

# **NATIONAL FAMILY HEALTH SURVEY (NFHS-5)**

## **CLINICAL, ANTHROPOMETRIC AND BIOCHEMICAL (CAB) MANUAL**

**2019-2020**

**OCTOBER 2019**



(स्थापना / Established in 1956)  
बेहतर भविष्य के लिए क्षमता निर्माण  
Capacity Building for a Better Future

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## PREFACE

In combination with classroom instruction and practical experience, this manual will be used to teach you how to collect blood samples and conduct basic tests to measure biomarkers for the 2019-2020 National Family Health Survey (NFHS-5). Before each training session, you should carefully study this manual and the biomarker section of the Household Questionnaire. You are encouraged to ask questions during training and to discuss problems encountered to avoid making mistakes during fieldwork. The training is organized into 4 phases:

- During the first phase, we will review with you the chapters of this manual. You will learn how to identify eligible respondents for biomarker measurement, how to record information relating to the biomarker being measured in the Biomarker Questionnaire or on special field forms, how to handle the technical procedures involved in the measurement of height/length, weight, waist circumference, and hip circumference, as well as blood sample collection, testing, and transportation, and other related instructions.
- In the second phase, you will practice the procedures you've been taught by role playing with other trainees. This practice will include height, weight, hip, and waist measurement; blood pressure measurement; and finger pricks for haemoglobin; blood glucose testing, and for the preparation of dried blood spots (DBS) for malaria, antimalarial drug resistance, HbA1c, and Vitamin D testing in central laboratories.
- In the third phase, you will visit a health facility for additional practice. After obtaining the consent from respondents or the person responsible, in the case of children, you will practice taking height and weight measurements among children and adults, taking hip and waist circumference measurements among adults, collecting blood samples from eligible respondents, and practice measuring biomarkers.
- In the final phase, known as field practice, you will be assigned to a NFHS-5 trainee team. During field practice, you will collect blood samples from eligible children and adults and measure biomarkers exactly as you will during the main survey fieldwork. Households that you visit will be in clusters that are not part of the India NFHS-5 sample.

Throughout the training, you may be given homework assignments and tests. At the end of the training, your overall performance will be assessed and those who have performed the best will be selected to work in the survey. Your training does not end at the start of fieldwork. Rather, it is a continuous process. Your team supervisor and the NFHS-5 health and survey coordinators will play important roles in continuing your training and in ensuring the quality of data you collect throughout the survey. They will:

- Periodically observe your fieldwork activities to ensure that you are conducting yourself professionally, obtaining informed consent from respondents, and following the sample collection and biomarker measurement protocol correctly;
- Spot check that you 1) visited the correct households, and 2) collected blood samples and measured biomarkers only from eligible respondents;
- Collect blood specimens for transport to the laboratory and consolidate the field record forms;
- Regularly meet with you to discuss your performance and give out future work assignments.

Any field staff member who is not performing at the level necessary to produce the high quality data required to make NFHS-5 a success may be released from service.

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## **CHAPTER 1: OVERVIEW OF SURVEY**

### **INTRODUCTION**

The 2019-2020 National Family Health Survey (NFHS-5) is a nationally representative household survey that measures a wide range of indicators relating to fertility, family planning, and maternal and child health. This is the fifth NFHS conducted in India and will include for the first time waist and hip circumference measurements. NFHS-5 will produce population-based estimates of anaemia, malaria, prevalence of Vitamin D deficiency, HbA1c, and height and weight measurements among women age 15-49 and men age 15-54. Among young children age 6-71 months, anaemia, height, and weight will be measured. Additionally, women and men age 15 and above in all PSUs will have their blood pressure and blood glucose measured.

### **Anemia Testing**

For anaemia testing, finger stick blood samples be collected from all women age 15-49 in all households and men age 15-54 in a subset of households sampled for NFHS-5 who voluntarily consent to the testing. In addition, anaemia testing will also be performed for children under age six<sup>1</sup> in the households. For the children, consent will have to be obtained from their parents or the adult who is responsible for their care. The anaemia testing will be conducted in the field using a HemoCue photometer and microcuvette, which requires a very small volume of blood to measure the level of haemoglobin. The results of the anaemia test will be recorded in the NFHS-5 Biomarker Questionnaire and provided immediately to each individual tested both verbally and in writing. The health investigator will describe to the respondent the meaning of the results and will advise the participant if medical treatment is necessary. Individuals whose haemoglobin levels fall below the designated cut-off points (9g/dl for men and pregnant women and 7g/dl for women who are not pregnant or don't know if they are pregnant and children under age six) will be referred to local health facilities for assessment and treatment (see Appendix 3). All households, whether eligible individuals found in the household participate in the anaemia testing or not will be provided an informational brochure on anaemia (see Appendix 7 and 8). Brochures will also be made available to other community residents who request them.

### **Blood Glucose Testing**

Finger stick blood will also be collected from women age 15+ and men age 15+ for glucose testing using the same procedures as those used for anaemia testing. NFHS-5 will use the Accu-Chek Performa Glucometer to conduct blood glucose testing. The readings are considered equivalent to blood glucose levels in laboratory estimations using the Glucose Oxidase Method for glucose levels in the range of 10-600 mg/dL. The results will be available in five seconds on an LCD digital display and they will be given to respondents on a health card immediately after the test is completed. The health investigator will describe to the respondent the meaning of the results and will advise the respondent if a referral to a medical centre is necessary (see Appendix 4).

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<sup>1</sup>Children born in January 2015 or later and older than 6 months are eligible for anaemia testing; for the sake of simplicity, this group of children is referred to as 'children under age six' throughout.

### **Blood Pressure Measurements**

Elevated blood pressure (high blood pressure) is a known risk factor for a number of chronic and non-communicable diseases. NFHS-5 will measure the blood pressure of eligible respondents using an OMRON Blood Pressure Monitor to determine the prevalence of hypertension. Blood pressure measurements for each respondent, women 15-49 and men 15-54, will be taken on three separate occasions and the readings recorded in the Biomarker Questionnaire with an interval of 5 minutes between readings. The results will be given to respondents on a health card immediately after the test is completed. The health investigator will describe to the respondent the meaning of the results and will advise the respondent if a referral to a medical centre is necessary. Respondents whose systolic blood pressure (SBP) is  $>130$  mm Hg or diastolic blood pressure (DBP)  $> 85$  mm Hg are considered to have elevated blood pressure readings and will be encouraged to see a doctor as soon as possible for a full evaluation (see Appendix 2).

### **Malaria disease testing**

Diagnosis of symptomatic and asymptomatic malaria (*Plasmodium* species like *P. falciparum*, *P. vivax*, *P. malariae*, *P. ovale*, and *P. knowlesi*) is important. Also, there is a need to detect markers of antimalarial drug resistance – specific molecular markers in the plasmodium DNA and *hrp2* deletions in the malaria parasites (if present). Most malaria is being reported from states in the eastern, central and north-eastern part of the country, such as Odisha, Chhattisgarh, Jharkhand, Madhya Pradesh, Maharashtra, Tripura, and Meghalaya (see Appendix 4). To test for malaria, dried blood spots (DBS) will be prepared. Blood spots will be collected on filter paper cards from women 15-49 and men 15-54 in households selected for man's interview. Blood spots will be tested in the laboratory.

### **HbA1c Testing**

Glycosylated haemoglobin is a parameter to provide information on status of diabetes control at the population level among diabetes patients. And also, will provide useful information on diabetes management strategies and guide policy makers in programme planning. To test for HbA1c, DBS will be prepared. Blood spots will be collected on filter paper cards from women 15-49 and men 15-54 in households selected for DBS collection. Blood spots will be tested in the laboratory.

### **Vitamin D**

The reported prevalence of Vitamin D3 deficiency is about 50-70% in India. Osteopenia and osteoporosis are common among India adults. Patients with chronic kidney diseases (CKD) may also present with bone disorders before or after developing kidney diseases. They may have osteoporosis and Vitamin D deficiency. Hence, determination of Vitamin D3 levels is of major importance. To test for vitamin D3 deficiency, DBS will be prepared. Blood spots will be collected on filter paper cards from women 15-49 and men 15-54 in households selected for DBS collection. Blood spots will be tested in the laboratory.

## **Survey Design**

The NHFS-5 design calls for anonymous, linked data analysis. DBS samples from adults will be collected for selected parameter related to nutrition, communicable and non-communicable diseases. ICMR will take the responsibility of storage, transport and testing of DBS for above mention parameters in pre-selected laboratories. Health investigators will give a referral card for free Malaria, HbA1c and Vitamin D testing/counseling to everyone eligible for testing. The fieldwork will be carried out by a number of interviewing teams. Field teams will consist of one field supervisor, three female interviewers, one male interviewer, and two health investigators. Female interviewers will interview women only and male interviewers will interview men only. Either female or male interviewers may conduct the household interview. Height, weight, waist and hip circumference measurements of male and female respondents and children under the age of six years will be done by the health investigators on each team with assistance from interviewers, as needed. However, blood pressure measurement, blood collection for haemoglobin and blood glucose testing, and preparation of dried blood spots for malaria, anti-malarial drug resistance, HbA1c and vitamin D testing will be done only by the specially trained health investigators.

## **OVERVIEW OF BIOMARKER COLLECTION**

A biomarker may be thought of as a characteristic that can be independently measured and evaluated as an indicator of normal biologic processes, pathogenic processes, or pharmacologic response to a therapeutic intervention<sup>2</sup>. Biomarker measurements can serve as diagnostic tools to identify diseases in their early stages and can be used as surveillance tools to track changes in disease patterns or to evaluate intervention programmes. In population-based surveys, biomarkers help assess the prevalence or occurrence of diseases or health conditions and can also be used at a macro level to measure the long-term effect of policies and programmes. In NFHS-5, biomarkers are measured in order to report levels of specific diseases and conditions at the population level. Specific to NFHS-5, the following biomarkers will be measured: Haemoglobin, random blood glucose, blood pressure, height & weight, waist & hip circumference measurements, malaria, anti- malarial drug resistance, HbA1c and vitamin D. This training manual will discuss the proper collection techniques and the appropriate recording and result reporting of these biomarkers.

Biomarker measurement or testing should take place only after the completion of the household and individual questionnaires. However, prior to measurement or testing, certain tasks must be completed. This chapter reviews these tasks, which include:

- Determining eligibility
- Obtaining informed consent.

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<sup>2</sup>Biomarker Definitions Working Group, National Institutes of Health, 2001



## ELIGIBILITY

Not all household members are eligible for biomarker measurements. Thus, the first step in the collection process is to identify members of the household who are eligible: women age 15-49 in all households, men age 15-54 in a subsample of households, and children under age 6 years old in all households who are usual household residents or are visitors who stayed in the house the night before the household interview took place. Women and men age 15+ will be eligible for testing of blood pressure and blood glucose in all PSUs. Based on age and residency, eligible respondents may qualify for one or more biomarker measurements or tests.

**It is the responsibility of the interviewer** to identify all of the household members who are eligible for biomarker measurements. **It is the responsibility of the health investigator** to ensure they have the correct respondent(s) and child(ren) as listed in the biomarker questionnaire. Individuals eligible for biomarker measurements will be identified by a Biomarker Summary menu in the CAPI program.

**The table below summarizes which household members are eligible for which measurements and tests**

Type of PSU Module	Eligible	Investigations
District Module	Children 0-5 months	Weight and Length
	Children 6-71 months	Weight, Length/Height and Haemoglobin
	Women 15-49	Weight, Height, Waist and Hip Circumference, Haemoglobin, Blood Glucose, Blood Pressure
	Women above 49 Men 15+	Blood Glucose, Blood Pressure
State Module	Children 0-5 months	Weight and Length
	Children 6-71 months	Weight, Length/Height and Haemoglobin
	Women 15-49	Weight, Height, Waist and Hip Circumference, Haemoglobin, Blood Glucose, Blood Pressure
	Men 15-54	Weight, Height, Waist and Hip Circumference, Haemoglobin, Blood Glucose, Blood Pressure
	Women above 49 Men above 54	Blood Glucose, Blood Pressure
PSU selected for DBS Collection*	Women 15-49 Men 15-54	DBS Collection

\*In addition to all the investigations done in state module PSUs

When the interviewers have completed the household and individual interviews, they will fill in information for all adults and children in the household who are eligible for biomarker measurements from their CAPI device in the appropriate sections of the paper Biomarker Questionnaire.

In the Biomarker Questionnaire, the eligible adult's name, line number, age, and marital status must be accurately recorded. It is the responsibility of the interviewer to transfer all the above information from his/her CAPI device into the Biomarker Questionnaire. The health investigator should check with the interviewer to make sure that the information entered in the Biomarker Questionnaire is correct and accurately recorded prior to collecting any biomarker-related information from the respondent. For children under age 6, the day, month, and year of the child's birth should be copied from the mother's birth history if she was interviewed, or else the date of birth should be asked from the mother or from another knowledgeable adult.

**The following are important points to keep in mind when completing the Biomarker Questionnaire:**

- 1. For all eligible adults who consent to biomarker testing and, who are also eligible for the individual interview, the biomarker data should only be collected after their individual interview has been completed.**
- 2. Measure biomarkers from one individual at a time.** All biomarker testing should be completed on one individual at a time before moving on to the next eligible, consenting person. For example, if there is more than one eligible respondent in a household who has consented to biomarker testing, complete all the biomarker measurements/tests on her/him *before* proceeding to the next respondent. Likewise, complete the testing of all biomarkers from one child before proceeding to the next child. Failure to do so may lead to results being recorded in the wrong columns of the Biomarker Questionnaire.
- 3. Never alter any responses in the Biomarker Questionnaire without consulting the interviewer.** Even in cases where there are concerns about an individual's eligibility for testing, proceed with height and weight measurement and testing. Record in the comments section of the Biomarker Questionnaire a description of the problem. Provide as many details as possible. The field organization/central office will decide later what will be done about the test results for the respondent in question.
- 4. The following questions on screening tests/examinations are part of the biomarker questionnaire and will be administered by the Health Investigator:**
  - For woman Q379 to Q381: These questions on screening tests/examinations of cervical cancer, breast cancer and oral cavity cancer are to be asked to all women age 15-49 irrespective of whether or not the consent is given for CAB investigations or completion of CAB investigations.
  - For man Q478: This question on examinations of oral cavity cancer is to be asked to all men age 15-54 (in households selected for state module) irrespective of whether or not the consent is given for CAB investigations or completion of CAB investigations.

## INFORMED CONSENT

One of the most important tasks that must be done before conducting any biomarker tests is for you to explain the purpose of the testing to eligible respondents, or in the case of children, to the parent or adult responsible for the child and to obtain their consent before collecting any blood samples. In order to ensure that these individuals can make an ‘informed’ decision about whether or not they want to be tested, the NFHS-5 Biomarker Questionnaire contains informed consent statements for each biomarker that must be read to the respondent (or to the parent or adult responsible for the child) before you do the biomarker testing (see Appendix 1). For height/length and weight measurements among children or adults, you need to explain the procedures and ask for a verbal permission from the respondent or responsible adult to take the anthropometric measurements.

### **These consent statements include the following basic elements:**

- a description of the objectives of the test
- basic information on how the test will be conducted
- assurances about the confidentiality of the results
- a specific request for permission to collect the sample

You must read the informed consent statements to each eligible respondent age 18 and over and obtain the respondent’s consent before you can begin any testing or measurement. The approach for obtaining consent differs slightly when the eligible individual is a child under age 6 or an adolescent age 15-17. If the respondent is a child or adolescent, you must first obtain the consent of one of the respondent’s parents, or in the absence of a parent, the consent of an adult who is at least 18 years of age and is responsible for the care of the child. For adolescents, you must also seek their assent. If the parent/responsible adult or the adolescent does not consent to the test, the test must not be performed. There are two exceptions to this rule of obtaining consent from a parent or responsible adult to test adolescents who are 15-17 years old: 1) if the adolescent is currently married or has ever been married, or 2) if the adolescent lives alone or in a household in which there are no adults. In either instance, the adolescent is considered an emancipated minor, and is to be treated like an adult. Under these conditions, consent of the adolescent is sufficient.

Prior to performing the blood pressure measurement, haemoglobin test, the test for random blood glucose, or to collecting blood samples for DBS preparation, you must record the outcome of the consent request in the applicable sections of the Biomarker Questionnaire. The informed consent procedure that should be followed throughout the questionnaire is shown in the box below.

## **INFORMED CONSENT SIGNATURE PROCEDURES**

**If the respondent agrees to the test, you should ask the respondent if she/he would be willing to sign on the signature line. If the respondent agrees to the test and to sign on the signature line, code '1' and have the respondent sign on the blank line. If the respondent agrees to the test, but does not want to sign her/his name, circle '3' and sign your own name. If the respondent refuses the test, circle '2' and sign your own name on the signature line. In the case of children, follow the same procedure as above with the parent/responsible adult.**

### **Key points to remember include:**

1. **Read the applicable consent statements to each eligible respondent exactly as they appear in the questionnaire.** When you arrive at the household and begin talking about the blood tests and blood pressure measurements with the respondent, you may informally discuss many of the items included in the informed consent statement. However, before beginning the testing procedures or taking blood pressure readings, you must still read the informed consent statements exactly as they are worded in the Biomarker Questionnaire. If you feel that the respondent may find the statements repetitive, tell him/her that you are required to read the statement to ensure that respondent is given all the appropriate information.
2. **Read the informed consent statements clearly.** Practice reading the consent statements out loud so that you become comfortable delivering them in a clear, natural voice and manner. Avoid speaking rapidly or in a monotone. Look at the respondent as you read the statement.
3. **For adults and adolescents, always request consent for the different tests separately.** Be sure the respondent knows that it is possible to consent to one test and not to another test. Since the outcome of the consent process may differ for the haemoglobin and blood glucose test, the blood pressure measurement, and DBS preparation for malaria, antimalarial drug resistance, HbA1c and Vitamin D testing, it is important that you accurately record the results for individual tests at the appropriate places.
4. **Never collect blood from an adolescent before obtaining the consent of the parent or the adult responsible for the adolescent,** as well as the adolescent, unless the adolescent is married, was formerly married, lives alone, or lives in a household in which there are no adult members.
5. **Never attempt to force or coerce consent.** Some respondents may be suspicious or fearful of having their blood collected for testing. Others may have questions or want to discuss the procedures before giving consent. Take time to patiently respond to all questions.
6. Some respondents may be reluctant to allow testing without consulting someone not present at the time of your visit (e.g., a woman may want to consult her husband before giving permission). **In such cases, make an appointment to return to the household later at an agreed upon time.** If you believe it will help, ask the team supervisor to visit a household where eligible respondents express fear or reluctance to be tested.

Once the individual interviews have been completed, eligible respondents have been identified, and consent has been obtained, biomarker measurement can take place.

### **Summary of Steps in Identifying Eligible Respondents and Obtaining Consent**

- Interviewer completes the household and individual questionnaires.
- Interviewer checks the list of individuals eligible for biomarkers to confirm individuals who are eligible for biomarker measurements:
  - **Adults:** All women age 15-49, men age 15-54 in a subsample of households, who are usual residents or who stayed in the household the night before the interview, are eligible for biomarker measurement.
  - **Blood Pressure:** All women and men age 15 and above in all PSUs.
  - **Blood Glucose:** All women and men age 15 and above in all PSUs.
  - Children under age 6 years who are usual residents or who stayed in the household the night before the interview are eligible for biomarker measurement.
  - Children 6-71 months are eligible for height/length, weight measurements and anaemia testing.
  - Children below 6 months: eligible for length and weight measurements only
- For adults, age 18 and older: Obtain consent for biomarker measurement and testing as follows:
  - Read consent statements exactly as written;
  - Record the outcome of the consent request based on the instructions in the BOX in the INFORMED CONSENT SECTION of the Introduction;
  - If consent is granted, proceed with biomarker measurement.
- For never-married adolescents, age 15-17:
  - Obtain consent for biomarker measurement from parent or responsible adult
    - Record whether the parent/responsible adult consented or refused and do the following based on the instructions in the BOX in the INFORMED CONSENT SECTION of the Introduction;
  - If the parent/responsible adult consented, obtain assent for biomarker measurement from the adolescent
    - Read consent exactly as written;
    - Record the outcome of the consent request based on the instructions in the BOX in the INFORMED CONSENT SECTION of the Introduction;
    - If consent was granted, proceed with biomarker measurement and testing.
- For children 6 -71 months (for anaemia testing):
  - Obtain consent for biomarker measurement and testing from parent or responsible adult
    - Read consent exactly as written;
    - Record the outcome of the consent request and based on the instructions in the BOX in the INFORMED CONSENT SECTION of the Introduction;
    - If consent was granted, proceed with biomarker testing.
- For height/length, weight measurement, and waist and hip circumference measurement among adults, you must obtain verbal permission from the respondent.

