue machine cleaned		Microcuvette holder cleaned (Yes/Not needed)	Results from Analysis of Quality Control Samples (Eurotrol)						Error codes		Comments
				External cleaning by wiping with a damp cloth (Yes/Not needed)	Internal with cleaning spatula (Yes/Not needed)		Eurotrol Low		Eurotrol Normal		Eurotrol High		Yes /No	Code	
							Acceptable range	Value	Acceptable range	Value	Acceptable range	Value			

Information on Eurotrol solutions: To perform a functional control of the complete HemoCue Hb 301 system (analyser, microcuvette and operator), Eurotrol Hb 301 Control (bovine based material) solutions should be used. The control material is available in three different levels and comes in 2 dropper bottles of 1.0 mL each: i) Low: ~8.0 g/dL (80 g/L); ii) Normal: ~12.0 g/dL (120 g/L); and iii) High: ~16.0 g/dL (160 g/L). If stored unopened in a refrigerator at temperature between 2-8 °C (35-46 °F), the solutions can be stored for up to 1 year from the date of manufacture. After opening the vials they are stable for 14 days when properly recapped and stored at room temperature (15-30 °C) or for 30 days if stored in a refrigerator at 2-8 °C.

Eurotrol solution for HemoCue Hb 301 Analyser

ANNEX 5 - TROUBLESHOOTING GUIDE (HEMOCUE 301)

This document is also available in SENS Anaemia tool: [**Tool 2**-Troubleshooting Guide HemoCue 301].

Error code	Explanation	Action
The analyser shows an error code	May be a temporary fault.	Turn off the analyser and turn it on again after 30 seconds. Take a new microcuvette and repeat the measurement. If the problem continues, see specific error code below.
E00	No stable endpoint of the measurement is found within the time range. 1. The cuvette is faulty 2. The circuit board is out of order	1a. Check the expiration date for the microcuvettes. 1b. Take a new microcuvette and repeat the measurement. 2. The analyser needs service. Contact the distributor.
E01-E05	1. Dirty optronic unit or faulty electronics or optronic unit.	1a. Turn off the analyser and clean the optronic unit. 1b. The analyser needs service. Contact the distributor.
E06	1. Unstable blank value. The analyser might be cold.	1. Turn off the analyser and allow to reach room temperature. If the problem continues, the analyser needs service. Contact the distributor.
E07	1. The battery power is too low.	1a. The batteries need to be replaced. Turn off the analyser and replace the batteries, 4 type AA. 1b. Use the power adapter.
E08	The absorbance is too high. 1. Light blocking item in the cuvette holder.	1a. Check that the analyser and microcuvettes are used according to the HemoCue Hb 301 operating manual and instructions for use. 1b. The analyser needs service. Contact the distributor.
E10-E30	1. Dirty optronic unit or faulty electronics or optronic unit.	1a. Turn off the analyser and clean the optronic unit. 1b. The analyser needs service. Contact the distributor.
E40	1. The cuvette holder is not replaced properly after cleaning. 2. Dirty optronic unit. 3. The microcuvette is not a HemoCue Hb 301 microcuvette. 4. The microcuvette is damaged.	1. Make sure that the cuvette holder is replaced properly. 2. Turn off the analyser and clean the optronic unit. 3. Only use HemoCue Hb 301 microcuvettes in the HemoCue Hb 301 Analyser. 4. Take a new microcuvette and repeat the measurement.
E41-49	1. The optronic unit has been scratched due to incorrect maintenance. 2. Hardware error.	1. Clean the optronic unit, using the HemoCue Cleaner. The analyser needs service. Contact the distributor. 2. The analyser needs service. Contact the distributor.
HHH	1. Measured value exceeds 25.6 g/dL (256 g/L, 15.9 mmol/L).	
No characters on the display	1. The analyser is not receiving power. 2. If on battery power, the batteries need to be replaced. 3. The display is out of order.	1a. Check that the power adapter is connected to the analyser and the AC power supply. 1b. Check that the cable is not damaged. 2. Turn off the analyser and replace the batteries, 4 type AA. 3. The analyser needs service. Contact the distributor.
The display contains erroneous characters	1. The display is out of order. 2. The microprocessor is out of order.	1. The analyser needs service. Contact the distributor. 2. The analyser needs service. Contact the distributor.
The display shows ''FIR''	This function is for manufacturing use only.	1. Remove and replace all cables and / or batteries, and restart. 2. The analyser needs service. Contact the distributor.
The display shows ''battery picture''	1. The batteries need to be replaced. 2. If on AC power, the power adapter or the circuit board is out of order.	1. Turn off the analyser and replace the batteries, 4 type AA. 2a. Check that the power adapter is properly connected and working. 2b. The analyser needs service. Contact the distributor.
The display	1. The cuvette holder sensor is out of order.	1. The analyser needs service. Contact the distributor.