## CHAPTER 2: ANTHROPOMETRY

Anthropometry refers to the measurement of humans. In NFHS-5, anthropometry refers solely to the measurement of a person's height (length), weight, waist circumference, and hip circumference. This information can be used to assess the nutritional status of a population. For children, standard indices of physical growth related to nutritional status are height-for-age, weight-for-height, and weight-for-age. A child who is below minus two standard deviations (-2 SD) from the median of a reference population in terms of height-for-age is considered short for his/her age or stunted. Stunting reflects the cumulative effect of chronic malnutrition. A child who is below minus two standard deviations (-2 SD) from the median of a reference population in terms of weight-for-height is considered too thin for his/her height, or wasted. Wasting is a condition reflecting acute or recent nutritional deficit or a recent illness. Weight-for-age is a composite index of stunting and wasting and is a good indicator to monitor nutritional status over time.

Among adults, height and weight measurement are used to calculate a person's body mass index (BMI) and to assess a woman's risk of having difficulty in delivering due to her short stature (height < 145 cm). BMI is calculated by dividing the weight in kilograms by the height in meters squared ( $\text{kg/m}^2$ ). BMI values are used to determine the percentage of the adult population that is normal, thin, overweight and obese.

Waist circumference is also one of the various anthropometric measurements commonly used as a predictor for non-communicable diseases like diabetes, cardiovascular, obesity, metabolic syndrome, etc. As per World Health Organization (WHO) guidelines, waist circumference (WC), waist-to-hip ratio (WHR) and waist-to-height ratio (WHtR) have been found to be appropriate measurements of abdominal obesity. However, WC is found to be the best measurement of abdominal obesity. WC is also a simple and more accurate predictor of Type 2 Diabetes Mellitus (DM) than any other measurements like BMI and WHR. WC measurement would help us to estimate the prevalence of Central Obesity which is also a predictor of Type 2 DM.

### MATERIALS AND EQUIPMENT FOR ANTHROPOMETRY

- **SECA 874 U digital scale<sup>3</sup>**: for weighing children and adults. The scale has a maximum capacity of 200 kg and weighs in 50 gram increments. The scale is powered by six type AA 1.5 V batteries and has an 'ON-OFF' switch located at the front side of the scale.
- **SECA 213 Stadiometer**: for measuring the height of adults.
- **SECA 417 Infantometer**: for measuring the length of children under 2 years or less than 85 cm.
- **Gulick tape**: for measuring waist and hip circumference.
- **Biomarker Questionnaire**

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<sup>3</sup> The Seca 874 digital floor scale is manufactured by Seca Corporation, Munich, Germany. These instructions were adapted from instructions that accompany the Uniscale and that were revised by Irwin J. Shorr, MPH, MPS.

## PROCEDURES AND PRECAUTIONS BEFORE MEASURING

1. **Layout of the Procedures:** Each step of the measurement procedures is directed at specific participants, who are named in bold letters at the beginning of each step: '**Measurer**' and '**Assistant**'.
2. **Two Trained People Required:** Two trained people are required to measure a child's height or length. The measurer holds the child and takes the measurements. The assistant helps hold the child and records the measurements on the questionnaire.
3. **Daily Calibration:** The weighing scale must be calibrated with standard weight on daily basis before going to field. The allowable error is +/- 50 gm. only. The stadiometer and Infantometer must be calibrated on daily basis with a standard measuring rod of a fixed length with allowable error of +/- 0.5 cm. The Health Investigators are required to keep a log of daily calibration. Any machine with error more than allowed should not be used for field work and should be immediately informed to IIPS.
4. **Measuring Board and Scale Placement:** Be selective about where you place the measuring board and scale. It is best to measure outdoors during daylight hours. If it is cold, raining or if too many people congregate and interfere with the measurements, it may be more comfortable to weigh and measure indoors. Make sure there is adequate light.
5. **Age Assessment:** Before you measure, determine the child's age. If the child is less than two years old, measure length (that is, with the child lying). If the child is two years of age or older, measure height (that is, with the child standing). If accurate age is not possible to obtain, measure length if the child is less than 85 cm. Measure height if the child is equal to or greater than 85 cm.
6. **Weigh and Measure One Child at a Time:** If there is more than one eligible child in a household, complete the weighing and measuring of one child at a time. Then proceed with the next eligible child. **DO NOT** weigh and measure all the children together, otherwise measurements may get recorded in the wrong columns of the questionnaire. Return measuring equipment to the storage bags immediately after you complete the measurements for each household.
7. **Control the Child:** When you weigh and measure, you must control the child. The strength and mobility of even very young children should not be underestimated. Be firm yet gentle with children. Your own sense of calm and self-confidence will be felt by the parent and the child.

When a child has contact with any measuring equipment, i.e., on an Infantometer, you must hold and control the child so the child will not trip or fall. Never leave a child alone with a piece of equipment.

8. **Coping with stress:** Since weighing and measuring requires touching and handling children, normal stress levels for this type of survey work are higher than for surveys where only verbal information is collected.

Explain the weighing and measuring procedures to the mother, father, or other responsible adult and to a limited extent, the child, to help minimize possible resistance, fears or discomfort they may feel. You must determine if the child or the parent is under so much stress that the weighing and measuring must stop. Remember, young children are often uncooperative; they tend to cry, scream, kick and sometimes bite. If a child is under severe stress and is crying excessively, try to calm the child or return the child to the parent before proceeding with the measuring.

**Do not weigh or measure a child if:**

- The parent/responsible adult refuses,
  - The child is too sick or distressed,
  - The child is physically deformed which will interfere with or give an incorrect measurement. To be kind, you may want to measure such a child and make a note of the deformity on the questionnaire.
9. **Recording Measurements and Being Careful:** Keep objects out of your hands and pens out of your mouth, hair or breast pocket when you weigh and measure so that neither the child nor you will get hurt due to carelessness. When you are not using a pen, place it in your equipment pack or on the questionnaire. Make sure you do not have long fingernails. Remove interfering rings and watches before you weigh and measure.
10. **Strive for Improvement:** You can be an expert measurer if you strive for improvement and follow every step of every procedure the same way every time. The quality and speed of your measurements will improve with practice. You will be required to measure women, men, and children. **Do not take these procedures for granted even though they may seem simple and repetitious. It is easy to make errors when you are not careful.** Do not omit any steps. Concentrate on what you are doing.

**STEPS FOR MEASURING WEIGHT AND HEIGHT/LENGTH:**

1. Before the health investigator (HI) starts any biomarker measurements, the interviewer should carefully check that all adults and children in the household who are eligible for weight and height/length measurement have been recorded on the paper Biomarker Questionnaire. Children born in 2015 or later who are usual residents of the household or who are visitors who spent the previous night in the household are eligible for anthropometry. This information should be entered in the appropriate columns of the Biomarker Questionnaire by the interviewer.

In **Question 203**, for children under age 6 years, the day, month, and year of the child's birth should be copied from the mother's birth history if she was interviewed; otherwise the date of birth should be asked from the mother or from another knowledgeable adult.

2. In **Question 204** confirm that the child was born in JANUARY 2015 or later. If the child



was born before JANUARY 2015, go to **Question 203** for the next child.

3. Perform the child weight and height/length measurements according to the instructions below.
4. Check that the **Name, Line Number, Age, and Marital Status** of all eligible women and men has been recorded in **Question 302/402**, respectively, of the Biomarker Questionnaire.
5. Perform the adult weight and height measurements according to the instructions below.

## TAKING WEIGHT

### Preparing the Adult and Children to Take Their Weight

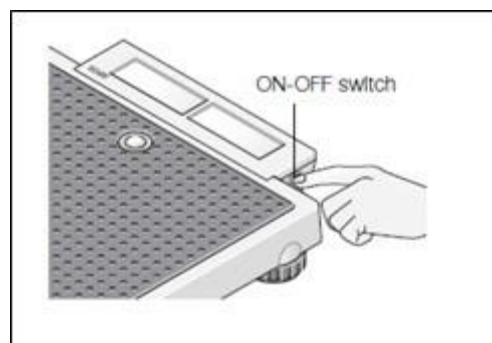
Show the scale to the adult and explain that you will weigh her/him and their young children on the scale. Tell her/him that infants and any other children who will not stand on the scale alone can be held by the adult to obtain the child's weight. Ask the adult to wear light clothing while being weighed and to remove shoes/sandals and any heavy clothing, etc. Ask the adult to undress the child just before taking his/her weight. Leave underpants on the child.

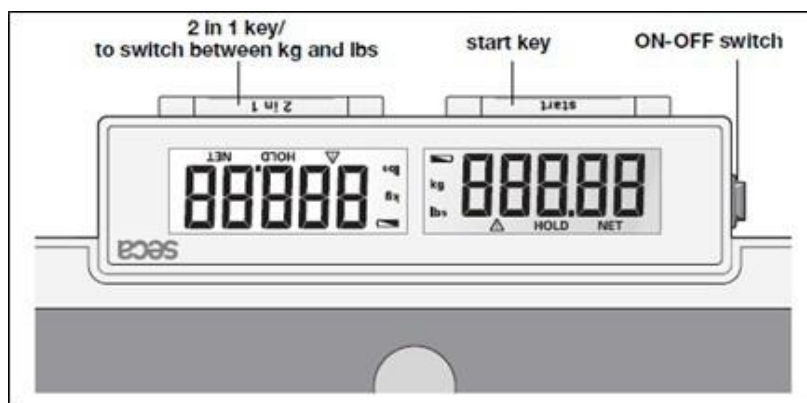


**SECA 874 model**

### Preparing the Scale

When you are about to weigh children or adults in the household, take the scale out of the storage bag and place the scale on a hard, level surface. Uneven surfaces or vibration may cause the scale to malfunction. You can adjust the individual feet on the base of the weighing scale to make it more stable. Turn on the power to the scale by pushing the switch located at the side of the display window of the scale to position 'ON'.





The scale will not function correctly if it is bumped, knocked or moved during the weighing. It is best to use the scale in the shade or indoors. Handle the scale carefully:

- Turn on the scale for weighing by pressing the ‘**START**’ key.
- Do not drop or bump the scale.
- Do not weigh a total weight of more than 200 kg.
- Do not store the scale in direct sunlight or other hot places.
- Protect the scale against excess humidity or moisture.
- To clean the scale, wipe surfaces with a damp cloth and dry immediately.
- Never put the scale in water.
- After using the scale, turn off the scale by pressing the ‘**START**’ key.
- The scale switches off on its own after a certain time:
  - After 3 minutes in Normal mode
  - After 2 minutes in the ‘**2 in 1**’ mode

### **Weighing Adults and Children Who Can Stand on the Scale by Themselves**

1. If the power supply is not activated, push the power switch to position ‘ON’. The scale now has power. To prepare the scale for weighing, press the ‘**START**’ key when no one is on the scale. The display should show ‘SECA, 8.8.8.8.8 and ‘0.00.’ The scale automatically sets to zero and is now ready for use. Wait for the scale to display the numbers ‘0.00’ before asking the adult or child to step on the scale.
2. Before stepping onto the scale, ask to remove as much outer clothing as possible. Do not set up next to electrical appliances, for instance by a television.
3. Ask the adult or child to step onto the centre of the scale and stand still. Wait until the numbers on the display no longer change and stay fixed in the display.
4. ‘**HOLD**’ and a triangle [Δ] with an exclamation mark appear in the display window and the weight remains frozen until the next weighing operation. Record the weight in kg to two decimal places (for example, 61.35) on the Biomarker Questionnaire. Note that the second decimal place on the scale will show only ‘0’ or ‘5’. The scale will never show 1, 2, 3, 4, 6, 7, 8, or 9 for the second decimal place.
  - For children, record the child’s **weight** measurement in **Questions 205**. If the child’s weight was not measured, record the appropriate code in **Question 205**.
  - Record an adult’s **weight** measurement in **Questions 303/403**. If the adult’s weight was not measured, record the appropriate code in **Questions 303/403**.

## **Weighing Infants or Children Who Must be Held by an Adult While on the Scale**

### **If You Do NOT Give the Adult a Blanket or Cloth to Cover the Child:**

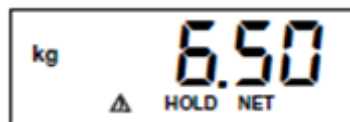
1. Ask the adult to step onto the center of the scale and stand still. Wait until the numbers are stable on the display window.

**PLEASE NOTE!!!** In the above statement, only a **“SHORT PRESS”** on the “2 in 1 function” is required in order to weigh children who need to be held. A **“LONG PRESS”** on the “2 in 1 function” will switch the units of measurements from **KILOGRAMS** to **POUNDS** instead.

2. Short press the **2 in 1** key. The scale stores the weight of the adult and the display returns to zero (**0.00**). **NET** will appear in the display.
3. Give the child to the adult. After the weight is stable for about 3 seconds, the weight will be retained. The display weight should not jump around, even due to a child’s movement after this point.
4. **▲ HOLD** and **NET** appear in the display and the weight of the child being held can be recorded.

**Please note:** the scale will determine the weight of the child even though the adult is on the scale. Once the value for the child’s weight becomes stable for about 3 seconds, the value is retained and **▲ HOLD** and **NET** appear in the display window. The number in the display is the weight of the child only, even though the adult is also standing on the scale.

5. Record the weight of the child as displayed on the scale (the scale measures with 50 g resolution) in the Biomarker Questionnaire. The second digit after the decimal will **ONLY** read “0” or “5”. Thus, a weight of 6.52 kg isn’t possible, but a weight of 6.50 kg or 6.55 kg is possible on the scale.



**If there are other children to be weighed who must be held by the adult, finish all measurements for the first child before moving onto the next.**

### **If You Give the Adult a Blanket or Cloth to Cover the Child:**

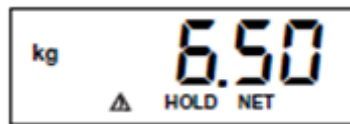
1. Ask the adult to step onto the center of the scale with the blanket and stand still. Wait until the numbers are stable on the display window.
2. Short press the **2 in 1** key. The scale stores the weight of the adult and the display returns to zero (**0.00**). **NET** will appear in the display.

**PLEASE NOTE!!!** In the above statement, only a **“SHORT PRESS”** on the “2 in 1 function” is required in order to weigh children who need to be held. A **“LONG PRESS”** on the “2 in 1 function” will switch the units of measurements from **KILOGRAMS** to **POUNDS** instead.

3. Give the child to the adult. After the weight is stable for about 3 seconds, the weight will be retained. The display weight should not jump around, even due to a child's movement after this point.
4. **▲ HOLD** and **NET** appear in the display and the weight of the child being held can be recorded.

**Please note:** the scale will determine the weight of the child even though the adult is on the scale. Once the value for the child's weight becomes stable for about 3 seconds, the value is retained and **▲ HOLD** and **NET** appear in the display window. The number in the display is the weight of the child only, even though the adult is also standing on the scale.

5. Record the weight of the child as displayed on the scale (the scale measures with 50 g resolution) in the Biomarker Questionnaire. The second digit after the decimal will ONLY read "0" or "5". Thus, a weight of 6.52 kg isn't possible, but a weight of 6.50 kg or 6.55 kg is possible on the scale.



**If there are other children to be weighed who must be held by the adult, finish all measurements for the first child before moving onto the next.**

**Additional Notes on the SECA scale:**

- The SECA scale switches off automatically 3 minutes after the last weighing in the 'Normal Mode' or two minutes if the '**2 in 1**' function is activated.
- The '**2 in 1**' key can be used to change the units of weight—from kilograms (Kg) to pounds (lb) or vice versa, if the key is held in for 3 seconds or longer. **DO NOT HOLD IN THE '2 IN 1' KEY! PRESS THE KEY ONCE TO ACTIVATE THE FUNCTION FOR WEIGHING CHILDREN WHO MUST BE HELD BY AN ADULT.**
- **Check that you have not changed the units of weight from Kg to lb. NFHS-5 does not record weights in lb.**
- Do not weigh loads with a total weight of more than 200 kg.
- Possible reasons for the scale not taring (returning to zero ('0.00') after pressing the '**2 in 1**' key when the adult stands on the scale):
  - There was no weight on the scale to tare (i.e., the adult was not on the scale).
  - The '**2 in 1**' function was not activated.
  - The load weighs more than 200 kg; 'STOP' appears in the display. Use a lighter load.

## **What to do if the Scale Display Shows the Following Errors:**

No weight is displayed when there is a load on the scale.

- Check to see if the scale is switched on. Ask the adult to step off the scale and step gently on the weighing platform.
- Check to see if the power switch at the side of the scale is in the 'ON' position
- Press the '**START**' key to prepare the scale for weighing
- Check the batteries

The scale keeps switching on, while being transported. The '**START**' key has been activated. Turn off the scale by pushing the 'ON-OFF' switch to the 'OFF' position.

The scale displays a weight after being transported or after new batteries have been put in. Press the '**START**' key; the scale will work normally again.

'0.00' does not appear before weighing. Start the scale again by pressing the '**START**' key. There should not be any load on the scale.

'----' appears instead of '0.00' before weighing. Start the scale again after it switches off automatically; there should not be any load on the scale.

One segment of the display is illuminated constantly or not at all. There is a problem with that segment of the scale. Inform your service dealer.

The display shows a battery with split shading. The battery voltage is running low. The batteries should be changed in a few days.

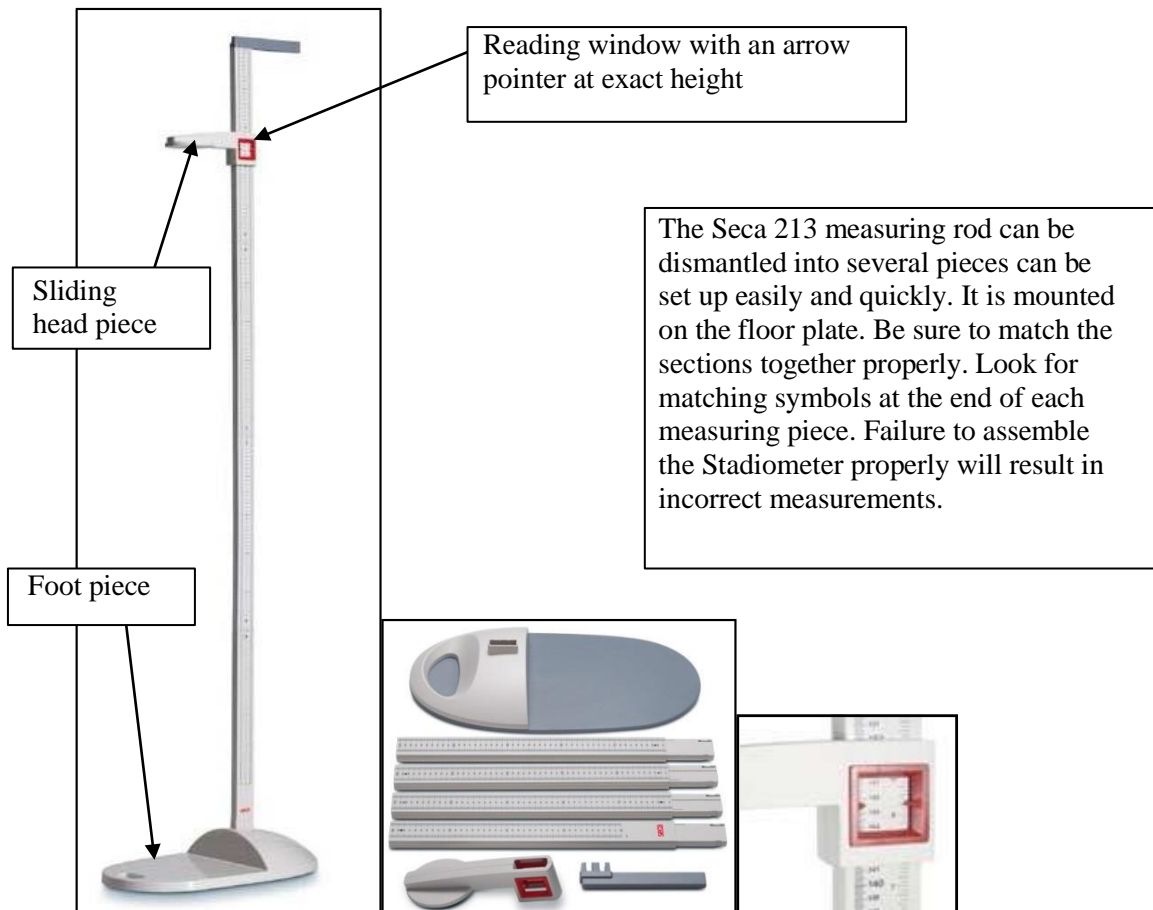
'..batt' appears in the display. The batteries are empty. Replace the batteries.

'STOP' appears in the display. The maximum load capacity of the scale has been exceeded.

The display flashes. Take the load off the scale and start again. Wait until 0.00 appears and weight gain.

The display *Err* and a number appear in the display window. Start the scale again after it switches off automatically. The scale will then work normally again. If this does not happen, turn off the power to the scale. If the scale still does not work properly, inform the regional coordinator or IIPS.

## MEASURING A CHILD'S HEIGHT: STANDING UP (ILLUSTRATION 1):

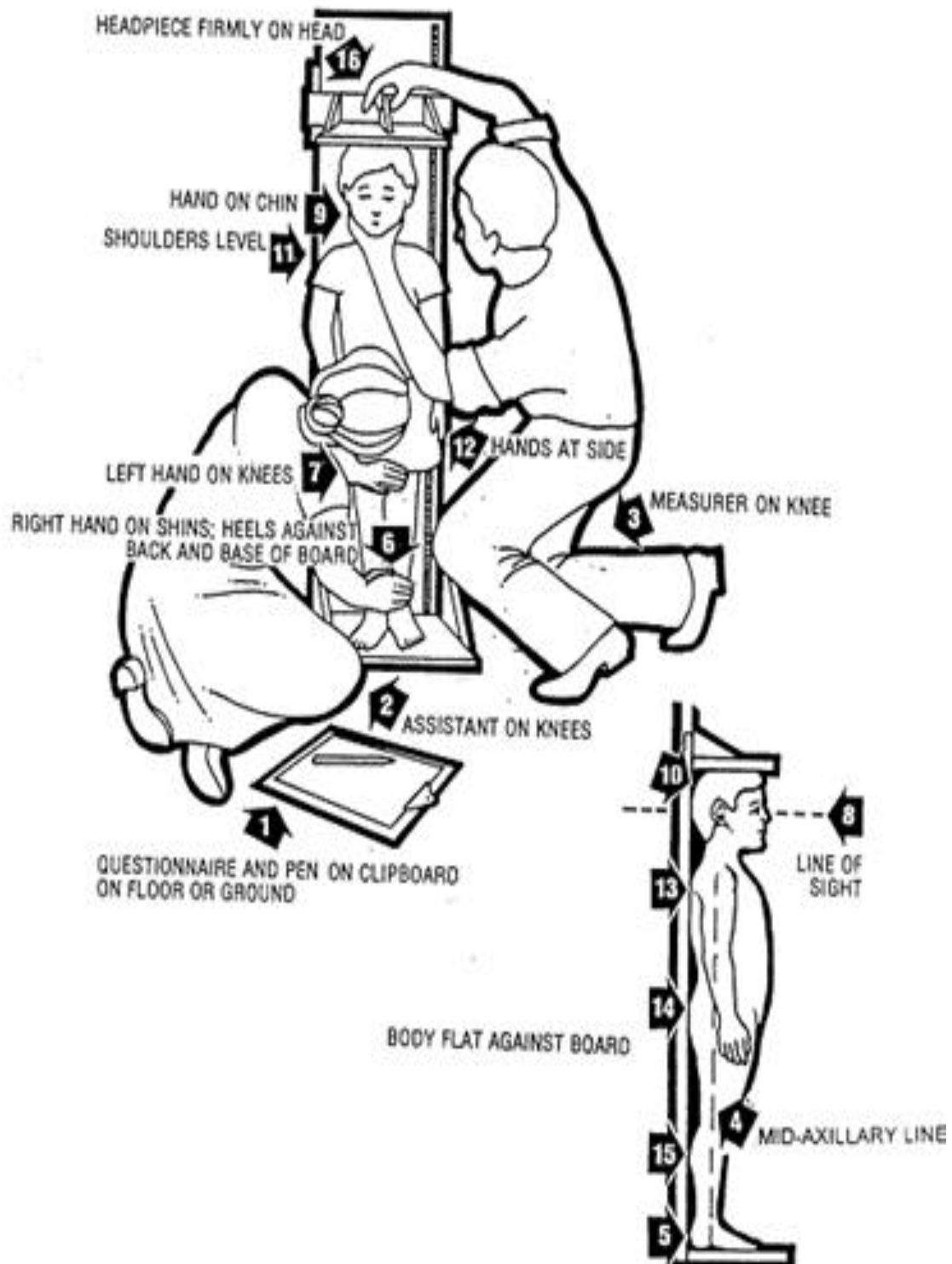


1. **Measurer or Assistant:** Place the Seca Stadiometer on a hard, flat surface against a wall, table, tree or staircase. Make sure the Stadiometer is stable. Many walls and floors are not at perfect right angles. If the Stadiometer is not completely stable, relocate it to a nearby location that provides the proper support.
2. **Measurer or Assistant:** Ask the parent to take off the child's shoes and to unbraid or push aside any hair that would interfere with the height measurement. If weather permits and the parent/guardian is comfortable, ask the parent to remove the child's clothing down to the undergarments. Ask the parent to bring the child to the Stadiometer and to kneel in front of the child so that the child will look forward at the parent.
3. **Assistant:** Place the Biomarker Questionnaire and pen on the ground (Arrow 1) and kneel on the right side of the child (Arrow 2).
4. **Measurer:** Kneel on the left of the child (Arrow 3).

**Assistant:** Place the child's knees and feet in the correct position, with knees and feet either together or apart. There are three possible positions for the knees and feet:

- Knees together and feet together
  - Knees together and feet apart
  - Knees apart and feet together
- } whichever touches first!

Illustration 1  
Child Height Measurement

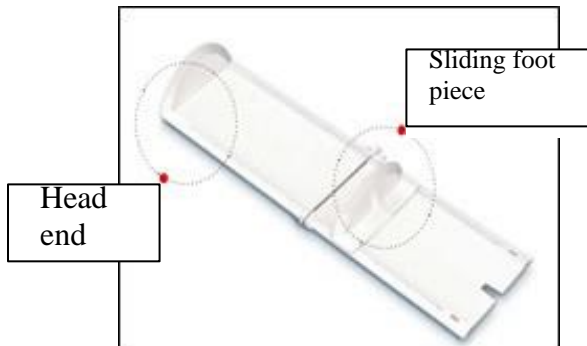


5. **Measurer:** Determine if the child's feet should be against or away from the back of the Stadiometer by observing the imaginary line drawn from the tip of the shoulder to the heel, which is called the 'mid-axillary line' (Arrow 4). This line should be perpendicular (i.e., 90°) to the base of the Stadiometer where the child is standing  
(You may have to move the child's feet away from the back of the Stadiometer to put them in the proper position). Note that with most preschool-age children who are not heavy or obese, the heels will probably touch the back of the height board (Arrow 5).
6. **Assistant:** With your thumbs against the index finger of each hand, place your right hand on the child's shins (Arrow 6) and your left hand on the child's knees (Arrow 7). Do not wrap your hands around the knees or feet (ankles) or squeeze them together. Make sure the child's legs are straight.
7. **Measurer:** Ask the child to look straight ahead at the parent if she is kneeling in front of the child. Make sure the child's line of sight is parallel to the ground (Arrow 8). Place the thumb and index finger of your left hand, one finger on each side of the child's chin, and gradually close your hand (Arrow 9). Note that with most preschool-age children who are not heavy or obese, the back of the head will touch the back of the Stadiometer (Arrow 10); however, if the child is heavy or obese, there will be a space between the back of the child's head and the back of the Stadiometer. Make sure the child's shoulders are level (Arrow 11), the hands are at the child's side (Arrow 12), and at least the child's buttocks touch the back of the Stadiometer. Note that with most preschool-age children who are not heavy or obese, the back of the head, the shoulder blades, the buttocks, the calves and heels will touch the back of the Stadiometer (Arrows 10, 13, 14, 15 & 5).
1. **Measurer and Assistant:** Check the position of the child (Arrows 1-15). Repeat any steps as necessary.
2. **Measurer:** When the child's position is correct, lower the headpiece on top of the child's head (Arrow 16) making sure to push through the child's hair. Read and call out the measurement to the nearest 0.1 cm. Remove the headpiece from the child's head, your left hand from the child's chin, and allow the child to return to the parent.
3. **Assistant:** Immediately record the **height** measurements in Questions **206** on the questionnaire and show it to the measurer. Record that the child was measured standing up in **Question 207**.
4. **Measurer:** Check the recorded measurement on the questionnaire for accuracy and legibility. Instruct the assistant to correct any errors.



## **MEASURING A CHILD'S LENGTH: LYING DOWN (ILLUSTRATION 2):**

For children less than **2** years old; or, when age cannot be obtained, length is measured for children less than **85** centimeters:



**SECA 417 Infantometer**

### **SECA 417 Infantometer**

**Measurement range:** 10–100 cm / 4-40"

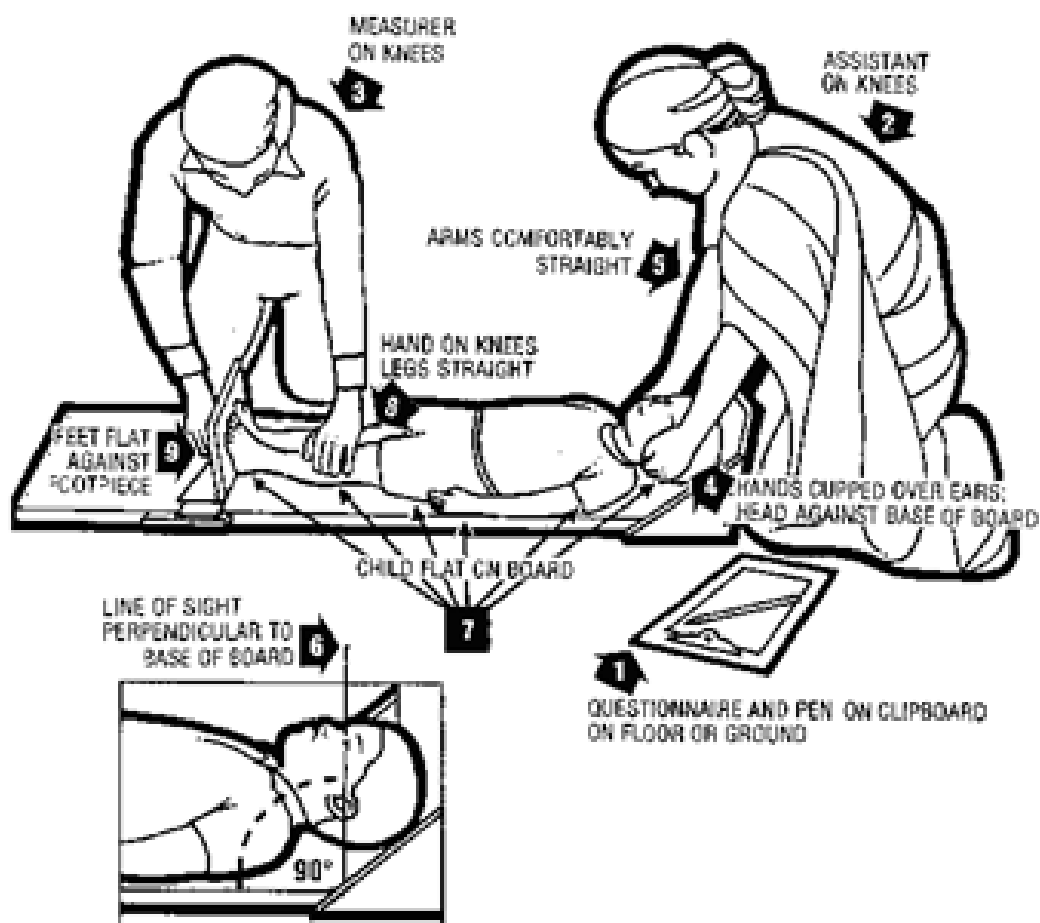
- Graduation: 2 mm / 1/8"
- Dimensions, measurement board (WxHxD): approx. 1.120 x 120 x 310 mm
- Dimensions, folded for transport (WxHxD): approx. 577 x 115 x 300 mm
- **Device weight:** approx. 1.4 kg

1. **Measurer or Assistant:** Place the Seca Infantometer on a hard, flat surface, such as the ground, floor. Make sure Infantometer is stable.
2. **Assistant:** Place the Biomarker Questionnaire on the ground, floor or table (Arrow 1) and kneel behind the fixed head end of the Infantometer if it is on the ground or floor (Arrow 2).
3. **Measurer:** Kneel at the right side of the child (at the child's feet) so that you can move the sliding foot piece with your right hand (Arrow 3).
4. **Measurer and Assistant:** With the help of the parent, gently lower the child on to the Infantometer, making sure the measurer supports the child at the trunk of the body while the assistant supports the child's head.



5. **Assistant:** Cup your hands over the child's ears (Arrow 4). With your arms straight (Arrow 5), place the child's head against the base of the fixed head end. The child should be looking straight up (Arrow 6) so that the line of sight is perpendicular to the board. Your head should be directly over the child's head. Watch the child's head to make sure it is in the correct position against the base of the fixed head end of the Infantometer.

Illustration 2  
Child Length Measurement



6. **Measurer:** Make sure the child is lying flat in the centre of the Infantometer (Arrow 7).

Place the child's knees and feet in the correct position, with knees and feet either together or apart. There are three possible positions for the knees and feet:

- Knees together and feet together
  - Knees together and feet apart
  - Knees apart and feet together
- } whichever touches first!

With your thumb against your index finger, place your left hand on the child's knees (Arrow 8) and press them gently, but firmly against the board. Do not wrap your hand around the knees or squeeze them together. Make sure the child's legs are straight.

7. **Measurer:** Check the position of the child (Arrows 1-8). Repeat any steps as necessary.
8. **Measurer:** When the child's position is correct, move the sliding foot piece with your right hand until it is firmly against the child's heels (Arrow 9). Read the measurement to the nearest 0.1 cm and call out the measurement to the assistant. Return the child to the parent.

**Please note:** Pay special attention to the infant's feet. The infantometer has two measuring tapes on both ends. Be sure that the footpiece is not tilted due to the pressing of the infant's feet, lack of pressure on the knees, etc.

9. **Assistant:** Record the **height** measurements in **Questions 206** and that the child was measured lying down in **Question 207**. Show the recorded measurement to the measurer for confirmation.
10. **Measurer:** Check the recorded measurement on the questionnaire for accuracy and legibility. Instruct the assistant to correct any errors.

### **MEASURING AN ADULT'S HEIGHT (ILLUSTRATION 3):**

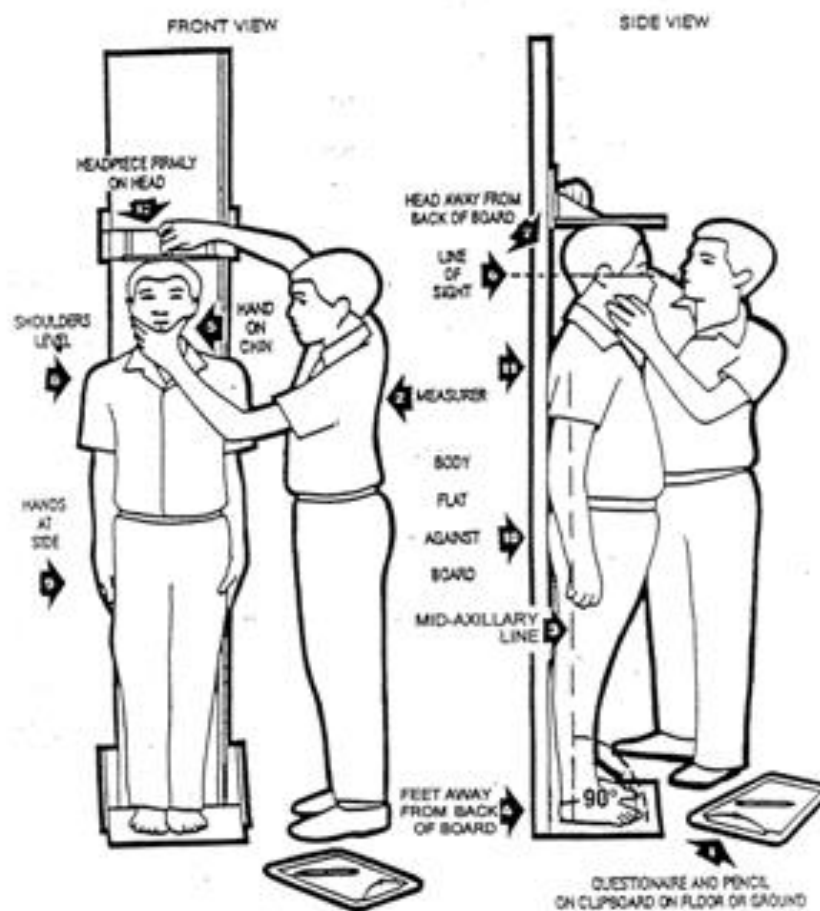
**NOTE:** The height of adults can be taken by one person alone, the Measurer.

1. **Measurer:** Place the Stadiometer on a hard, flat surface against a wall, table, tree, or staircase. An interviewer or health investigator can hold the board steady, if necessary. Make sure the Stadiometer is stable. Many walls and floors are not at perfect right angles. If the Stadiometer is not completely stable, try to move it to a more stable location. You can also adjust the individual feet on the base of the Stadiometer to make it more stable.
2. **Measurer:** Ask the person to take off his/her shoes and ask him/her to unbraid or push aside any hair that would interfere with the height measurement. Ask the person to stand on the base of the height Stadiometer and to face forward.
3. **Measurer:** Place the Biomarker Questionnaire and pen on the ground (Arrow 1) and stand on the left side of the person (Arrow 2).
4. **Measurer:** Determine if the person's feet should be against or away from the back of the height board by observing the imaginary line drawn from the tip of the shoulder to the heel, which is called the 'mid-axillary line' (Arrow 3). This line should be perpendicular (i.e., 90°) to the base of the Stadiometer where the person is standing. Note that with almost all adults you will have to move the person's feet away from the back of the height board to put them in the proper position (Arrow 4).
5. **Measurer:** Place the knees and feet in the correct position, with knees and feet either together or apart. There are three possible positions for the knees and feet:

- Knees together and feet together
  - Knees together and feet apart
  - Knees apart and feet together
- } whichever touches first!

**Illustration 3**

## *Standing Height of Adults\**



\* From: "Anthropometry as Part of Household Surveys", I.J. Shorr, The World Bank, Washington, D.C., (in press)

6. **Measurer:** Ask the person to look straight ahead. Cup the respondent's chin between the thumb and index finger of your left hand and gradually close your hand (Arrow 5). Position the person's head so that the line of sight is parallel to the ground (Arrow 6). Note that with most adults, the back of the head will not touch the back of the Stadiometer—there will be a space between the back of the person's head and the back of the Stadiometer (Arrow 7). After you have placed the person's head in the proper position, release your hand from the person's chin and ask him/her to hold his/her head in the position you have just placed it in.

Make sure the person's shoulders are level (Arrow 8), the hands are at the person's side (Arrow 9), and at least the buttocks touches the back of the Stadiometer). Note that with most adults, only the buttocks and perhaps the shoulder blades, will touch the back of the Stadiometer (Arrows 10 & 11).

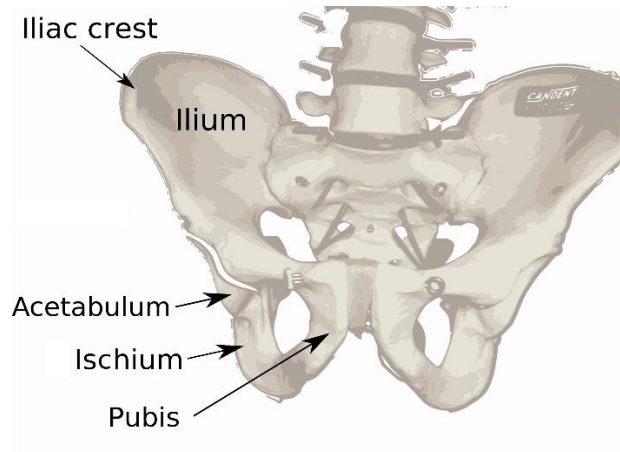
7. **Measurer:** Check the position of the person (Arrows 1-11). Repeat any steps as necessary.
8. **Measurer:** When the person's position is correct, lower the headpiece on top of the head (Arrow 12) Making sure to push through the person's hair. **Read and call out the measurement to the nearest 0.1 cm.** Remove the headpiece from the person's head, and escort the person off the height board.
9. **Measurer:** Immediately record the measurement on the questionnaire. Record an adult's **Height** measurements in **Questions 304/404**. If the adult's height was not measured, record the appropriate code in **Questions 304/404**.
10. **Measurer:** Check the recorded measurement on the questionnaire for accuracy and legibility. Correct any errors.