does not switch from 'timer symbol' and ''Hb'' to three flashing dashes and 'hemocuvette symbol' (ready for measuring)		
Measurement on control materials are out of range- either too high or too low	1. The microcuvettes are beyond their expiration date, damaged or have been improperly stored. 2. The optical eye of the microcuvette is contaminated. 3. The controls are beyond their expiration dates or have been improperly stored. 4. The control has not been mixed properly and / or is not at room temperature. 5. The microcuvette has not been placed in the analyser within 40 seconds of filling. 6. Air bubbles in the microcuvette. 7. The optronic unit is dirty. 8. The control is not suitable for use with the HemoCue Hb 301 system. 9. The calibration of the analyser has been changed.	1. Check the expiration date and the storage conditions of the microcuvettes. 2. Remeasure the control with a new microcuvette. 3. Check the expiration date and the storage conditions of the control. Remeasure the control with a new microcuvette. If the problem continues, contact the manufacturer of the control. 4. Make sure that the control is mixed properly and at room temperature. If the problem continues, contact the manufacturer of the control. 5. Remeasure the control with a new microcuvette. 6. Check the microcuvette for air bubbles. Remeasure the control with a new microcuvette. 7. Clean the optronic unit. 8. Contact the distributor for control information. 9. The analyser needs service. Contact the distributor.
Measurement on patient samples are higher or lower than anticipated	1. Improper sampling technique. 2. The microcuvettes are beyond their expiration date, damaged or have been improperly stored. 3. The optical eye of the microcuvette is contaminated. 4. Air bubbles in the microcuvette. 5. The optronic unit is dirty. 6. The calibration of the analyser has been changed.	1. Check the expiration date and the storage conditions of the microcuvettes. 2. Remeasure the sample with a new microcuvette. 3. Check the microcuvette for air bubbles. Remeasure the sample with a new microcuvette. 4. Clean the optronic unit. 5. The analyser needs service. Contact the distributor.

ANNEX 6 - ANAEMIA TEST FOR SURVEYORS

The test is to be preferably done pre- and post-training. Select (circle) the answer/s you believe to be the correct ones. **There may be more than one correct answer per question**.

(1) Which indicator is most commonly used to indicate anaemia in field surveys?

a. Haemoglobin
b. Serum ferritin
c. Pallor of the palm
d. Lack of energy

(2) During a nutritional survey, the measurement of anaemia in children 6-59 months of age:

a. Is done from a prick on the foot
b. Is done from a prick on the index or middle finger
c. Is done from a prick on the thumb or index finger
d. Is done from a prick on the middle or ring finger

(3) A woman of reproductive age (non-pregnant) presenting with haemoglobin concentration below 8.0 g/dL is considered :

a. anaemic
b. moderately anaemic
c. severely anaemic
d. non-anaemic

(4) Please fill out the table below with the appropriate cut-off values:

Age group	**Categories of Anaemia (Hb g/dL)**			
	Total	Mild	Moderate	Severe
Children 6 - 59 months				

(5) State five common errors that happen when measuring haemoglobin concentration with the HemoCue, which could result in faulty readings?

1. _____
   _____
2. _____
   _____
3. _____
   _____
4. _____
   _____
5. _____
   _____

(6) What action(s) should never be undertaken when assessing haemoglobin concentration?

a. Use the same pair of gloves on two individuals
b. Hurt the individual by pricking
c. Filling up the microcuvette using the first drop of blood
d. Use a HemoCue machine that is damaged
e. Spill some blood on the individual's clothes

(7) Which of the following steps must be followed when doing a haemoglobin test during a nutritional survey?

a. Inform the individual about the standard procedure
b. Inform the individual about the haemoglobin results from the neighbour's house
c. Obtain verbal informed consent
d. Put a sticking plaster on the pricked finger
e. Tell the individual that the procedure will be painless

(for the answers, see SENS Anaemia too: [**Tool 3**-Test Surveyors Answers)

ANNEX 7 - STANDARDISATION EXERCISE

This is also available in SENS Anaemia tool: [**Tool 4**-Anaemia Standardisation Exercise].