**Please note:** If an adult is taller than the measurer, the measurer must identify an object (chair, stool, etc.) he/she can safely stand on to ensure that the measuring tape is at his/her eye level. Alternately, if a respondent to be measured is shorter than the measurer, the measurer must stoop to ensure the measuring tape is at eye level when reading. Reading the tape above or below eye level will skew the measurement.

#### MEASURING AN ADULT'S WAIST CIRCUMFERENCE (ILLUSTRATION 4)

**NOTE:** Preferably a female HI should measure waist and hip circumference of women and a male HI that of men. If not possible, then measurement of a woman's waist and hip circumference should be done in presence of an adult family member or female field investigator.

Explain to the participant how you will measure the waist and hip circumference before beginning the measurement. You may give a demo on yourself to explain the procedure. Take help from the respondent to move the tape. Touching to the respondent should be minimum.



- ✓ Ask the person to have only light clothing during waist measurement between the Gulick measuring tape and their skin.
- ✓ Locate the top of the hip bone (Iliac Crest). It is the superior boarder of the Ilium, palpable when someone puts hands on the waist.
- ✓ Using the tailor chalk, make a horizontal line on the highest point of Iliac Crest.
- ✓ In the mid auxiliary line identify the lower margin of the last palpable rib and using the tailor chalk, make a horizontal line.
- ✓ Identify the mid-point of abdomen;hold the zero end of the measuring tape at this mark and extend the tape down to the horizontal line of highest point of Iliac Crest. Take the measurement to the nearest 0.1 cm.
- ✓ **Mark the midpoint:** Divide the value in half to calculate the midpoint of the measured length. Holding the tape in place, make a horizontal mark at the midpoint and cross this mark with a **perpendicular line centered** on the mid auxiliary line. This mark defines the site at which the waist circumference will be measured.
- ✓ Ask the respondent to stand with their feet together and their arms at their side with the palms facing inwards. Investigator and helper should stand at the side of the respondent. Put Gulick tape around the waist of the respondent, with side written 'UP' facing upwards. You can request help from the respondent in placing the Gulick tape. Make sure the tape is parallel to the floor all the way round the body when preparing to make the measurement. Both investigator and helper are required to inspect and ensure that the tape is parallel to the floor. For any adjustment of position of the tape, you may take help of the respondent. Minimize touching to the respondent.
- ✓ Ask the respondent to breathe normally and hold the breath at the end of the normal expiration, when you will take the reading.

- ✓ Fit the tape snugly, but not so tightly as to compress the belly. Make sure the tension in the Gulick tape is such that only one bead visible and the metal ring is at margin. Any lesser or greater tension will not give accurate reading.
- ✓ Record the reading to the nearest 0.1 cm. Record an adult's waist circumference measurement in **Question 305/405**. If the adult's waist circumference was not measured, record the appropriate code in **Questions 305/405**.

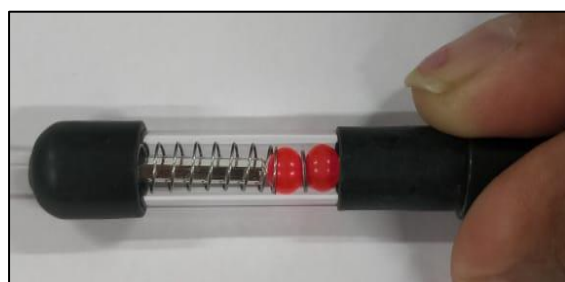
### Gulick Tape

#### Gulick Tape

- Measure up to 160 cms (0-60") length
- A spring gauge attachment creates uniform tension ensuring accurate circumferential measurement



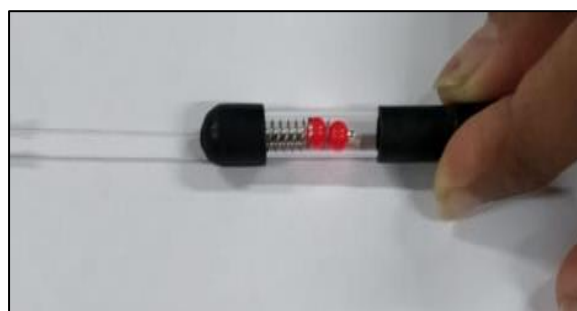
The spring of Gulick Tape



Excess tension



Correct tension



Excess tension

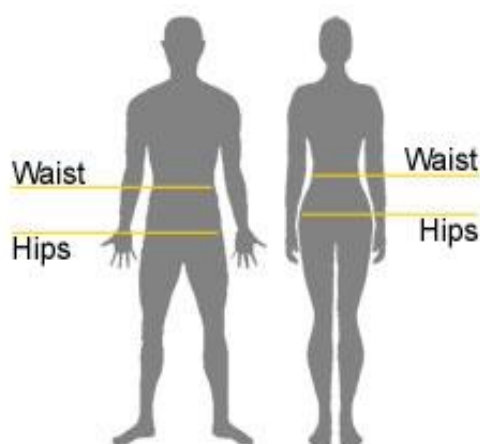
#### Illustration 4

### Waist and Hip Measurement



#### MEASURING AN ADULT'S HIP CIRCUMFERENCE

- ✓ Make sure the person has minimal clothing on the hips between the tape and skin.
- ✓ Ask the respondent to remain standing with their feet together, arms at their side with palms facing inwards.
- ✓ Move the Gulick tape from the waist, to the maximum circumference of the hips.
- ✓ Take the flexible tape measure around the maximum circumference of the respondent's buttocks, being careful to make sure the tape is parallel to the floor all the way around. Both investigator and helper are required to inspect and ensure that the tape is parallel to the floor. For any adjustment of position of the tape, you may take help of the respondent. Minimize touching to the respondent.
- ✓ Fit the tape snugly, but not so tightly as to compress the soft tissue. Make sure the tension in the Gulick tape is such that only one bead visible and the metal ring is at margin. Any lesser or greater tension will not give accurate reading.
- ✓ Record the measurement in centimeters to the nearest 0.1 cm. Record an adult's hip circumference measurement in **Questions 306/406**. If the adult's hip circumference was not measured, record the appropriate code in **Questions 306/406**.



Waist and hip circumference-Position of measuring tape



#### Precautions during measurements:

1. Measuring tape should have a snug but not too tight a fit of the tape measure around the waist; do not make compressions in the skin with the tape measure.
2. It is important to recognize when referring to waist circumference measurement that this should not be the same as the belt in cm in males.
3. Make sure that the Gulick tape is not twisted around the waist or hips.
4. If the tape has both centimeters and inches, make sure you measure in cm.
5. When measuring waist circumference, it is important not to be tempted to measure around the narrower part of the abdomen situated below the umbilicus.
6. Do measure waist & hip circumference in pregnant women as well.
7. Do not pull out tape from the container without pressing the knob to avoid damage to the gears of the Gulick tape.
8. Make sure to darken (using Black Permanent Marker) the side of Gulick tape with the markings in inches to avoid confusion during measurement.

### Summary of Steps in Measuring Anthropometry

- Children less than 2 years old or, in the absence of age information, less than 85 cm
  - Obtain the exact day, month, and year of birth for a child from the mother's birth history if she was interviewed, or else the date of birth should be asked from the mother or from another knowledgeable adult.
  - Confirm that the child was born in January 2015 or later
  - Measure weight
  - Measure length with child lying down on an Infantometer
  - Record weight and height measurements in Q205 and Q206
  - Record that the child was measured lying down in Q207
- Children 2 years or older or, in absence of age information, 85 cm or greater
  - Obtain the exact day, month, and year of birth for a child from the mother's birth history if she was interviewed, or else the date of birth should be asked from the mother or from another knowledgeable adult.
  - Confirm that the child was born in January 2015 or later
  - Measure weight
  - Measure height standing up
  - Record weight and height measurements in Q205 and Q206
  - Record that child was measured while standing in Q207
- Adults
  - Verify the name with the respondent
  - Measure weight
  - Measure standing height
  - Measure waist and hip circumference
  - Record the weight, height, waist and hip circumference in Q303, 304, 305 and 306 for women or Q403, 404, 405 and 406 for men.
  - Record weight and height measurements in the appropriate sections

### CHAPTER 3: BLOOD PRESSURE MEASUREMENT

Elevated blood pressure (high blood pressure) is a known risk factor for death from stroke and coronary heart disease (CHD).

Arterial blood pressure is the force exerted by the blood on the wall of the artery as the heart pumps (contracts) and relaxes. Systolic Blood Pressure (SBP) is the degree of force when the heart is pumping (contracting) and Diastolic Blood Pressure (DBP) is the degree of force when the heart is relaxed. In this survey, you will measure systolic and diastolic blood pressure. Respondents who are found to have high blood pressure, identified as systolic pressure greater than 200 mmHg and/or diastolic pressure greater than 109 mmHg will receive an immediate referral to a local health facility and no further investigations should be done. All households where biomarkers were collected will be provided with an information brochure on blood pressure.

#### TECHNIQUE OF BLOOD PRESSURE MEASUREMENT

In NFHS-5, blood pressure measurements will be taken to assess the population prevalence of high blood pressure; the focus is not on the clinical diagnosis of high blood pressure. **Therefore, these measurements in a survey situation do not constitute a medical diagnosis of disease, but will be used only as a statistical description of the survey population.** The OMRON BP monitor will be used in NFHS-5.



**OMRON BLOOD PRESSURE MONITOR**

The person having his/her blood pressure measured will be referred to as the ‘respondent’ and the person taking the measurements will be referred to as the ‘health investigator’. The Blood Pressure Measurement will be recorded in the blood pressure section of the Biomarker Questionnaire, household brochure and referral form if appropriate.

FIRST BP MEASURE			
SYSTOLIC .....	<input type="text"/>	<input type="text"/>	<input type="text"/>
DIASTOLIC .....	<input type="text"/>	<input type="text"/>	<input type="text"/>
REFUSED .....			994
TECHNICAL PROBLEMS ...			995
OTHER .....			996
(IF NOT MEASURED, GO TO 338) ←			

To measure the respondent's blood pressure, three blood pressure readings will be obtained. For simplicity, all blood pressure measurements will be made on the respondent's left arm. Where this is not feasible, the right arm will be utilized.

### **PRELIMINARY STEPS IN TAKING BLOOD PRESSURE MEASUREMENTS FROM ADULTS**

1. Before starting the blood pressure measurements, the respondent should have been sitting quietly for at least 5 minutes.
2. Be sure that the respondent does not smoke or drink coffee or tea during the measurements since smoking or drinking coffee or tea can affect the blood pressure. If the respondent consumed any alcohol, coffee, or tea, or smoked cigarettes before the examination, record this in **Qs. 314/414**.
3. If the respondent indicates any reason why the blood pressure procedure should not be done on the left arm, use the right. If there is a problem with both arms, do not take the blood pressure and note this in **Qs.318/418**. Observe the respondent's arm while talking to him/her. If you observe any rashes, small gauze/adhesive dressings, casts, withered arms, puffiness, tubes, open sores, haematomas (a localized swelling that is filled with blood caused by a break in the wall of a blood vessel) or wounds on both arms, do not take the blood pressure.

### **Positioning the Respondent for Blood Pressure Measurement**

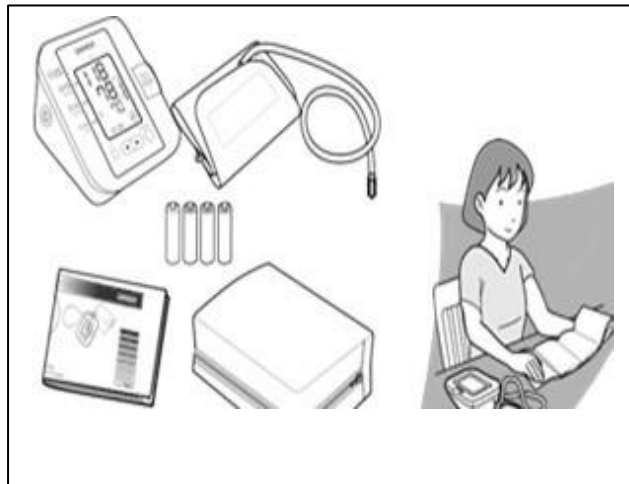
1. The respondent should be seated at a table in a relaxed, but not slouched, position with feet flat on the floor. The outer jacket or sweater should be removed and the sleeve should be rolled loosely up to the shoulder, ensuring that two fingers can be placed under the sleeve without difficulty. The respondent's left arm should be placed on the table, slightly flexed with palm upward.
2. The respondent's arm should be positioned so that it is resting on the table at heart level. Heart level is halfway between the shoulders and the waist. The respondent's elbow must be no lower than the lowest rib and must not be raised as high as the shoulder.
3. If the respondent is tall, it may be necessary to support the arm higher than a standard desk or table-top. Place the tall respondent's forearm on a pillow or a large book to raise the arm to heart level.

**For smaller or shorter adults, place a cushion or large book on the chair so that the arm is at heart level when the arm is resting on the desk or table-top. Place a box or large book under the respondent's feet if the feet do not rest flat on the floor.**

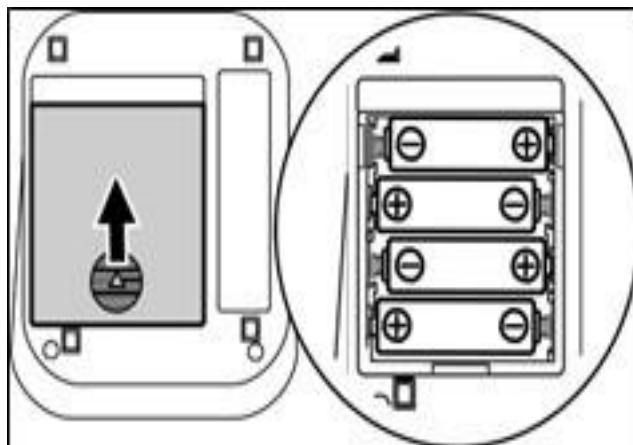
4. The health investigator should be seated facing and slightly to the left of the respondent, permitting easy access to the respondent's arm. The measuring equipment will be positioned so that the tube to the manometer is away from the respondent's body.

## **BEFORE YOU START**

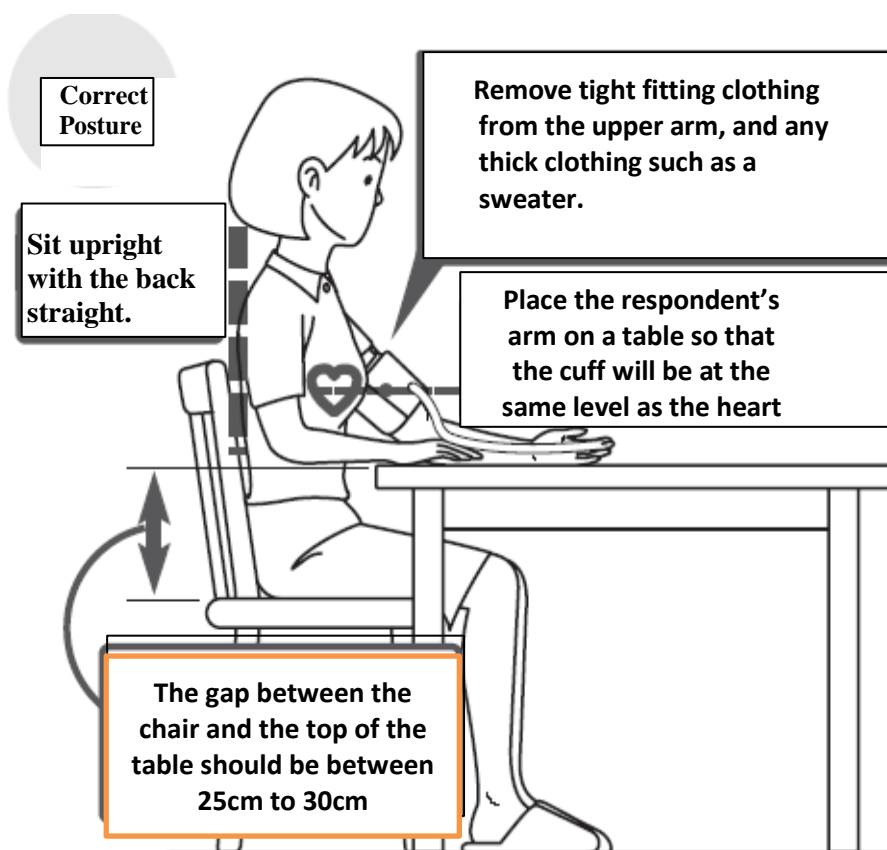
1. Make sure that all the components of the OMRON BP monitor are present.



2. Remove the battery cover and insert or replace 4 'AA' batteries as indicated in the battery compartment and replace the cover. If the battery is low, a symbol will appear on the display and it requires that the batteries be replaced immediately.



## HOW TO SEAT THE RESPONDENT CORRECTLY WHEN TAKING A MEASUREMENT



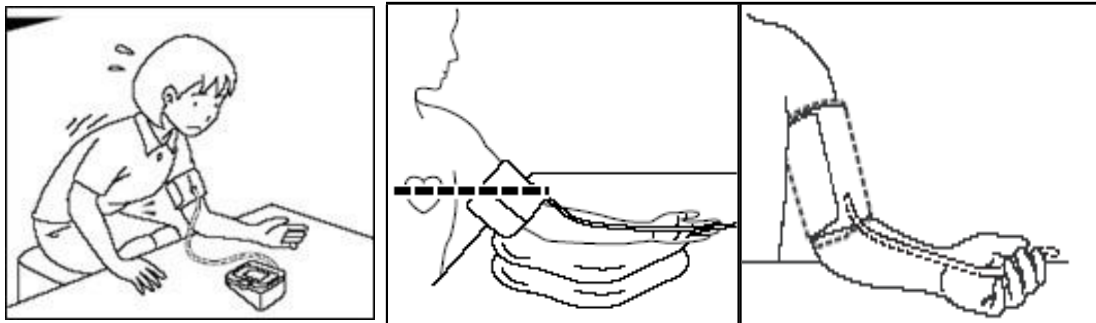
### Notes:

- Measurements should be taken in a quiet place. The respondent should be in a relaxed, seated position.
- Make sure that the room is not too hot or cold.
- The respondent should avoid eating, smoking, or **exercising for at least 30 minutes before having a measurement taken.**
- The respondent should not move or talk during the measurement procedure.
- Do not place the cuff over thick clothes and do not roll up the sleeve if it is too tight.

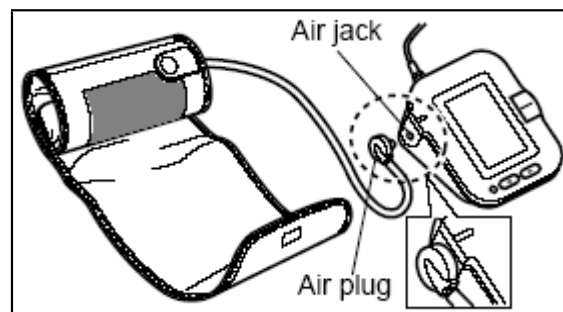
Correct posture during measurement is necessary to get accurate results. Examples of incorrect posture:

- Arched back (leaning forwards)
- Sitting cross-legged or crossed ankles
- Seating the respondent on a sofa or at a low table so that the respondents tend to lean forward.

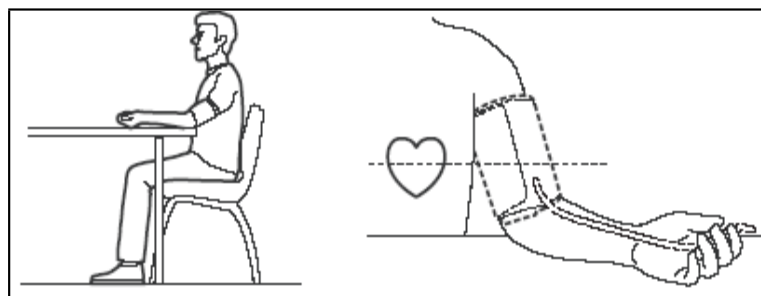
These situations could lead to higher blood pressure values due to strain or the arm cuff being lower than the heart. If the arm cuff is at a lower position than the respondent's heart, use cushions or pillow to adjust the height of the respondent's arm.



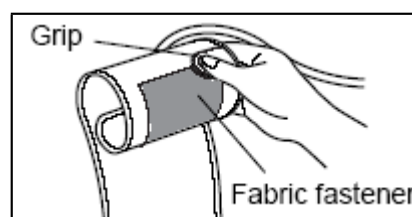
1. Insert the air plug into the air jack (on the left side of the device). The cuff must be fully deflated when it is inserted into the air jack.

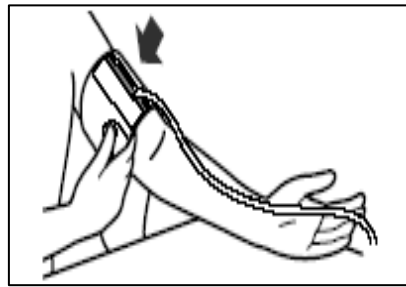
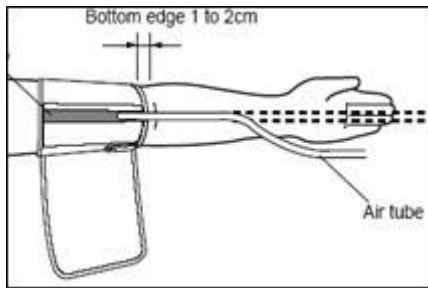


2. Have the respondent sit in a chair with her/his feet flat on the floor and place her/his arm on a table so that the cuff will be at the same level as her/his heart.



3. Hold the grip on the cuff securely with your hand.
4. Turn the palm of the respondent's hand upward.

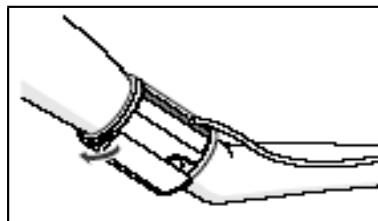




5. Apply the cuff to the respondent's upper arm so that the air tube is centered on the middle of the respondent's inner arm and points down the inside of the arm. The air tube should run down the inside of the respondent's forearm and be in line with her/his middle finger.

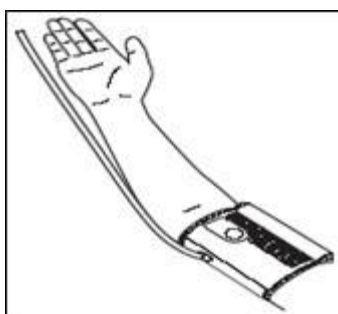
The bottom of the cuff should be approximately 1 to 2 cm above the elbow.

6. When the cuff is positioned correctly, close the fabric fastener firmly.



- Make certain the cuff fits snugly around the arm.
- The cuff should make good contact with the respondent's skin. You should be able to fit your index finger between the cuff and the respondent's arm easily, so you can pull the cuff off and on.
- Make sure that there are no kinks in the air tubing.

### **Measurements on the right arm**



**Note the following points when applying the cuff to your right arm. Apply the cuff so that the air tube is at the side of the respondent's elbow.**

- Be careful not to rest your arm on the air tube, or otherwise restrict the flow of air to the cuff.
- Apply the arm cuff so that no part of the cuff is positioned over the elbow joint. The cuff should be 1 to 2 cm above the elbow.

## DETERMINING THE CUFF SIZE

Before the blood pressure measurement, the health technician will measure the upper arm circumference to determine the blood pressure cuff size. Using the correct size cuff is important for obtaining an accurate blood pressure reading. If the cuff is too large for the respondent, the blood pressure reading will be lower than the true value. If the cuff is too small, the blood pressure reading will be higher than the true value. Measure the circumference of the bare upper arm at the midpoint using Gulick tape. Use the circumference measured to determine the required cuff size.

SMALL: 17 CM – 22 CM

MEDIUM: 23 CM – 31 CM


LARGE: 32 CM – 42 CM



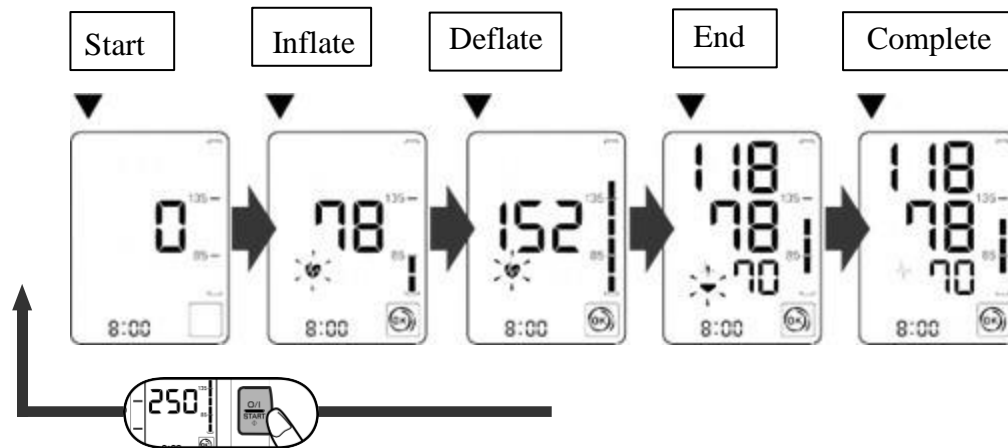
Upper arm circumference

## TAKING A BLOOD PRESSURE READING

For NFHS-5, OMRON BP Monitor will be used for respondents with small, medium and large arm circumference.

1. Measure the respondent's arm circumference (as described above) to enable you select the correct cuff size for use. Press the **START** button and ask the respondent to remain still; the cuff will start to inflate automatically. As the cuff begins to inflate, the monitor automatically determines the ideal inflation level. The respondent should remain still and not talk until the measurement is completed. Communicate to the respondent that he/she may experience a squeeze in their arm but it won't hurt.
2. Inflation stops automatically and measurement is started. As the cuff slowly deflates, decreasing numbers appear on the display and the Heartbeat display  flashes at every heartbeat. In rare circumstances, the monitor might re-inflate the cuff to continue with the measurement.















3. When the measurement is complete, the arm cuff completely deflates and the blood pressure [and pulse rate] readings are displayed. Record the systolic and diastolic readings in the appropriate boxes.
4. Remove the arm cuff from the respondent's arm.
5. After the measurement is completed, you can either press the O/I start button to turn the monitor off or it will shut off automatically after 5 minutes.

### Safety and precaution:

1. Do not use the instrument close to strong electromagnetic fields such as **mobile telephones or radio installations**.
2. If the instrument is not going to be used for a prolonged period, the batteries should be removed.
3. Do not open the instrument.
4. Do not inflate the cuff if it is not wrapped around the respondent's arm.

### WHAT DISPLAY SYMBOLS AND ERROR MESSAGES MEAN

Error Display	Cause	Remedy
	Irregular or weak pulses are detected.	Remove the arm cuff. Wait 2-3 minutes and then take another measurement. If this error continues to appear, contact your doctor.
	Movement during measurement.	Carefully repeat the steps measurement.
	Cuff is not applied correctly.	Apply the arm cuff correctly.
 Blink	The batteries are low.	You should replace them with new ones ahead of time.
 Lit	The batteries are exhausted.	You should replace them with new ones at once.

Error Display	Cause	Remedy
	Irregular or weak pulses are detected.	Remove the arm cuff. Wait 2-3 minutes and then take another measurement. If this error continues to appear, contact your doctor.
	Movement during measurement.	Carefully repeat the steps measurement.
	Cuff is not applied correctly.	Apply the arm cuff correctly.
 Blink	The batteries are low.	You should replace them with new ones ahead of time.
 Lit	The batteries are exhausted.	You should replace them with new ones at once.

Error Display	Cause	Remedy
EE	Cuff is under inflated.	Carefully read and repeat the steps listed under taking BP measurement.
E	Movement during measurement.	Repeat measurement. Remain still and do not talk during measurement. Refer to section 3.3.
	Air plug disconnected.	Insert the air plug securely.
	Arm cuff not applied correctly.	Apply the arm cuff correctly.
	Clothing is interfering with the arm cuff.	Remove any clothing interfering with the arm cuff.
	Air is leaking from the arm cuff.	Replace cuff with new one.
EE	The arm cuff was inflated above 299 mmHg when inflating the cuff manually.	Do not inflate the arm cuff above 299 mmHg.
EE	Device error.	Contact your OMRON retail outlet or distributor.

**Note:**  
The irregular heartbeat symbol ( ) may also be displayed with error messages.

Other than these, additional error E2 (technical error) was observed during the field practice. It is usually caused due to movement of hands, any underlying infection or twitching in arm.

### Troubleshooting

Problem	Cause	Remedy
The reading is extremely low (or high).	Arm cuff not applied correctly.	Apply the arm cuff correctly.
	Movement or talking during measurement.	Remain still and do not talk during measurement.
	Clothing is interfering with the arm cuff.	Remove any clothing interfering with the arm cuff.
Arm cuff pressure does not rise.	The air tube is not securely connected into the main unit.	Make sure that the air tube is connected securely.
	Air is leaking from the arm cuff.	Replace the arm cuff with a new one.
Arm cuff deflates too soon.	The arm cuff is loose.	Apply the cuff correctly so that it is firmly wrapped around the arm.
Cannot measure or readings are too low or too high.	The arm cuff has not been inflated sufficiently.	Inflate the cuff so that it is 30 to 40 mm Hg above your previous measurement result.

Nothing happens when you press the buttons.	The batteries are empty.	Replace the batteries with new ones.
	The batteries have been inserted incorrectly.	Insert the batteries with the correct (+/-) polarity.
Other problems.	<ul style="list-style-type: none"> <li>Press the O/I START button and repeat measurement.</li> <li>If the problem continues, try replacing the batteries with new ones.</li> </ul> If this still does not solve the problem, contact your OMRON retail outlet or distributor.	

## CHAPTER 4: GENERAL PROCEDURES FOR COLLECTING CAPILLARY BLOOD DROP SAMPLES FROM ADULTS AND CHILDREN

Capillary blood will be collected in NFHS-5 to test for the following biomarkers: haemoglobin (anaemia), random blood glucose (risk for diabetes), malaria, antimalarial drug resistance, extent of vitamin D deficiency in the population, and level of diabetes control (HbA1c). Capillary blood can be obtained from the palm side of the end of a finger. This chapter describes the materials needed for, and the steps involved in, obtaining a capillary blood sample from adults and children.

### MATERIALS AND SUPPLIES FOR PERFORMING FINGERPRICK

The capillary blood drop(s) collected for biomarker testing will be drawn from a finger or a heel (children 6-12 months). The following supplies and materials will be used in performing the finger or heel prick:

1. **Disposable gloves:** used to reduce the risk of blood borne diseases. Gloves must be worn by the health investigators and by anyone else who may assist with the blood collection.
2. **Absorbent paper sheets:** the surface area where your supplies will be placed while you conduct the blood collection. Be sure to place the plastic side of the absorbent sheet down/the absorbent side up.
3. **Alcohol preps:** used for cleaning the skin prior to pricking the finger or heel.
4. **Safety lancets:** the lancet is a single-use, disposable device used to prick the fingertip or heel (Figure 4.1). The needle is retractable: when the trigger is pressed, a surgical blade quickly protrudes from the device, punctures the skin, and then automatically retracts. The Unistik 3 Normal lancets have a gauge of 23G and a depth of 1.8mm. This lancet can be used for both children and adults.



Figure 4.1 Example of safety lancet

Hold the lancet by the sides, taking care **NOT** to press down on the release button. Just twist off the protective sterile cap full circle, do not pull the cap off or the lancet will not trigger, and the lancet is ready to use.



5. **Sterile gauze pads:** used to wipe away the first drop(s) of blood which helps to stimulate blood flow.
6. **Adhesive bandages (plaster or Band-Aid):** used to cover the puncture site to minimize the risk of infection.
7. **Sharps container:** A sharps container is a hard plastic container that will be used to safely dispose of lancets and microcuvettes.

8. **Plastic bag for waste:** Large bags that are provided to hold all of the other biohazardous waste generated during the day. All waste bags are to be clearly labelled 'biohazard'.

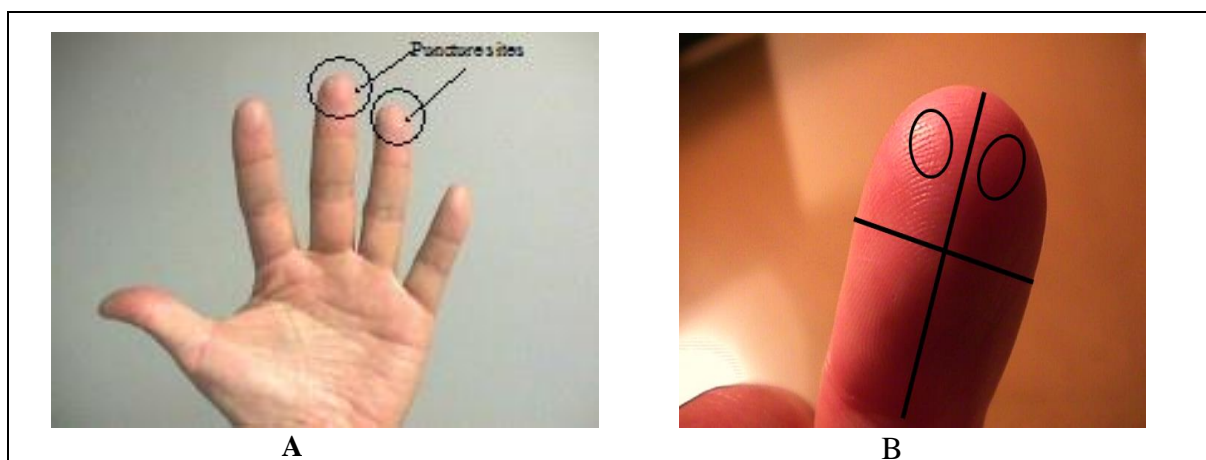
#### STEPS IN OBTAINING CAPILLARY BLOOD FROM THE FINGER OF ADULTS FOR HAEMOGLOBIN, BLOOD GLUCOSE, MALARIA, ANTIMALARIAL DRUG RESISTANCE, HbA1c, AND VITAMIN D TESTING

The following describes the steps that are involved in obtaining a capillary blood drop sample from the finger.

1. Complete general preparation

- If possible, find an indoor site to encourage privacy. If available, use a table or other piece of furniture with a flat surface to lay out your supplies. A couch, bed or mat should be readily available in the event the respondent feels faint and needs to lie down.
- If you find you must do the test outdoors, find a site in the full shade and away from rain, dust, and other environmental elements that might affect the sample.
- When and where possible, wash and dry your hands. **Always put on gloves** before touching the supplies or beginning the collection of the blood sample from the first respondent.
- Take out a clean **absorbent paper sheet** and spread it over a flat surface where you will lay out your supplies.
- Refer to the **Biomarker Questionnaire for adults** to confirm the number of eligible individuals for whom blood samples will be collected. After going through the Biomarker Questionnaire and obtaining informed consent, **take out the appropriate equipment and general supplies for that respondent prior to testing.** You will want to have all general materials in easy reach when you begin collecting blood samples from the respondents.

**Note** - wait as long as possible before removing a microcuvette, preferably right before pricking. These items should be taken out on an individual basis. In other words, take out one microcuvette to test a respondent. Do not remove multiple microcuvettes at the same time even if you will test more than one respondent. Take out a glucose strip from the container and insert in the glucometer following the manufacturer's instruction.



**Figure 4.2 Fingers for blood collection**

## 2. Select and prepare the prick site

Blood collection is usually easier if you **sit on the side of the respondent opposite to the hand** that you will collect blood from. For example, if you want to collect blood from the left hand, place yourself to the right side of the respondent.

Only use the third or fourth finger for collecting the blood (Figure 4.2). Do not use a finger with a scar, a wound or cut, an infection, swelling, a deformity, or a rash. Also, do not use a finger on which the respondent is wearing a ring, because the ring may disrupt the free flow of blood to the tip of the finger. You can ask the respondent to remove the ring.

- **Ask the respondent to warm her fingers by rubbing the palms together briskly until the skin becomes warm.** This will increase blood flow to the fingertip and improve the ease with which a sample can be obtained.

- **Prepare the lancet for use**

- Simply twist the blade slot cover 360° until the cover comes out.

- ***Do not remove the blade slot cover from the lancet other than as instructed above,*** as this may cause the blade not to pierce the skin.

- **With an alcohol swab, clean the skin of the finger thoroughly** (Figure 4.3). If the swab is stained (with dirt), clean the finger a second time or until the swab is no longer stained. Allow the alcohol to air dry. Do not blow on the area to dry the alcohol. Blowing may deposit bacteria on the skin and contaminate the prick site.



**Figure 4.3 clean the finger**

## 3. Prick the Finger

- **Make sure that the finger is below the level of the respondent's heart** to increase the flow of blood to the finger. With your thumb, gently push the blood from the top knuckle toward the fingertip.
- When your thumb reaches the fingertip, **maintain a gentle pressure to trap the blood in the finger tip.**



**Figure 4.4 Placement of lancet**



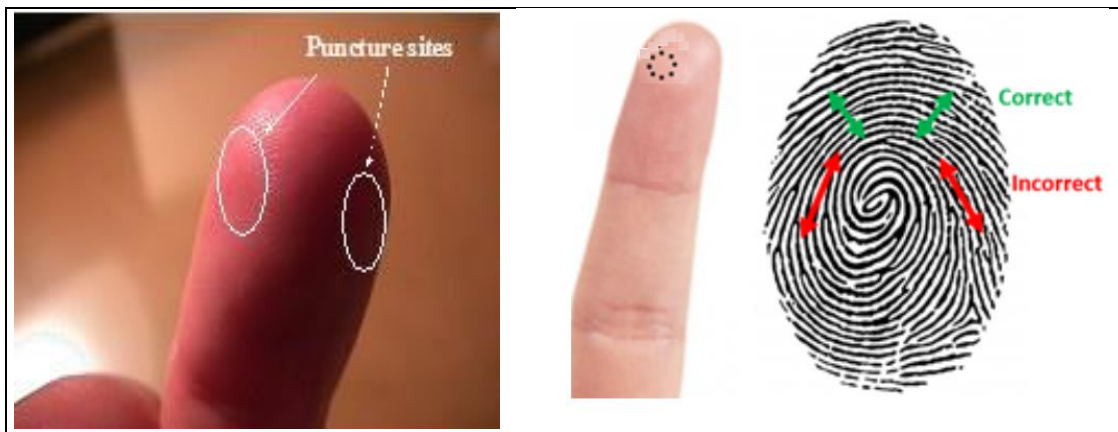


Figure 4.5 Puncture sites on the finger

- Place the lancet **firmly** against the skin with **the trigger facing upwards, so that the arrow preceding the trigger is visible** (Figure 4.4).
  - **Note:** Avoid placing the lancet on the very tip of the finger or the sides beyond the palmar area or you will risk piercing the underlying bone. Proper puncture sites are shown in Figure 4.5.
  - Use the lancet to prick the skin by placing the blade-slot surface against the area and pressing the trigger. The tip of the blade ejects through the blade slot, producing a micro-incision in the skin, and immediately retracts into the device. After pricking the skin, discard the lancet in the sharps container.
4. Collect the blood drops
- When the blood appears, use a sterile gauze pad to wipe away *the first one or two well-formed drops of blood depending on the tests being performed.*
  - If the blood stops flowing before you have collected at least the blood drops needed for the tests that are being done, the pricking procedure may be repeated with the respondent's consent. For minors, you must get consent from the parent or adult responsible for the child. ***Do not reuse any of the supplies used for the first finger prick.***
5. After the blood collection, discard all used materials in the sharps container (for lancets and microcuvettes) or the biohazardous waste bag.