The suggested practical exercise described below is not a true standardisation test, however it will help you standardise the way the Hb measurements are taken and select the best Hb measurers. If you have time to conduct a standardisation test, refer to the following publication: Burger S and Pierre-Louis J. A procedure to estimate the accuracy and reliability of HemoCue™ measurements of survey workers. ILSI, 2003.

Typically, a training on haemoglobin measurement will contain between 6 to 12 members. For the standardising exercise, each trainee should take two measurements (i.e. filing out two microcuvettes from two different blood drops-blood drop #3 and #4) from two different finger sticks from a minimum of 3 fellow trainees. Use the table below to write down the results and assess the quality of the Hb measurements.

FORM FOR STANDARDIZATION EXERCISE

Volunteer name	Assessing how good the trainee is at filling up the microcuvette								Assessing how good the trainee is at finger sticking	
	Finger 1				Finger 2					
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
	Blood drop #3	Blood drop #4	C1- C2	Potential reasons for difference ≥ (+/-) 0.5 g/dL	Blood drop #3	Blood drop #4	C5-C6	Potential reasons for difference≥(+/-) 0.5 g/dL	C1-C5	Potential reasons for difference ≥ (+/-) 0.5 g/dL
1										
2										
3										

EXAMPLE OF A FILLED OUT FORM

	Assessing how good the trainee is at filling up the microcuvette								Assessing how good the trainee is at finger sticking	
	Finger 1				Finger 2					
Volunteer name	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
	Blood drop #3	Blood drop #4	C1- C2	Potential reasons for difference ≥ (+/-) 0.5 g/dL	Blood drop #3	Blood drop #4	C5-C6	Potential reasons for difference≥(+/-) 0.5 g/dL	C1-C5	Potential reasons for difference ≥ (+/-) 0.5 g/dL
1	9.4	9.7	-0.3	-	9.7	9.3	0.2	-	-0.3	-
2	11.0	11.6	-0.6	2nd microcuvette not completely filled	11.3	11.0	0.3	-	-0.3	-
3	10.9	12.2	-1.3	2nd microcuvette not completely filled	11.6	11.9	0.3	-	0.7	Squeezed finger 1 while filling microcuvette
4	12.6	12.5	0.1	-	11.8	12.4	-0.6	Air bubbles in 1st microcuvette	0.8	Air bubbles in finger 2 microcuvette
5	10.0	12.8	-2.8	Alcohol not dry before filling 1st microcuvette	13.3	13.0	0.3	-	-3.3	Alcohol not dry before filling microcuvette on finger 1