## STEPS IN OBTAINING CAPILLARY BLOOD FROM CHILDREN 6-71 MONTHS OLD

Capillary blood will be collected in NFHS-5 from children 6-71 months old to test for **haemoglobin** only. Capillary blood can be obtained from the palm side of the end of a finger. If the blood is obtained from the finger, the steps in obtaining the blood sample are the same as those for an adult. However, if the child has very thin fingers that if used for the testing may result in injury to the underlying bone, the **heel** should be used instead. For children **6 – 12 months**, a heel prick should be performed. The following describes the steps that are involved in obtaining a capillary blood drop sample from the heel.

The prick should be made outside a line drawn from the middle of the big toe to the heel or outside a line drawn from the area between the fourth and fifth toes to the heel (Figure 4.6). Take care to avoid the central area of the foot (to avoid injury to the nerves and tendons) or the centre of the heel (to avoid piercing the heel bone).



Figure 4.6 Site for heel puncture

1. Prepare the lancet for use
  - Simply twist the blade slot cover 360° until the cover comes out.
  - Do not remove the blade slot cover from the lancet other than as instructed above, as this may cause the blade not to pierce the skin.
2. Hold the heel firmly (Figure 4.7). Apply moderate pressure near the puncture site. This can be done by wrapping the heel using your thumb and second finger.
3. Clean the site with an alcohol swab. Make sure the site is dry before puncturing the skin with the lancet. In selecting a puncture site, avoid any areas of the skin that are broken or appear to be infected.
4. Use the lancet for the skin puncture by placing the blade-slot surface against the area and pressing the trigger. Ensure the free flow of blood.
5. Wipe away the first two well-formed drops of blood using a sterile gauze pad and collect the third drop for haemoglobin testing (see Chapter 5).
6. After blood collection is complete, discard all materials used in the collection procedure in a sharps container or a labelled biohazardous waste container (bag).



Figure 4.7 Holding the infant's heel



## PRECAUTIONS TO OBSERVE WHEN COLLECTING BLOOD SAMPLES<sup>4</sup>

This section describes the universal (general) precautions to be followed during blood collection<sup>5</sup>. You should take precautions when collecting blood to prevent exposure to blood borne infections, such as Hepatitis B or human immunodeficiency virus (HIV). When handling biological fluids, such as blood during the biomarker testing, the following rules should be followed to minimize your exposure to potentially biohazardous materials, thereby decreasing your chances of acquiring blood borne infections.

1. **Wear gloves.** Gloves help to prevent skin and mucous-membrane exposure to blood. Gloves should be worn during blood collection, until the specimen(s) from a respondent is collected, and all waste materials produced during the collection are disposed of. At that point, the gloves used should be treated as biohazardous waste. A new pair of gloves should be used with each respondent. Gloves must never be reused!  
Avoid penetrating injuries. Although gloves can prevent blood contamination of intact and non-intact skin surfaces, they cannot prevent penetrating injuries caused by the instruments used for finger or heel pricks. Safety lancet devices reduce the risk of penetrating injuries.
2. **Lancets** should not be used for purposes other than pricking the finger or heel. 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 the sharps container.
3. **Wash** any skin surfaces or mucus membranes that become contaminated with blood immediately and thoroughly with running water or copious amounts of standing water.
- **Never eat or drink during the testing.** Since eating and drinking may result in you contaminating yourself, they are not permitted during haemoglobin and blood glucose measurements or collection of blood samples for DBS preparation. And for similar reasons, you should not apply make-up during the biomarker testing.
- **Properly dispose of all biohazardous materials.** All materials coming in contact with blood must be placed in a sharps container or a biohazardous waste bag after use and disposed according to the survey's policy on infectious waste disposal. Take precautions when storing and transporting the waste during the fieldwork.

## GOOD BLOOD COLLECTION PRACTICES

- **Good position in relation to the respondent.** Position yourself well before you puncture the respondent's finger.
- **Do not prick the finger if the hand is cold!** Warm the hands by asking the respondent to rub them together vigorously. In the case of a child, ask the mother to rub the child's hands.
- **Never 'milk' the finger.** Excessive massaging or squeezing of the finger or heel will cause tissue juice to mix with and dilute the blood. This will result in erroneous test results, particularly yielding low levels of haemoglobin in the blood. Instead, employ only mild pressure by using the thumb and the second and third fingers to make a 'pad' at the puncture site.

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<sup>4</sup> Adapted from National Committee for Clinical Laboratory Standards (NCCLS) 1997

<sup>5</sup> For the universal precautions regarding blood borne pathogens, see the U.S. Centers for Disease Control and Prevention guidelines and the U.S. Occupational Safety and Health Administration (OSHA) standards for protection from exposure to blood borne pathogen.

- **Never allow alcohol to mix with the blood.** Alcohol, which is used to clean the puncture site, can mix with the blood and cause haemolysis (the rupture or destruction of red blood cells) of the sample leading to errors in the testing results. To avoid this problem, the finger or heel must be air dried completely before being punctured.
- **Avoid obstructing the blood flow to the fingertip.** It is important to hold the finger properly to allow for the accumulation of blood in the tip of the finger. Holding the finger too tightly can obstruct the blood flow to the finger, which will prevent you from getting an adequate volume of blood for testing.
- **Avoid shallow punctures.** A deep puncture should be made for better blood flow and to have a blood sample that is representative of that in the body.

#### **Summary of Steps for Capillary Blood Collection**

- For children between 6 and 12 months, a heel prick should be performed
- Set up blood collection supplies
- Clean the surface of finger/heel
- Prick the finger/heel
- Collect capillary blood
- Never 'milk' the finger
- Dispose of all used materials in the sharps container (lancet and microcuvette) or the bag provided for biohazardous waste

## CHAPTER 5: HAEMOGLOBIN (ANAEMIA) TESTING

Red blood cells contain haemoglobin (Hb), an iron-rich protein that binds oxygen in the lungs and carries the oxygen to organs and tissues throughout the body. Anaemia is defined as a reduction in the normal number of red blood cells or a decrease in the concentration of Hb in the blood. Symptoms of anaemia include pallor, fatigue and weakness, shortness of breath, and irregular heart rhythms. In NFHS-5, respondents will be screened for anaemia by measuring the level of Hb in their blood. Individuals who have an Hb level below a defined cut-off will be classified as anaemic.

Common causes of anaemia include:

- Iron deficiency from inadequate intake of foods containing iron, such as beans, lentils, palak, and red meat;
- Intake of foods that contain non-bioavailable iron;
- Malaria and other parasitic infections (e.g., schistosomiasis and hookworm);
- Blood disorders (e.g., sickle cell anaemia and thalassaemia).

Anaemia is a common and significant global health problem. Consequences of anaemia include an increased risk of maternal and child mortality, impaired cognitive development in children, increased numbers of pre-term and low birth weight babies, and reduced work productivity in adults.

The measurement of Hb is the primary method of screening for anaemia. Hb measurement provides an opportunity to:

- Estimate the prevalence of anaemia in a nationally-representative sample;
- Link the levels of anaemia with demographic data to examine the socioeconomic, residential, and demographic differences in the prevalence of anaemia among populations;
- Design programs to prevent anaemia among the populations most in need of intervention (e.g., iron fortification programs for women and young children living in rural districts).

Haemoglobin measurement in NFHS-5 will be performed using the HemoCue photometer (Hb 201+). This widely used system measures the Hb concentration in a drop of blood obtained from a finger or heel prick. The test is rapid, allowing results to be reported to the respondent immediately following the testing procedure. **Respondents found to have severe anaemia (an Hb level below 9 g/dL for pregnant women and men and below 7 g/dL for women who are not pregnant or who don't know if they are pregnant and children), will be referred to a health facility for further evaluation and treatment.**

This chapter discusses the materials needed and the procedure for haemoglobin measurement. Apart from discussing the materials required for haemoglobin measurement, directions are given regarding precautions to take during collection and testing, recording results in the **Biomarker Questionnaire**, and providing test results and information about anaemia to respondents.

## MATERIALS AND SUPPLIES FOR HAEMOGLOBIN MEASUREMENT

In addition to the supplies listed in Chapter 4, the following equipment and supplies are required for haemoglobin measurement:

- **Microcuvette:** a plastic disposable unit that serves as both a reagent vessel and a measuring device (Figure 5.1). The tip of the microcuvette contains a dry, yellow reagent (sodium azide). The microcuvette is designed to draw up the exact amount of blood needed for the test.
- **HemoCue Hb 201+ photometer:** a device that uses the absorption of light to measure haemoglobin concentration from a single drop of blood collected in a microcuvette (Figure 5.2). Test results are presented on the photometer's electronic display. The HemoCue system is described in greater detail below.
- **Anaemia Brochure:** a brochure that provides basic information to the respondent about anaemia, including its definition, symptoms, causes, and methods of treatment and prevention. In addition, the respondent's Hb results are recorded and classified within this document. See Appendix 7 or 8 for an example of an anaemia brochure.
- **Anaemia Referral Form for Severely Anaemic Respondents:** on this form is written the name and Hb results of severely anaemic respondents. It is to be given to individuals with an Hb result indicative of severe anaemia. Respondents can take the referral form to a local participating clinic or health centre to receive proper treatment for their anaemia.

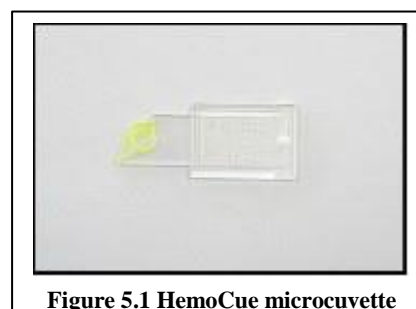


Figure 5.1 HemoCue microcuvette



Figure 5.2 HemoCue Hb 201+ photometer

### THE HEMOCUE PHOTOMETER SYSTEM (Hb 201+)

Although the HemoCue system has proven to be durable and reliable under field conditions, there are some technical limitations to the system. One major limitation is that the reagent in the microcuvettes is sensitive to humidity. Thus, to minimize the degradation of the reagent, follow these instructions for the proper handling and storage of microcuvettes:

1. Record on the microcuvette container the date on which it is first opened;
2. Remove from the container only those microcuvettes required for immediate testing;
3. Remove the microcuvettes by holding the side opposite the tip;

4. Immediately after taking a microcuvette out of the container, snap the container lid back on tightly;
5. Keep the microcuvette container in a cool place and avoid exposing it to heat or direct sunlight.

Under these conditions, a microcuvette container can be stored for up to 3 months (90 days) after opening. Under field conditions, it is not advisable to store the microcuvettes in the opened container for more than a month. Microcuvettes from unopened containers can be used up to the expiration date on the container.

To ensure that the HemoCue Hb 201+ system operates properly, allow the photometer to come to the ambient temperature and protect it from direct sunlight. The device operates optimally between 18 and 30<sup>0</sup> C. The photometer has an internal electronic ‘SELFTEST’; every time the device is turned on, the device automatically verifies the performance of its optronic unit.

The photometer’s black microcuvette holder has three operating positions: 1) ‘pushed in’ for measuring; 2) ‘pulled out’ until ‘clicked’ for placing the microcuvette; 3) removed completely for cleaning.

Clean the microcuvette holder at the end of each day’s fieldwork. For cleaning, use an alcohol swab, or cotton wool/cotton-tipped swabs moistened with 70% alcohol. Check for dirt or dried blood on the swabs. Follow these procedures to clean the microcuvette holder (Figure 5.3):

1. Check that the analyser is turned off and the display window is blank.
2. Pull the microcuvette holder out of its loading position. Carefully press the small catch positioned in the upper right corner of the microcuvette holder.
3. While pressing the catch, carefully rotate the microcuvette holder towards the left as far as possible. Carefully pull the microcuvette holder away from the analyser.
4. Clean the microcuvette holder with an alcohol swab or cotton wool moistened with 70% alcohol (ethanol or isopropyl alcohol).



Figure 5.3 Cleaning microcuvette holder

Blood may get on the optronic system if you do not wipe the outside of the microcuvette before placing the microcuvette in the holder. If this happens, you will get an error message (E01-E05; E09-E30). Clean the optronic unit of the HemoCue machine immediately when you get an error message before proceeding with measurements. Use a HemoCue cleaner to clean the optronic unit of the HemoCue device by pushing the swab into the opening of the microcuvette holder (Figure 5.3). Move the cleaner from side to side 5-10 times. If the swab of the cleaner is stained with blood or dirt, repeat the cleaning procedure with a new cleaner. **Do not use alcohol to clean the optronic unit.** It is important that the microcuvette holder is completely dry prior to reinserting it in the photometer. Furthermore, it is recommended to clean the optronic unit once a week during fieldwork.

## COLLECTING BLOOD AND HAEMOGLOBIN MEASUREMENT

**Children: Follow the procedure below to measure the haemoglobin level in children:**

1. Determine if the child is 6 or more months old and eligible for haemoglobin measurement:  
For **Question 208**, refer to **Question 203** to determine if the child is less than 6 months old (i.e., the child was born in the month of interview or within the 6 months preceding the interview). If the child is less than 6 months old, the child is not eligible for haemoglobin measurement. Record '1' and continue to the next child. If the child is older than 6 months, proceed to **Question 209**.
2. Record the **Name** of the parent/responsible adult of the child in **Question 209**.
3. Read the informed consent statement in **Question 210** to seek consent for haemoglobin measurement of the child from the parent/responsible adult. Record the outcome of the consent process in **Question 211**; confirm that you read the statement to the parent/responsible adult and recorded their response accurately based on the instructions in the BOX in the INFORMED CONSENT SECTION of the Introduction.
4. If consent was granted, collect a finger or heel stick blood sample from the child, following the procedure described in Chapter 4. Use a sterile gauze pad to wipe away the **first two well-formed** large blood drops from the finger or heel.
5. Conduct the haemoglobin measurement as follows:
  - Step 1: Collect the capillary blood in the microcuvette:
    - Apply the tip of the HemoCue microcuvette to the middle of the blood drop. The microcuvette chamber will fill automatically by capillary action. The chamber needs to be filled completely (Figure 5.5). Never 'top off' the microcuvette. Instead, if the microcuvette is not completely filled, use a fresh microcuvette and fill it with the next drop.
    - Wipe any surplus blood off both sides of the microcuvette 'like butter from a knife', using the clean end of a sterile gauze pad. Ensure that no blood is sucked out of the microcuvette when wiping the microcuvette.



Figure 5.4



Figure 5.5



Figure 5.6

After filling the chamber, the microcuvette needs to be visually inspected for air bubbles. Since air bubbles may influence the haemoglobin measurement, any microcuvette containing air bubbles must be discarded. In such cases, with the permission of the parent/responsible adult, repeat the blood drop collection using a different finger (heel). Again, you must use new disposable supplies and follow all of the steps described previously in obtaining the new sample.

- Step 2: Obtain the haemoglobin level:
  - Place the microcuvette in its holder and gently push the holder into the photometer (Figure 5.6).
  - Reading the results: The microcuvette should be analysed immediately, and no later than ten minutes after being filled. The blood haemoglobin level in grams per deciliter (g/dl) is displayed after 15-45 seconds (Figure 5.7).
- Step 3: Stop bleeding at the site of the prick.
  - After the blood drop collection, wipe any remaining blood from the prick site with a sterile gauze pad. Press the gauze pad against the prick site until the blood flow has stopped completely.

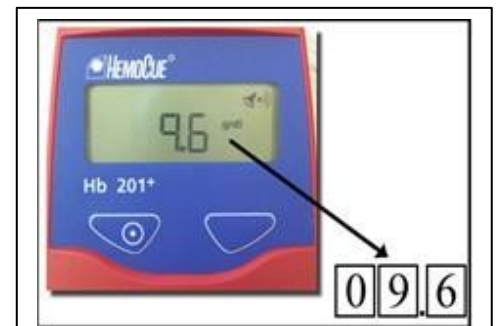


Figure 5.7 Haemoglobin level displayed on the HemoCue photometer and as it should be recorded on the Biomarker Questionnaire

Take an adhesive bandage from its wrapper and apply it to the prick site (Figure 5.8). Advise the mother, especially when the child is a toddler, to watch carefully that the child does not take off the bandage and put it in his/her mouth because it may choke the child.

- Step 4: Record the haemoglobin level and test result:
  - Record the haemoglobin level shown on the photometer (Figure 5.6) in the appropriate box in **Q. 212** of the **Biomarker Questionnaire**. If there is no Hb result to record because the parent/responsible adult did not consent to the test, or there was some other problem, record the appropriate code in **Q. 212**. If more than one child in the household is eligible, check carefully that you are recording the haemoglobin level in the correct column of the Biomarker Questionnaire.



Figure 5.8 Applying adhesive bandage

- Step 5: Collect biohazardous waste:
  - Place all used lancets and microcuvettes in a sharps container, and place all used alcohol swabs, gauze, and gloves in a plastic bag provided for field disposal of these items. At the end of the day, follow the procedures described in Chapter 9 for the proper disposal of these waste materials.
- 6. Record the child's haemoglobin level in the anaemia brochure of either the parent or responsible adult. Inform the parent/responsible adult of the results and provide the parent with the brochure (see Appendix 7 or 8).
- 7. Provide a written referral to a health facility for medical treatment for any child with severe anaemia (haemoglobin level less than 7 g/dl; referral described at the end of chapter).

**Adults: Follow the procedure below for haemoglobin measurement in adults:**

1. Verify that the interviewer correctly entered the respondent's information in the Biomarker Questionnaire.
2. **For a respondent age 18-49 for women and 18-54 for men (or a respondent age 15-17 who has been in a union):**
  - a. Seek consent for measurement in **Questions 344/444** by reading the consent statement. If the adult does not consent to the haemoglobin measurement, record REFUSED in **Questions 345/445**, and sign your name on the blank line. If the adult consents, follow the instructions in the BOX in the INFORMED CONSENT SECTION of the Introduction.
  - b. For a female respondent who has consented to measurement, record pregnancy status in **Questions 346**.
  - c. For a respondent age 15-17 who is not in a union, ask consent from the parent in **Questions 342/442**, and only if the parent consents to testing can you proceed to request assent from the adolescent.
3. Prepare the equipment and supplies for the test(s) for which consent has been granted as described in **Appendix 1**.
4. If consent was granted, collect blood from a finger prick following the procedure described in Chapter 4. Use a sterile gauze pad to wipe away the **first two well-formed** blood drops from the finger prick.
5. Conduct the anaemia test as described above for children:
  - Step 1: Collect the capillary blood in the microcuvette
  - Step 2: Obtain the haemoglobin level
  - Step 3: Stop bleeding at the site of the prick
  - Step 4: Record the haemoglobin level and test result in **Question 375/474**
  - Step 5: Collect biohazardous waste



6. Record the respondent's haemoglobin level in the anaemia brochure.
7. Inform the respondent of her/his haemoglobin level and provide the anaemia brochure.  
**For reasons of confidentiality, please provide each eligible adult who was tested with an informational brochure with their results recorded.**
8. Provide a written referral to a health facility for treatment for any respondent with severe anaemia (below 9g/dl for men and pregnant women and below 7g/dl for women who are not pregnant or don't know if they are pregnant).

#### PRECAUTIONS TO TAKE DURING HAEMOGLOBIN MEASUREMENT

Please take the following precautions while doing haemoglobin measurement:

- **Never remove a microcuvette from the container with fingers wet with alcohol.** This can result in alcohol coming into contact with the reagents inside the microcuvette which can inactivate the reagents. Using fingers wet with alcohol to handle other microcuvettes in the container can also affect them.
- **Never use the first two drops of blood for haemoglobin measurement.** If the respondent consents to the haemoglobin measurement and no other blood-related tests are being done, **wipe away the first two drops** of blood and then collect the third drop in the microcuvette. Make sure that the blood drops are large and well-formed before wiping. This ensures the free flow of blood and allows for the collection of blood with a representative concentration of red blood cells.
- **Avoid inadequate filling or re-filling of the microcuvette.** The compartment of the microcuvette that contains dry reagents (yellow portion) has to be completely filled. The microcuvette should be filled with a drop of blood in one continuous motion. A microcuvette that contains air bubbles should be discarded.
- **Wiping off blood on the microcuvette.** Blood on the exterior of the microcuvette should be removed. Failure to clean the exterior of the microcuvette can lead to an erroneously high haemoglobin reading and produce errors related to maintenance with the analyser.
- **Avoid keeping the microcuvette out for too long.** Keeping the microcuvette out of the container for too long before using it can lead to errors. Remove the microcuvette from its container immediately before starting the testing procedure.
- **Avoid misalignment of the microcuvette in the photometer.** The microcuvette only fits into the photometer's microcuvette holder in one position. Therefore, place the microcuvette carefully in the holder and slowly push the holder inside the photometer to obtain a reading. Forcefully closing the microcuvette holder can cause blood to spray onto the optronic system, which can result in inaccurate Hb results.
- **Expired or improperly stored microcuvettes should not be used for testing.** While in the field, microcuvettes should not be used if more than 1 month has elapsed since

the seal on the container was broken. The containers must be kept tightly closed when not in use to avoid exposure to moisture, which can destroy the reagents.