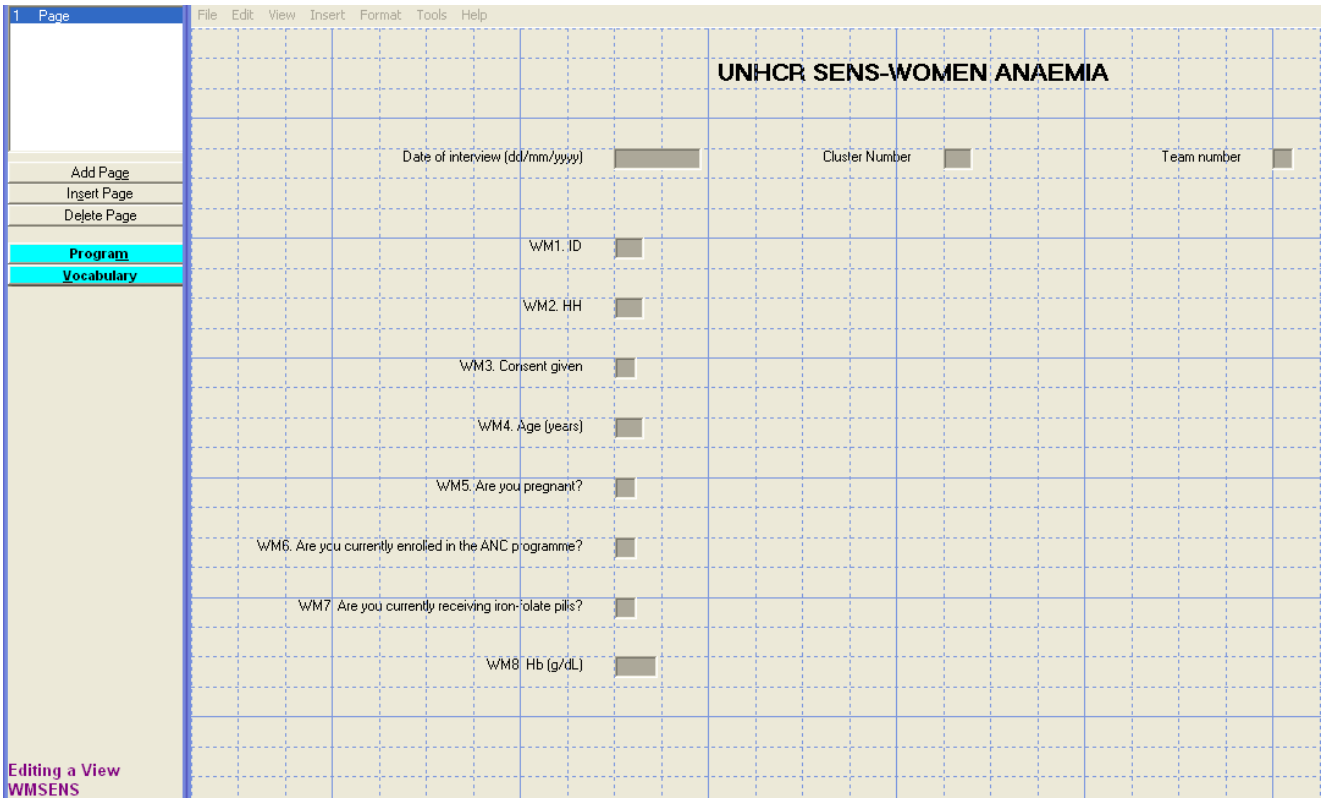
ANNEX 8 - EPI INFO DATA ENTRY

CHILDREN ANAEMIA

Refer to Module 1 and ENA for SMART guidance.

WOMEN ANAEMIA

Below is the standard Epi Info view available in the Epi Info mdb file entitled HUN1207WMBUDA in the SENS Anaemia tool: [**Tool 8**-WM Data]. To access the view, go to the Make View module and open the corresponding View entitled WMSENS.



ANNEX 9 - EPI INFO ANALYSIS

CHILDREN ANAEMIA

Below are the standard Epi Info codes to use for analysis. The standard PGM files containing these Epi Info codes can be found in the Epi Info mdb file entitled HUN1207CHBUDA in the SENS Anaemia tool: [**Tool 7**-CH Data]. To access the PGM files, go to the Analyze Data module, Program Editor window and open the corresponding PGM file needed for the analysis.

Refer to the fictitious dataset available for practical purposes; Go to SENS Anaemia **Tool 7**, and see the Excel database KEN_1211_CH_NAI.

The practical Excel database KEN_1211_CH_NAI is from a survey using a *cluster design*.

DATA CLEANING

Run these commands (together or separately; regardless of the survey design) and make sure that the ranges of the variables entered in the database match the standard codes shown in **Table 4** above.

```
MEANS CHHB
MEANS MONTHS
```

You should check the missing data in your database and double-check that this was not a data entry oversight. The commands below need to be run separately, one by one. After selecting the variable using the code shown below, use the LIST command to view the specific records with missing data and double-check with the original data collection questionnaire. Then cancel the selected variable by typing SELECT and proceed with checking another variable.

```
SELECT CHHB=(.)
SELECT (this will cancel the selected variable)

SELECT MONTHS=(.)
```

DATA ANALYSIS

Results from the practical survey dataset are illustrated below.

TOTAL ANAEMIA, ANAEMIA CATEGORIES AND MEAN HB ANALYSIS FOR CHILDREN AGED 6-59 MONTHS AND BY AGE GROUP ANALYSIS

PREVALENCE OF TOTAL ANAEMIA, ANAEMIA CATEGORIES, AND MEAN HAEMOGLOBIN CONCENTRATION IN CHILDREN 6-59 MONTHS OF AGE AND BY AGE GROUP

	6-59 months n = 598	**6-23 months** n=205	**24-59 months** n=393
Total Anaemia (Hb<11.0 g/dL)	(271) 45.3% (40.4-50.2 95% CI)	(130) 63.4 (56.0-70.8 95% CI)	(141) 35.9 (30.0-41.8 95% CI)
Mild Anaemia (Hb 10.0-10.9 g/dL)	(145) 24.2% (20.4-28.1 95% CI)	(66) 32.2 (25.7-38.7 95% CI)	(79) 20.1 (15.4-24.8 95% CI)
Moderate Anaemia (7.0-9.9 g/dL)	(123) 20.6% (16.7-24.5 95% CI)	(64) 31.2 (24.5-38.0 95% CI)	(59) 15.0 (10.9-19.1 95% CI)
Severe Anaemia (<7.0 g/dL)	(3) 0.5% (0-1.1 95% CI)	(0) 0 (0-0 95% CI)	(3) 0.8 (0-1.6 95% CI)
Mean Hb, g/dL **(95% CI)** **[range]**	11.0 g/dL (10.8-11.1 95% CI) [5.5-14.5]	10.5 g/dL (10.3-10.7 95% CI) [7.2-13.8]	11.2 g/dL (11.0-11.4 95% CI) [5.5-14.5]

Total Anaemia in children aged 6-59 months

```
DEFINE ANAEMIA

RECODE CHHB TO ANAEMIA
        LOVALUE - 10.9 = "ANAEMIA"
        11.0 - HIVALUE = "NO ANAEMIA"
END

FREQ ANAEMIA PSUVAR=Cluster
```

If you are analysing a simple random survey, the code is as follows:

```
FREQ ANAEMIA
```

ANAEMIA	TOTAL
ANAEMIA	271
Row %	100.000
Col %	45.318
SE %	2.401
LCL %	40.438
UCL %	50.198
NO ANAEMIA	327
Row %	100.000
Col %	54.682
SE %	2.401
LCL %	49.802
UCL %	59.562
TOTAL	598
Design Effect	1.389

Anaemia categories in children aged 6-59 months

```
DEFINE ANAEMIA_c

RECODE CHHB TO ANAEMIA_c
        LOVALUE - 6.9 = "SEVERE"
        7.0 - 9.9 = "MODERATE"
        10.0 - 10.9 = "MILD"
        11.0 - HIVALUE = "NO ANAEMIA"
END

FREQ ANAEMIA_c PSUVAR=Cluster
```

If you are analysing a simple random survey, the code is as follows:

```
FREQ ANAEMIA_c
```

ANAEMIA_c	TOTAL
MILD	145
Row %	100.000
Col %	24.247
SE %	1.889
LCL %	20.409
UCL %	28.086
MODERATE	123
Row %	100.000
Col %	20.569
SE %	1.911
LCL %	16.684
UCL %	24.453
NO ANAEMIA	327
Row %	100.000
Col %	54.682
SE %	2.401
LCL %	49.802
UCL %	59.562
SEVERE	3
Row %	100.000
Col %	0.502
SE %	0.281
LCL %	-0.069
UCL %	1.072
TOTAL	598
Design Effect	1.160

Mean haemoglobin in children aged 6-59 months

MEANS CHHB PSUVAR=CLUSTER

If you are analysing a simple random survey, the code is as follows:

MEANS CHHB

	CHHB						
	Count	Mean	Std Error	Confidence Limits		Minimum	Maximum
				Lower	Upper		
TOTAL	598	10.967	0.067	10.830	11.104	5.500	14.500

Age categories

DEFINE AGEGROUP

RECODE MONTHS TO AGEGROUP
6 - 23.99 = 1
24 - 59.99 = 2
END

Anaemia, anaemia categories and mean haemoglobin in children aged 6-23 months (cluster survey)

Use the newly generated variables 'ANAEMIA', 'ANAEMIA_c' and 'AGEGROUP' defined above to conduct the following analysis.

SELECT AGEGROUP=1

FREQ ANAEMIA ANAEMIA_c PSUVAR=CLUSTER

MEANS CHHB PSUVAR=CLUSTER

SELECT (this will cancel the selected variable(s); only to be executed after the analysis is done and the results recorded)

ANAEMIA	TOTAL
ANAEMIA	130
Row %	100.000
Col %	63.415
SE %	3.641
LCL %	56.016
UCL %	70.813
NO ANAEMIA	75
Row %	100.000
Col %	36.585
SE %	3.641
LCL %	29.187
UCL %	43.984
TOTAL	205
Design Effect	1.165

ANAEMIA_c	TOTAL
MILD	66
Row %	100.000
Col %	32.195
SE %	3.194
LCL %	25.705
UCL %	38.685
MODERATE	64
Row %	100.000
Col %	31.220
SE %	3.314
LCL %	24.485
UCL %	37.954
NO ANAEMIA	75
Row %	100.000
Col %	36.585
SE %	3.641
LCL %	29.187
UCL %	43.984
TOTAL	205
Design Effect	0.953

	CHHB						
	Count	Mean	Std Error	Confidence Limits		Minimum	Maximum
				Lower	Upper		
TOTAL	205	10.507	0.084	10.335	10.678	7.200	13.800

Anaemia, anaemia categories and mean haemoglobin in children aged 24-59 months (cluster survey)

Use the newly generated variables 'ANAEMIA', 'ANAEMIA_c' and 'AGEGROUP' defined above to conduct the following analysis.