#### PROVIDING HAEMOGLOBIN TEST RESULTS AND REFERRALS FOR SEVERE ANAEMIA

Before leaving the household, you will verbally report the results of the haemoglobin measurement for each person for whom a haemoglobin measurement was completed. In addition to verbally reporting the Hb results, Hb results will also be written in an informational brochure for each adult respondent in the household. For eligible children, their haemoglobin results should be recorded in the brochure of their parent or responsible adult. When reporting the results, briefly explain to the respondent what his/her haemoglobin reading means, using the anaemia brochure as a guide. Please see Appendix 7 or 8 for an example of the anaemia brochure.

Respondents with severe anaemia should be informed about the effects of severe anaemia and encouraged to visit a health facility for follow-up medical attention. For each respondent with severe anaemia, you will fill out an Anaemia Referral Form (Appendix 3), on which you have recorded the haemoglobin level.

##### **Summary of the steps involved in haemoglobin measurement:**

- Obtain consent
- Clean the finger or heel with an alcohol swab;
- Prick the finger or heel with the lancet;
- Wipe away the first two drops of blood;
- Collect the third blood drop in a microcuvette;
- Measure the haemoglobin level in the blood sample using the HemoCue photometer;
- Stop the bleeding and apply an adhesive bandage to the puncture site;
- Record the haemoglobin level in the appropriate section of the Biomarker Questionnaire;
- Collect biohazardous waste;
- Inform the respondent of his/her haemoglobin level and provide an informational brochure on anaemia;
- Provide a written referral for follow-up medical attention for a respondent found to be severely anaemic

## **CHAPTER 6: BLOOD GLUCOSE TESTING**

### **INTRODUCTION**

Diabetes (diabetes mellitus) is a set of metabolic disorders that is characterized by hyperglycaemia (elevated blood glucose levels) due to defective insulin secretion, ineffective insulin action, or a combination of the two. Early symptoms of hyperglycaemia may include polyuria, polydipsia, weight loss and blurred vision. Long-term complications of diabetes include retinopathy, loss of vision, kidney failure, and wounds that do not heal (or heal very slowly). Consequently, diabetes is the major cause of non-traumatic amputations of the lower limbs, blindness, and kidney disease worldwide. Glucose is derived primarily from digestion of carbohydrates and is the principal source of energy for cells. Insulin is required for the transfer of glucose from the blood into cells where it can be utilized for energy. Impairment of the glucose transporting mechanism, because of insufficient insulin (autoimmune disease), cancer of the pancreas, viruses, drugs, or insulin that does not work properly (obesity, inactivity) may lead to diabetes.

### **CAUSES OF DIABETES**

Diabetes is a poorly understood condition and the cause(s) of the disorder is/are not clearly known. Diabetes may be classified into two primary groups based on the aetiology of the disease: Type 1 diabetes and type 2 diabetes. Type 2 diabetes mellitus is the most common form of diabetes and is strongly linked to obesity and a sedentary life style. Individuals with a family history of diabetes are more likely to develop the condition than the general population. In addition to lifestyle factors, diabetes mellitus (type 2 diabetes) may result from trauma to the pancreas, endocrine disorders (hyperthyroidism; Cushing's syndrome), prescription drugs and infections (congenital rubella). The underlying cause of type 2 diabetes is a deficiency in insulin secretion and/or insulin that is partially effective in removing glucose from the blood and into cells. Treatment options range from weight reduction to drugs that promote the secretion of insulin or enhance its effectiveness. Type 1 diabetes is characterized by a lack of insulin due to destruction of the beta cells of the pancreas. Individuals with type 1 diabetes require exogenous insulin for survival.

### **BLOOD GLUCOSE TESTING IN NFHS-5**

All women and men age 15 and above + in a households are eligible for blood glucose testing in NFHS-5. Health investigators should keep in mind that random blood glucose testing is done at any time of the day in combination with other biomarkers that the respondent has given her/his consent. It is also important to note that the NFHS-5 random blood glucose tests cannot be used to diagnose actual diabetes.

### **GENERAL PROCEDURE IN CONDUCTING THE RANDOM BLOOD GLUCOSE TEST**

This chapter discusses the materials needed and the procedure for random blood glucose testing. In addition, directions are given regarding precautions to take during blood collection and testing, recording results in the Biomarker Questionnaire, and providing test results to the respondents in a brochure and a referral form to a local health facility if necessary.

## MATERIALS AND SUPPLIES FOR BLOOD GLUCOSE TESTING

In addition to the Biomarker Questionnaire and supplies listed in Chapter 4, the following equipment and supplies are required for random blood glucose level measurement.

Accu-Chek Performa with glucose test strips will be used in NFHS-5 to measure random blood glucose. This equipment provides laboratory quality analysis of glucose with capillary blood. The results of the glucose test are displayed as whole blood glucose. The standard way of reporting glucose measurement in blood is as plasma glucose. The blood plasma glucose level is about 11% higher than the level in whole blood. The conversion of whole blood glucose to plasma glucose will be calculated during data processing. The health investigators will record in the Biomarker Questionnaire the measured blood glucose value on the glucometer display.

### The components of the glucose testing:

#### 1. Accu-Chek Performa

The glucometer is a device for measuring the concentration of glucose in the blood (Figure 6.1/6.2). Its measurement of the blood glucose level is equivalent to the glucose levels using the glucose oxidase laboratory technique, in the range of 10-600 mg/dL (1.1 – 27.8 mmol/L). The advantage of the glucometer is that results are available in 20 seconds on an LCD digital display which can be immediately communicated to respondents. A very small volume of blood is required for the blood glucose measurement. This device is suitable for use as point-of care equipment. A small drop of blood obtained from a finger prick is used by a disposable glucose test strip and is read by the glucometer. The glucometer then displays the results of the glucose measurement in **mg/dL**.



Figure 6.1 Glucometer

#### 2. Disposable test strip

This is a plastic test strip with a small spot impregnated with glucose oxidase and other components (Figure 6.2). Each disposable test strip is used once and then discarded. A blood drop is put on the end of a glucose strip after the strip has been inserted in the glucometer. Usually the test strips come in packs of 50 strips per vial along with a glucose test strip calibrator.



Figure 6.2 Disposable strips

### Accu-Chek Performa Control Solutions (supplementary reagents not included in the kit)

Control test are used to ensure the device and test strips are working properly. It is advisable to perform control tests in following scenarios:

- About 3000 tests have been completed
- The test strips are damaged
- You want to perform a meter and test strip check
- You dropped the meter
- The strips were stored in a hot, humid environment
- To make sure you are performing the test and using the meter correctly

### Using Control Solution

Important notes to remember:

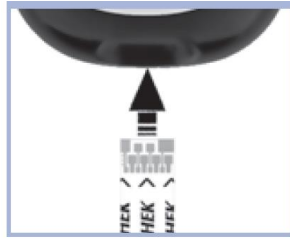
- a. When you open a control solution bottle for the first time, count forward 90 days and write this date on the control solution bottle using a pen that won't smear or wipe off. Throw away any remaining solution after this date.
- b. Control solutions may be used with glucose test strips. **The control solution is used to confirm that the meter and test strips work together correctly and that you are performing the test correctly.**
- c. Use only Accu-Chek Performa control solutions with this glucometer. Replace the cap securely on the bottle immediately after use.
- d. Do not use the control solution past the expiry date.

### Performing Control Test

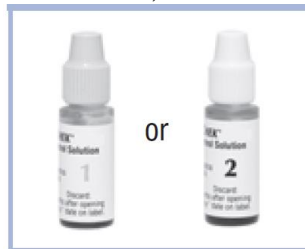
1. Check the expiration date on the control solution.



2. Remove one test strip and insert it into the meter.



3. Control solutions come in two levels, 1 and 2.



4. Remove the cap to the bottle and gently wipe the tip with a tissue. Squeeze the bottle until a drop forms.

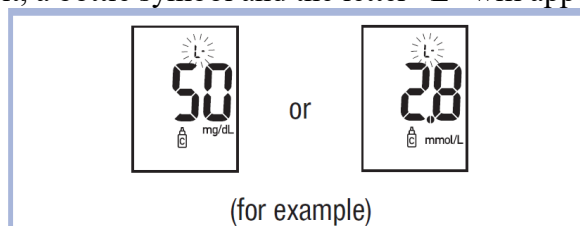



5. Touch the drop to the EDGE of the test strip until the hour glass flashes. **NEVER put the drop on top of the test strip!**




6. Wipe the tip of the bottle with the tissue and close the bottle tightly.

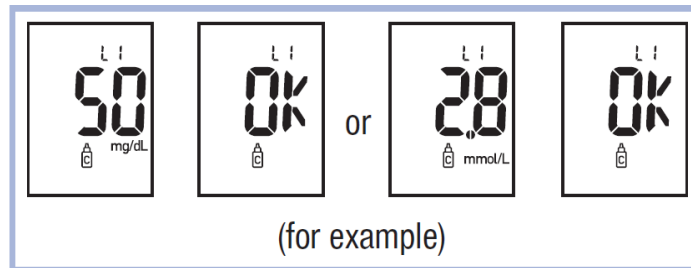
7. The control result, a bottle symbol and the letter “L” will appear on the display.



8. Leave the test strip in, and press the right arrow  once to mark the control result as level 1. Press the arrow twice to mark the control as level 2.

9. Press and release the  to set the control level in the meter.

10. **OK** and the control result will alternate on the display is the control value is in range.  
**ERR** and the control result alternate on the display is the control result is out of range.



11. The test strip can now be removed.
12. Documentation – blood glucose brochure and referral

### STEPS FOR MEASURING RANDOM BLOOD GLUCOSE LEVEL USING THE ACCU-CHEK PERFORMA INSTRUMENT

1. Check the expiration date on the container, if the strips have not expired, remove a strip from the container and close the container tightly.



Figure 6.3 Prepare glucose strip for use

2. Insert the test strip into the meter with the contact bars and arrow facing up until it stops. This turns on the meter automatically.
- Note: The meter turns off after 3 minutes of inactivity. Remove and reinsert the unused test strip to restart the meter.*

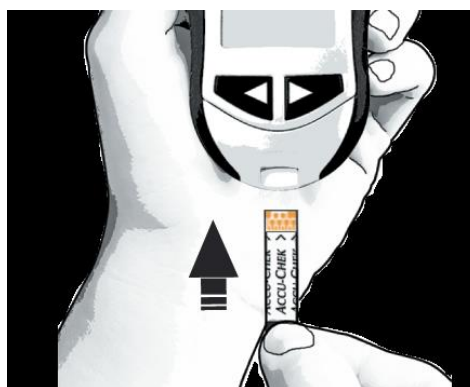


Figure 6.4 Insert glucose test strip in glucometer

3. This display always appears when the meter is turned ON. Do not use the meter if the

display check screen does not exactly match the example. If this happens, ask IIPS to contact Customer Service.

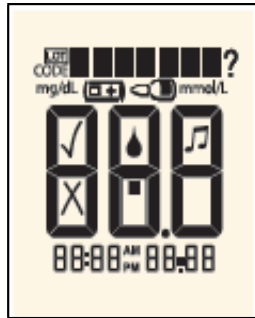


Figure 6.5 glucometer screen check

4. The 'Apply Sample' symbol appears next, indicating the meter is ready for you to apply a sample to the test strip.



Figure 6.6 'Apply Sample' symbols on glucometer display

5. Obtain a Blood Sample: Select a test site. Use the retractable safety lancet to obtain a blood sample. Wipe away the first drop of blood and use the **SECOND** drop for glucose testing.



Figure 6.7 Prick finger



6. Apply blood to the test strip by bringing the blood drop to the white area at the end of the test strip. The blood is drawn into the test strip.

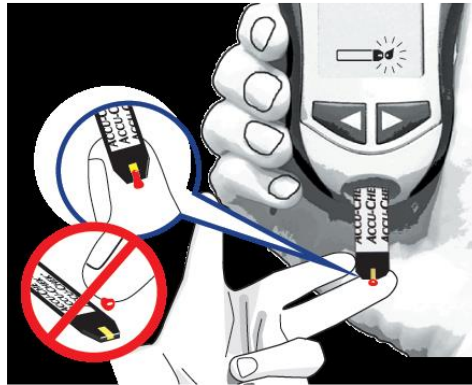


Figure 6.8 Collect blood in to glucose test strip

7. Hold the blood drop to the yellow area until the meter beeps (if sound is on) and the hour glass appears on the display. This indicates the test strip has obtained enough blood.



Figure 6.9 Test strip has required blood volume

8. The countdown appears on the display as the meter checks your glucose level. **Note:** Do not remove the test strip from the meter or disturb the test strip during the countdown.




Figure 6.10 5 seconds to result


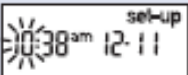


9. The meter beeps (if sound is on) when the result appears on the display. The test is complete (see figure). Record this result in your Biomarker Questionnaire. The result is also stored in memory of the Accu-Chek Performa glucometer device.










Figure 6.11 Blood glucose results on display screen

10. Turn off the meter by removing the used test strip from the glucometer. Discard the used test strip in a biohazard bag. **Note:** You can also press and hold  for at least 2 seconds to turn off the meter. The meter also turns off after 5 seconds of inactivity.
11. The meter displays results in mg/dL or mmol/L. The unit of measurement is preset by the manufacturer. You cannot change this setting. Check for the setting on the sticker on the back of the meter.
12. The meter displays results from 10–600 mg/dL (1.1–27.8 mmol/L). Low or high blood glucose results can indicate a potentially serious medical condition.
13. **In case of delay of more than 3 minutes of inactivity before applying blood to the glucose strip**, the glucometer turns off. Do not panic, simply remove and reinsert the unused strip into the glucometer to restart the meter.
14. Stop the bleeding at the prick site with a sterile gauze pad.
15. Record the results of the random blood glucose measurement in the Biomarker Questionnaire for women and men in **Q374/473**, respectively.
16. Record the respondent's random blood glucose level in the blood glucose brochure. Explain the results to the respondent and (if adolescent) the parent/responsible adult. Each respondent should have a blood glucose brochure with their results recorded.
17. **Provide a referral form to a health facility for additional medical evaluation for any respondent with a random blood glucose level  $\geq 200$  mg/dL.**
18. Discard lancets in a sharps container and discard glucose strips, alcohol swabs, gauze, and gloves in the biohazard bag. At the end of the day, follow the procedures described in Chapter 9 for the proper disposal of waste materials.

## ERROR MESSAGES

Display	Action
The meter will not turn on or the display is blank.	<ul style="list-style-type: none"> <li>• Battery is dead. Insert new battery.</li> <li>• Display is damaged. Contact Roche.</li> <li>• Meter is defective. Contact Roche.</li> <li>• Extreme temperatures. Move the meter to a more temperate area.</li> </ul>
	Battery power is low. Change the battery soon.
	The meter is in set-up mode, waiting for you to change or confirm settings.
	The meter is ready for you to insert a test strip.
	The meter is ready for a drop of blood or control solution.
HI	Blood glucose may be higher than the measurement range of the system. See Chapter 2, Unusual Blood Glucose Results.
LO	Blood glucose may be lower than the measurement range of the system. See Chapter 2, Unusual Blood Glucose Results.

## TROUBLESHOOTING

Display	Action
	Blood glucose is below the defined hypoglycaemic (low blood glucose) level. See Chapter 2, Unusual Blood Glucose Results.
	A general marker was assigned to this test result.
	A pre-meal marker was assigned to this test result.
	A post-meal marker was assigned to this test result.
	A pre-meal marker was assigned to this test result and the post-meal test reminder has been activated.
	The test strip may be damaged or not properly inserted. Remove and reinsert the test strip and replace it if damaged.
	<p>Your blood glucose may be extremely high or a meter or a test strip error has occurred.</p> <ul style="list-style-type: none"> <li>• If your test result matches how you feel, contact your healthcare professional immediately.</li> <li>• If your test result does not match how you feel, repeat the blood glucose test. See Chapter 2, Unusual Blood Glucose Results. <ul style="list-style-type: none"> <li>• If the E-3 code still appears for your blood glucose test, your blood glucose result may be extremely high and above the system's reading range. <b>Contact your healthcare professional immediately.</b></li> <li>• If the second test result does not match how you feel, perform a control test with the control solution and a new test strip. <ul style="list-style-type: none"> <li>• If the control result is within the acceptable range, review the proper testing procedure and repeat the blood glucose test with a new test strip.</li> <li>• If the control result is not within the acceptable range, see Chapter 4, Understanding Out-of-Range Control Results.</li> </ul> </li> </ul> </li> </ul>

Display	Action
<b>E-4</b>	Not enough blood or control solution was drawn into the test strip for measurement or was applied after the test had started. Discard the test strip and repeat the blood glucose or control test.
<b>E-6</b>	Blood or control solution was applied to the test strip before the flashing drop symbol appeared on the display. Discard the test strip and repeat the blood glucose or control test.
<b>E-7</b>	An electronic error occurred, or in rare cases, a used test strip was removed and reinserted. Turn the meter off and on, or take the battery out for 20 seconds and reinsert it. Perform a blood glucose or control test.
<b>E-8</b>	The temperature is above or below the proper range for the system. Refer to the test strip package insert for system operating conditions. Move to an area with the appropriate conditions, wait 5 minutes, and repeat the blood glucose or control test. Do not artificially heat or cool the meter.
<b>E-9</b>	The battery is almost out of power. Change the battery now. If the message reappears after the battery has been replaced, remove the battery again, press any meter button, then reinsert the battery.
<b>E-10</b>	The time and date settings may be incorrect. Make sure the time and date are correct and adjust, if necessary.

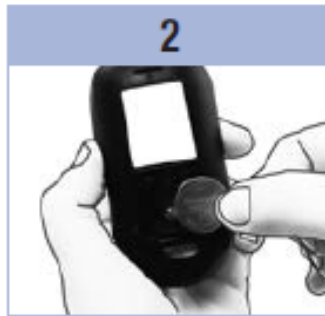
## MAINTENANCE OF THE GLUCOMETER

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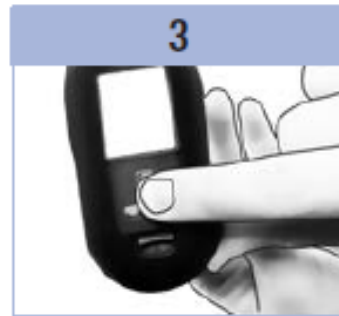
### Changing the Battery



Open the battery door on the back of the meter by pushing the tab in the direction of the arrow and pulling the door up.



Remove the old battery. Insert the new battery with the (+) side facing up.



Put the battery door back in place and snap it closed.

### CLEANING THE GLUCOMETER

1. Confirm that the meter is turned off.
2. Gently wipe the meter's surface with a cloth slightly dampened with:
  - 70% isopropyl alcohol
  - Mild dishwashing liquid mixed with water
  - 10% household bleach solution made the same day (1 part bleach to 9 parts water).

## CHAPTER 7: COMBINED RANDOM BLOOD GLUCOSE AND HAEMOGLOBIN TESTING

In households in which women age 15-49 are eligible for combined haemoglobin and blood glucose measurement should follow the instructions in this chapter. In Chapters 5 and 6 above, the procedures for haemoglobin and blood glucose measurements have been described as independent tests. Women and men age 15+ are eligible for blood glucose testing, but not for anaemia testing, so for that age group you should follow the instructions in Chapter 6.

The order of collection is very important and must be followed strictly. Blood is to be collected for blood glucose measurement first, while collection of blood for haemoglobin testing follows. Consent for each test must be obtained separately, following the order in the Biomarker Questionnaire. If consent has not been given to perform a test, follow the skip instructions. **You should complete the testing process for one eligible respondent before proceeding to the next eligible individual.**

### PROCEDURE FOR COMBINED HAEMOGLOBIN AND BLOOD GLUCOSE TESTING

1. The interviewer identifies all women eligible for haemoglobin and blood glucose testing from the household schedule and records their name, line number, age, and marital status in **Question 302** of the Biomarker Questionnaire. Women age 15-49 who are usual members of the household or who stayed in the household the night before the day of the interview are eligible for blood glucose and haemoglobin testing. Apart from this, women age 50 and above will be eligible only for blood glucose testing.
2. When instructed, the health investigator must check the respondent's age and marital status in **Question 302**. You must do this step because if the respondent is age 15-17 and not in a union, or has never been in a union, he/she is an adolescent and consent for testing must be obtained from the parent or adult responsible for the adolescent, as well as the adolescent directly. If the respondent is in a union or has been in a union or is age 18-49, skip to the appropriate question.
3. **For a respondent age 18-49 or a respondent age 15-17 who is in a union, or has been in a union:**
  - Read the appropriate informed consent statement in the Biomarker Questionnaire separately for haemoglobin and blood glucose testing to the respondent and record the outcome of the consent request in the appropriate question.
  - For a female respondent who has consented to haemoglobin measurement, record the pregnancy status in **Question 346**.