SELECT AGEGROUP=2

FREQ ANAEMIA ANAEMIA_c PSUVAR=CLUSTER

MEANS CHHB PSUVAR=CLUSTER

SELECT (this will cancel the selected variable(s); only to be executed after the analysis is done and the results recorded)

ANAEMIA	TOTAL
ANAEMIA	141
Row %	100.000
Col %	35.878
SE %	2.916
LCL %	29.952
UCL %	41.804
NO ANAEMIA	252
Row %	100.000
Col %	64.122
SE %	2.916
LCL %	58.196
UCL %	70.048
TOTAL	393
Design Effect	1.449

ANAEMIA_c	TOTAL
MILD	79
Row %	100.000
Col %	20.102
SE %	2.291
LCL %	15.446
UCL %	24.758
MODERATE	59
Row %	100.000
Col %	15.013
SE %	2.023
LCL %	10.902
UCL %	19.124
NO ANAEMIA	252
Row %	100.000
Col %	64.122
SE %	2.916
LCL %	58.196
UCL %	70.048
SEVERE	3
Row %	100.000
Col %	0.763
SE %	0.430
LCL %	-0.111
UCL %	1.637
TOTAL	393
Design Effect	1.281

	CHHB						
	Count	Mean	Std Error	Confidence Limits		Minimum	Maximum
				Lower	Upper		
TOTAL	393	11.207	0.080	11.045	11.369	5.500	14.500

Anaemia, anaemia categories and mean haemoglobin in children aged 6-23 and 24-59 months (simple random survey)

If you are analysing a simple random survey, the code is as follows:

FREQ ANAEMIA ANAEMIA_c STRATAVAR = AGEGROUP

MEANS CHHB STRATAVAR = AGEGROUP

MODERATE AND SEVERE ANAEMIA (HB<10) IN CHILDREN AGED 6-59 MONTHS AND BY AGE GROUP ANALYSIS

PREVALENCE OF MODERATE AND SEVERE ANAEMIA IN CHILDREN 6-59 MONTHS OF AGE AND BY AGE GROUP

	6-59 months n = 598	**6-23 months** n=205	**24-59 months** n=393
Moderate and Severe Anaemia (Hb<10.0 g/dL)	(126) 21.1 % (17.1-25.0 95% CI)	(64) 31.2% (24.5-38.0 95% CI)	(62) 15.8 % (11.6-20.0 95% CI)

Moderate and severe anaemia (Hb<10 g/dL) in children aged 6-59 months

```
DEFINE HBLESS10

RECODE CHHB TO HBLESS10
        LOVALUE - 9.9 = "LOW HB"
        10.0 - HIVALUE = "HIGH HB"
END

FREQ HBLESS10 PSUVAR=Cluster
```

If you are analysing a simple random survey, the code is as follows:

```
FREQ HBLESS10
```

HBLESS10	TOTAL
HIGH HB	472
Row %	100.000
Col %	78.930
SE %	1.952
LCL %	74.963
UCL %	82.897
LOW HB	126
Row %	100.000
Col %	21.070
SE %	1.952
LCL %	17.103
UCL %	25.037
TOTAL	598
Design Effect	1.368

Moderate and severe anaemia (Hb<10 g/dL) in children aged 6-23 months (cluster survey)

Use the newly generated variables 'HBLESS10' and 'AGEGROUP' defined above to conduct the following analysis.

SELECT AGEGROUP=1

FREQ HBLESS10 PSUVAR=CLUSTER

SELECT (this will cancel the selected variable(s); only to be executed after the analysis is done and the results recorded)

HBLESS10	TOTAL
HIGH HB	141
Row %	100.000
Col %	68.780
SE %	3.314
LCL %	62.046
UCL %	75.515
LOW HB	64
Row %	100.000
Col %	31.220
SE %	3.314
LCL %	24.485
UCL %	37.954
TOTAL	205
Design Effect	1.043

Moderate and severe anaemia (Hb<10 g/dL) in children aged 24-59 months (cluster survey)

Use the newly generated variables 'HBLESS10' and 'AGEGROUP' defined above to conduct the following analysis.

SELECT AGEGROUP=2

FREQ HBLESS10 PSUVAR=CLUSTER

SELECT (this will cancel the selected variable(s); only to be executed after the analysis is done and the results recorded)

HBLESS10	TOTAL
HIGH HB	331
Row %	100.000
Col %	84.224
SE %	2.078
LCL %	80.002
UCL %	88.446
LOW HB	62
Row %	100.000
Col %	15.776
SE %	2.078
LCL %	11.554
UCL %	19.998
TOTAL	393
Design Effect	1.274

Moderate and severe anaemia (Hb<10 g/dL) in children aged 6-23 and 24-59 months (simple random survey)

If you are analysing a simple random survey, the code is as follows:

FREQ HBLESS10 STRATAVAR = AGEGROUP

WOMEN ANAEMIA

Below are the standard Epi Info codes to use for analysis. All the standard PGM files containing these Epi Info codes can be found in the Epi Info mdb file entitled HUN1207WMBUDA in the SENS Anaemia tool: [**Tool 8**-WM Data]. To access the PGM files, go to Program Editor window and open the corresponding PGM file needed for the analysis.

Refer to the fictitious dataset available for practical purposes; Go to **Tool 8**, and see the Excel database HUN_1207_WM_BUDA.

The practical Excel database HUN_1207_WM_BUDA is from a nutrition survey using *simple random sampling*.

DATA CLEANING

Run these commands (together or separately; regardless of the survey design) and make sure that the ranges of the variables entered in the database match the standard codes shown in **Table 5** above.

MEANS WMAGE
MEANS WMHB

FREQ PREGNANT
FREQ ANC
FREQ FEREC

You should check the missing data in your database and double-check that this was not a data entry oversight. The commands below need to be run separately, one by one. After selecting the variable using the code shown below, use the LIST command to view the specific records with missing data and double-check with the original data collection questionnaire. Then cancel the selected variable by typing SELECT and proceed with checking another variable.

SELECT WMAGE=(.)
SELECT (this will cancel the selected variable)

SELECT PREGNANT=2 OR PREGNANT=8 (this is equivalent to PREGNANT<>1). Then
SELECT WMHB=(.)

SELECT PREGNANT=(.)

SELECT PREGNANT=1 AND ANC=(.)

SELECT PREGNANT=1 AND FEREC=(.)

DATA ANALYSIS

Results from the practical survey dataset are illustrated below.

TOTAL ANAEMIA, ANAEMIA CATEGORIES AND MEAN HB ANALYSIS

PREVALENCE OF ANAEMIA AND HAEMOGLOBIN CONCENTRATION IN NON-PREGNANT WOMEN OF REPRODUCTIVE AGE (15-49 YEARS)

Anaemia - Women of reproductive age 15-49 years	**All** n = 189
Total Anaemia (<12.0 g/dL)	(32) 16.9% (11.9-23.1 95% CI)
Mild Anaemia (11.0-11.9 g/dL)	(10) 5.3% (2.6-9.5 95% CI)
Moderate Anaemia (8.0-10.9 g/dL)	(22) 11.6% (7.4-17.1 95% CI)
Severe Anaemia (<8.0 g/dL)	(0) 0 (0-0 95% CI)
Mean Hb, g/dL **(SD)** **[range]**	13.3 g/dL 1.8 [8.0-17.9]

Total Anaemia

DEFINE ANAEMIA

RECODE WMHB TO ANAEMIA
LOVALUE - 11.9 = "ANAEMIA"
12.0 - HIVALUE = "NO ANAEMIA"
END

SELECT PREGNANT=2 OR PREGNANT=8 (This is equivalent to SELECT PREGNANT<>1)

FREQ ANAEMIA

If you are analysing a cluster survey, you need to use the C-Sample commands and the code is as follows:

FREQ ANAEMIA PSUVAR=CLUSTER

SELECT (this will cancel the selected variable(s); only to be executed after the analysis is done and the results recorded)

ANAEMIA	Frequency	Percent	Cum Percent	
ANAEMIA	32	16.9%	16.9%	
NO ANAEMIA	157	83.1%	100.0%	
Total	189	100.0%	100.0%	

	95% Conf Limits	
ANAEMIA	11.9%	23.1%
NO ANAEMIA	76.9%	88.1%

Anaemia categories

DEFINE ANAEMIA_c

RECODE WMHB TO ANAEMIA_c
LOVALUE - 7.9 = "SEVERE"
8.0 - 10.9 = "MODERATE"
11.0 - 11.9 = "MILD"
12.0 - HIVALUE = "NO ANAEMIA"
END

SELECT PREGNANT=2 OR PREGNANT=8 (this is equivalent to SELECT PREGNANT <>1)

FREQ ANAEMIA_c

If you are analysing a cluster survey, you need to use the C-Sample commands and the code is as follows:

FREQ ANAEMIA_c PSUVAR=CLUSTER

SELECT (this will cancel the selected variable(s); only to be executed after the analysis is done and the results recorded)

ANAEMIA_c	Frequency	Percent	Cum Percent	
MILD	10	5.3%	5.3%	
MODERATE	22	11.6%	16.9%	
NO ANAEMIA	157	83.1%	100.0%	
Total	189	100.0%	100.0%	

	95% Conf Limits	
MILD	2.6%	9.5%
MODERATE	7.4%	17.1%
NO ANAEMIA	76.9%	88.1%

Mean haemoglobin

SELECT PREGNANT=2 OR PREGNANT=8 (this is equivalent to SELECT PREGNANT <>1)

MEANS WMHB

If you are analysing a cluster survey, you need to use the C-Sample commands and the code is as follows:

MEANS WMHB PSUVAR=CLUSTER

SELECT (this will cancel the selected variable(s); only to be executed after the analysis is done and the results recorded)

Obs	Total	Mean	Variance	Std Dev
189	2515.4000	13.3090	3.4192	1.8491

Minimum	25%	Median	75%	Maximum	Mode
8.0000	12.5000	13.6000	14.5000	17.9000	13.9000

ANC ENROLMENT AND IRON-FOLIC ACID PILLS COVERAGE ANALYSIS

ANC ENROLMENT AND IRON-FOLIC ACID PILLS COVERAGE AMONG PREGNANT WOMEN (15-49 YEARS)

	Number /total	% (95% CI)
Currently enrolled in ANC programme	9/20	45.0 (23.1-68.5)
Currently receiving iron-folic acid pills	9/21	42.9 (21.8-66.0)

ANC enrolment

SELECT PREGNANT=1 AND ANC<>8

FREQ ANC

If you are analysing a cluster survey, you need to use the C-Sample commands and the code is as follows:

FREQ ANC PSUVAR=CLUSTER

SELECT (this will cancel the selected variable(s); only to be executed after the analysis is done and the results recorded)

ANC	Frequency	Percent	Cum Percent	
1	9	45.0%	45.0%	
2	11	55.0%	100.0%	
Total	20	100.0%	100.0%	

95% Conf Limits

1 23.1% 68.5%

2 31.5% 76.9%

Iron-folic acid pills coverage

SELECT PREGNANT=1 AND FEREC<>8

FREQ FEREC

If you are analysing a cluster survey, you need to use the C-Sample commands and the code is as follows:

FREQ FEREC PSUVAR=CLUSTER

SELECT (this will cancel the selected variable(s); only to be executed after the analysis is done and the results recorded)

FEREC	Frequency	Percent	Cum Percent	
1	9	42.9%	42.9%	
2	12	57.1%	100.0%	
Total	21	100.0%	100.0%	

95% Conf Limits

1 21.8% 66.0%

2 34.0% 78.2%

ANNEX 10 - PRESENTATION OF COMBINED CAMP RESULTS

- Weighting the data will need to be done if you have conducted surveys in a number of different camps or areas, and need to combine the results for reporting or planning purposes.

- It is not required to report the combined results for all indicators or to report the confidence intervals for the combined estimates. The tables below outline the indicators that should be reported during a combined analysis and included in the survey report.

- For a tool that will automatically generate weighed prevalence results, see SENS Pre-Module tool: [**Tool 14**-Weighting Data Tool].

COMBINED PREVALENCE OF ANAEMIA IN CHILDREN 6-59 MONTHS OF AGE

Anaemia in Children 6-59 months	
Total Anaemia (Hb<11.0 g/dL)	%
Moderate Anaemia (7.0-9.9 g/dL)	%
Severe Anaemia (<7.0 g/dL)	%

COMBINED PREVALENCE OF ANAEMIA IN NON-PREGNANT WOMEN OF REPRODUCTIVE AGE (15-49 YEARS)

Anaemia in Non-pregnant women of reproductive age 15-49 years	
Total Anaemia (<12.0 g/dL)	%
Moderate Anaemia (8.0-10.9 g/dL)	%
Severe Anaemia (<8.0 g/dL)	%