4. **For a respondent age 15-17 who has never been in a union (an adolescent):**

- Record the **Name** of parent/responsible adult in the appropriate questions for haemoglobin and blood glucose measurement in **Question 309**.

Seek consent for haemoglobin and blood glucose measurements separately from the parent/responsible adult in the appropriate questions. If the parent/responsible adult does not consent to any or both tests, record REFUSED and sign your name on the blank line in the appropriate questions. If the parent/responsible adult consents to any or both tests, follow the instructions in the BOX in the INFORMED CONSENT SECTION of the Introduction.

Ask consent for the haemoglobin and blood glucose testing from the adolescent and record the outcome of the consent request in the appropriate question. If the adolescent respondent does not consent to any testing, skip to the appropriate question.

5. If consent was granted for both haemoglobin and blood glucose testing, the health investigator puts on a pair of gloves and prepares the work station with the appropriate biomarker supplies and equipment.

6. Prick a finger with a Unistik 3 Normal lancet and wipe away the first well-formed large drop of blood.

7. Apply blood from the next drop of blood to the test strip by bringing the blood drop to the white area at the end of the test strip. The blood is drawn into the test strip.

8. Hold the blood drop to the white area until the meter beeps (if sound is on) and the status bar appears on the display. This indicates that the test strip has obtained enough blood.

9. The countdown appears on the display as the meter checks the glucose level. **Note:** Do not remove the test strip from the meter or disturb the test strip during the countdown

10. The meter beeps (if sound is on) when the result appears on the display. The test is complete. The result is stored in the memory of the Accu-Chek Performa glucometer device.

11. Use the sterile gauze to wipe away the excess blood on the skin.

12. Collect the third blood drop into a microcuvette for haemoglobin measurement by applying the tip of the microcuvette in the middle of the well-formed large blood drop (Figure 7.2).



Figure 7.1 Large drop of blood



Figure 7.2 Filling the microcuvette



13. Clean the sides of the microcuvette on the sterile gauze and check for air bubbles. The haemoglobin level will be shown in the HemoCue machine in about 15 seconds.
14. Wipe any remaining blood from the prick site with a sterile gauze pad. Press the gauze pad against the prick site until the blood flow has stopped completely.
15. Take an adhesive bandage from its wrapper and apply it to the prick site.
16. Record the **blood glucose and haemoglobin levels in Question 374 and 375, respectively**. If the blood glucose or haemoglobin measurement was not obtained because the respondent did not consent to the test, or if there was a technical problem with the testing, circle the appropriate code.
17. Place used lancets and microcuvettes in the sharps container and all other biohazardous waste (alcohol swabs, gauzes, glucose strip and gloves) into a clearly labelled 'biohazard' plastic bag, which has been provided for field disposal of these items. Before leaving the enumeration area (cluster), the bags with biohazardous waste must be taken to a health facility and incinerated or disposed of in the field following the recommended protocol in Chapter 9.
18. Record the test results in the appropriate informational brochures.  
Each eligible respondent should receive the appropriate brochures with their test results recorded.
19. Explain to the respondent what her haemoglobin and blood glucose results mean with the brochure as a guide.
20. Provide a written referral to a health facility for treatment for any respondents with severe anaemia (below 9 g/dl for pregnant women and men and below 7 g/dl for children and women who are not pregnant or don't know if they are pregnant).
21. Provide a written referral to a health facility for additional medical evaluation for any respondents with a random blood glucose level  $\geq 200\text{mg/dL}$ .

## **CHAPTER 8: DRIED BLOOD SPOT (DBS) COLLECTION FOR MALARIA, ANTIMALARIAL DRUG RESISTANCE, HbA1c, AND VITAMIN D TESTING**

Malaria is an acute infectious and communicable disease caused by *Plasmodium* parasites and transmitted by the bite of an infected mosquito. The parasite has different stages of its life cycle in human beings and mosquitoes. The symptoms of malaria include fever, chills, headache, muscle aches, tiredness, nausea and vomiting, diarrhoea, anaemia, and jaundice (yellow colouring of the skin and eyes). Convulsions, coma, severe anaemia, and kidney failure can also occur. The risk of getting malaria is particularly high during the monsoon and post monsoon seasons because malaria mosquitoes breed in stagnant water. In India, malaria is most common in states in the eastern, central, and northeastern part of the country, such as Odisha, Chhattisgarh, Jharkhand, Madhya Pradesh, Maharashtra, Tripura, and Meghalaya.

Emergence of resistance to currently used antimalarial drugs is one of the biggest challenges for malaria elimination efforts in India. Countrywide cross-sectional data on antimalarial drug resistance will be crucial for effective control of malaria cases and understanding the emergence/spread of resistance in different regions.

HbA1c will provide useful information in terms of diabetes control reflected as average blood glucose level over the last 8-12 weeks. It has been shown to be associated with a greater risk of developing diabetes related complications. This parameter will provide valid information on status of diabetes control at the population level. This will be very useful for generating information on diabetes management strategies and the National Program on Prevention and Control of Cancer, Diabetes, Cardiovascular Disease and Stroke during 2010-2011 after integrating the National Cancer Control Programme (NCCP) with the National Programme for Prevention and Control of Diabetes, Cardiovascular Disease, and Stroke.

Vitamin D helps regulate the amount of calcium and phosphate in the body. These nutrients are needed to keep bones, teeth and muscles healthy. A lack of vitamin D can lead to bone deformities such as rickets in children, and bone pain caused by a condition called osteomalacia in adults. A good source of Vitamin D is sunlight, as well as a few foods such as red meat, liver, egg yolks and fish.

Studies report that the prevalence of Vitamin D3 deficiency is about 50-70% in India. Osteopenia and osteoporosis are common in Indian adults. Patients with chronic kidney diseases may also present with bone disorders before or after developing kidney diseases. They may have osteoporosis and Vitamin D deficiency. Hence, determination of Vitamin D3 levels would be helpful in predicting the potential risk of the above-mentioned disorders.

## MATERIALS AND SUPPLIES FOR DBS COLLECTION FOR MALARIA, ANTIMALARIAL DRUG RESISTANCE, HbA1c, AND VITAMIN D TESTING

In addition to the supplies listed in Chapter 4, the following materials are required for DBS collection for malaria, antimalarial drug resistance, HbA1c, and Vitamin D testing:

- **Filter paper card:** You will use special filter paper cards (Figure 8.1) to collect the blood samples. Each card has five pre-printed circles that hold about 100 µl of blood when filled.
- **The filter paper cards must be kept clean and dry at all times.** Water, dust, sweat from your hands, or other environmental contaminants can affect malaria, antimalarial drug resistance, HbA1c, and Vitamin D testing. **Use gloves at all times when handling the filter paper cards.**

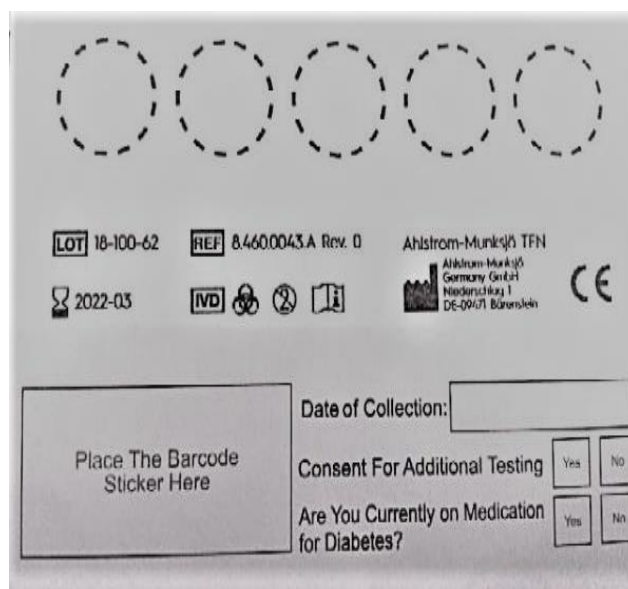


Figure 8.1 Filter paper card

- The filter paper cards come in packets of 200 cards. Before opening a new packet, put on gloves. Open the packet and place the cards in 6-8 smaller ziploc bags; place these smaller bags in a large ziploc bag. The bags must be stored stacked to avoid compressing the filter paper. **Place a few desiccant packets and a humidity indicator card in each small bag before sealing it. You must also place desiccants and a humidity indicator card in the larger ziploc bag.** If the humidity indicator card and/or desiccants change colour before the cards have all been used, replace the humidity indicator card and desiccants following the instructions described in the **Desiccant packets** and **Humidity indicator card** sections below.
- **Note:** Keeping the unused filter paper cards with desiccants in a ziploc bag will prevent moisture from being absorbed on the filter paper card which will prevent over-saturation or merging of circles when blood is collected.

**Barcode labels:** because the malaria, antimalarial drug resistance, HbA1c, and Vitamin D testing in NFHS-5 is anonymous, respondents' names are never written on the filter paper cards. Instead, barcode labels are used to identify the DBS samples and link them to the interview data. You will be provided with sheets of 'peel-off' adhesive barcode labels (Figure 8.2). The barcodes are arranged in rows; the codes on each label are the same across one row. **A different row of barcode labels is to be used for each respondent from whom a DBS sample is collected.**

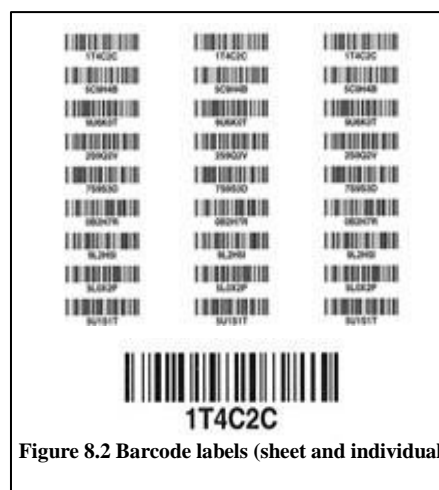


Figure 8.2 Barcode labels (sheet and individual)

- **Drying box:** a plastic box with a cardboard rack positioned inside.
  - For proper use, stand the box vertically (the filter paper cards will be positioned horizontally). The drying boxes are to be used for transport of DBS while in the field and overnight drying of DBS samples. They are not to be used for long-term sample storage.

- **Desiccant packets:** drying agents used to absorb moisture from the air to keep the filter paper cards dry (Figure 8.3). The granules inside the packets change colour from brown to green as they absorb moisture.

- Change the desiccants when the granules change to a green colour or as indicated by the humidity indicator card.
- Treat used desiccants as biohazardous waste and throw them away in a biohazardous waste bag.



Figure 8.3 Desiccants

- **Humidity indicator cards:** cards that allow closer monitoring of the level of moisture than monitoring the colour of the desiccant packets alone.

- There are three circles on the humidity indicator card (Figure 8.4). If the circle at the bottom of the card (labelled 30%) turns pink, it indicates a relatively high level of humidity and it is a warning to carefully monitor the humidity level. If the middle circle (labelled 40%) turns pink, replace the

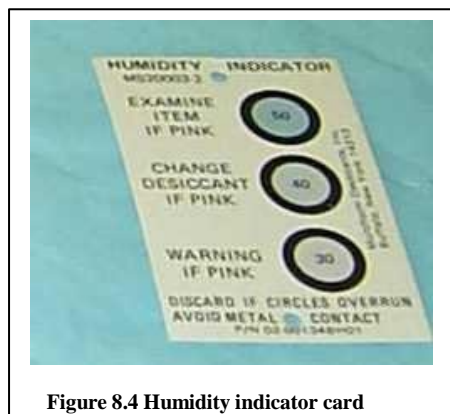


Figure 8.4 Humidity indicator card

desiccant packets and humidity card. If the top circle (50%) turns pink, you must examine the DBS cards as their quality might have been compromised due to the high humidity in the bag. You should replace the desiccant packets and humidity card with fresh ones.

- **Low gas-permeable bags (small ziploc bags):** special small ziploc bags used for storing the DBS samples prior to transfer to the lab. These bags are specially manufactured to reduce the exposure of their contents to air and moisture. These bags are expensive and should never be used for other purposes, such as carrying food or adhesive bandages. The bags have a sliding ‘zipper’ that is used to close and seal the bag.

- **Large ziploc bags or Cluster bag:** A large ziploc bag will be provided for each of the NFHS-5 sample clusters in which you will work. These bags will be used to hold the small ziploc bags with DBS samples from the cluster during storage and transport to the laboratories.
- **DBS Transmittal Sheet:** accompanies the DBS samples to the laboratory. The purpose of this sheet is to track the samples from the field to their arrival in the laboratory for testing to ensure that the number of DBS samples sent to the laboratory matches the number of samples collected in the field. A barcode with the same unique identifier as the barcode label attached to the DBS sample is attached to the DBS Transmittal Sheet and in the space provided in the Biomarker Questionnaire (**Question 376 for women or Question 475 for men**). See Appendix 9 for an example of the DBS Transmittal Sheet. One transmittal sheet can only hold 30 barcodes.

### **COMBINED PROCEDURE FOR GLUCOSE TESTING, HAEMOGLOBIN TESTING, AND DBS COLLECTION FOR MALARIA, ANTIMALARIAL DRUG RESISTANCE, HbA1c, AND VITAMIN D TESTING**

This section focuses on the steps involved in collecting the blood samples for blood glucose and haemoglobin testing, followed by blood collection for laboratory testing for malaria, antimalarial drug resistance, HbA1c, and Vitamin D. When blood is collected for these tests, the order of collection is very important and must be followed strictly. Blood is first collected for blood glucose testing and then for haemoglobin testing. Finally, blood is collected on a filter paper card to prepare dried blood spots for testing for malaria, antimalarial drug resistance, HbA1c, and Vitamin D.

Consent for each test must be obtained separately, following the order in the Biomarker Questionnaire. If consent has not been given to perform a test, follow the skip instructions. **You should complete the testing process for one respondent before proceeding to the next eligible individual.**

**Follow the procedure below to collect blood for blood glucose testing, haemoglobin testing, and blood collection on a filter paper card.**

- 1) The interviewer identifies all women and men from the household schedule who are eligible for blood glucose testing, haemoglobin testing, and DBS collection. In approximately 15% of the clusters, women age 15-49 and men 15-54 years who are usual members of the household or who stayed in the household the night before the survey are eligible. Women and men age 50+ are also eligible for glucose testing.
- 2) Interviewer records the **Name, Line Number, Age, and Marital Status** of all eligible women and men in **Question 302** and **Question 402**, respectively, in the Biomarker Questionnaire.
- 3) When instructed, the health investigator must check the respondent's age and marital status in **Question 302/402**. You must do this step because if the respondent is age 15-17 and not in a union, or has never been in a union, he/she is an adolescent and consent for testing must be obtained from the parent or adult responsible for the adolescent, as well as the adolescent. If the respondent is in a union or has been in a union or is age 18-49, skip to **Question 344/444**.

**For women age 18-49 and men age 18-54 or a respondent age 15-17 who is in a union, or has been in a union:**

- Read the informed consent statement for anemia testing in **Question 344/444** to the respondent and record the outcome of the consent request **Questions 345/445**.
- For the female respondent who consents to anemia testing, record the pregnancy status in **Question 346**.
- Read the informed consent statement for blood glucose testing in **Question 351/450** to the respondent and record the outcome of the consent request in **Question 352/451**. If a female respondent does not consent to blood glucose measurement, follow the skips to **Question 358**.
- If the household was selected for DBS preparation, read the informed consent statement for malaria, antimalarial drug resistance HbA1c, and Vitamin D **testing** to the respondent in **Question 363/462**. Record the outcome of the consent request in **Question 364/463**; confirm that you read the statement to the respondent and recorded their response accurately based on the instructions in the BOX in the INFORMED CONSENT SECTION of the Introduction. If the respondent does not consent to malaria, antimalarial drug resistance, HbA1c, and Vitamin D testing, follow the skips to **Question 372/471**.
- Read the informed consent statement for **additional testing** to the respondent in **Question 369/468**. Record the outcome of the consent request in **Question 370/469**; confirm that you read the statement to the respondent and recorded the response accurately based on the instructions in the BOX in the INFORMED CONSENT SECTION of the Introduction.
- Prepare the work station for the test for which consent was granted.
- According to **Question 376/475**, place a barcode on the filter paper card if DBS is being prepared. Refer to **Question 356/455** to determine if blood glucose (HbA1c testing) will be done, check “Yes” or “No.” Refer to **Question 370/469** if additional testing was permitted, check “Yes” or “No.”

**For a respondent age 15-17 who has never been in a union (an adolescent):**

- Check and record name of his/her parent/responsible adult in **Question 309/409**.
- Seek consent for anemia testing from the parent/responsible adult by reading the consent statement in **Question 342/442**. If consent is granted, proceed to request consent from the adolescent in **Question 344/444** and record the consent outcome. Ensure that you correctly follow the skip instructions in the Biomarker Questionnaire.
- For the female respondent who consents to anemia testing, record the pregnancy status in **Question 346**.
- Seek consent for blood glucose measurement from the parent/responsible adult in **Question 349/448**. If the parent/responsible adult does not consent to the adolescent’s haemoglobin measurement in **Question 351/450** record REFUSED, sign your name on the blank line, and go to **Question 358/457**. If the parent/responsible adult consents to the testing, in **Question 350/449** follow the instructions in the BOX in the INFORMED CONSENT SECTION of the Introduction.
- If parent/guardian or an adolescent female respondent does not consent to blood glucose measurement, follow the skips to **Question 358**.
- If the household was selected for DBS preparation, read the informed consent statement for malaria, antimalarial drug resistance HbA1c, and Vitamin D testing to

- the parent/guardian in **Question 361/460**. If the parent/guardian gives consent, seek adolescent assent in **Question 363/462**. Record the outcome of the consent request in **Question 364/463**; confirm that you read the statement to the respondent and recorded their response accurately based on the instructions in the BOX in the INFORMED CONSENT SECTION of the Introduction. If the parent/guardian or adolescent respondent does not consent to malaria, antimalarial drug resistance, HbA1c, and Vitamin D testing, follow the skips to **Question 372/471**.
- Read the informed consent statement for **additional testing** to the parent/guardian in **Question 367/466**. If the parent/guardian consents, seek adolescent assent in **Question 369/468**. Record the outcome of the consent request in **Question 370/469**; confirm that you read the statement to the respondent and recorded the response accurately based on the instructions in the BOX in the INFORMED CONSENT SECTION of the Introduction.
  - Prepare the work station for the test for which consent was granted.
  - According to **Question 376/475**, place a barcode on the filter paper card if DBS is being prepared. Refer to **Question 356/455** to determine if blood glucose (HbA1c testing) will be done, check “Yes” or “No.” Refer to **Question 370/469** if additional testing was permitted, check “Yes” or “No.”
- 4) Prepare the equipment and supplies **ONLY for the tests for which consent has been granted.**
- 5) If consent for malaria, antimalarial drug resistance, HbA1c, and Vitamin D testing was granted, identify the next available complete set (**row**) of barcode labels. **Wearing a pair of gloves**, carefully remove a new filter paper card from the plastic ziploc bag in which you have stored the cards. Make sure to handle the card in such a way that you do not touch the areas within the pre-printed circle. ***Never handle a card with your bare hands as you may transfer sweat, dirt or other contaminants to the card.***
- Place the card with the pre-printed circles face-up on the clean absorbent sheet that you have spread out on a flat surface. Discard the card if it drops on the floor or ground or if it becomes dirty in any other manner.
  - Take the **first barcode label** from the first complete row on the sheet of barcode labels and paste it in the appropriate column of the Biomarker Questionnaire containing the line number of the respondent from whom you will collect blood for malaria, antimalarial drug resistance, HbA1c, and Vitamin D testing (**Question 376** for women or **Question 475** for men).
  - Take the **second barcode label** from the same row on the sheet of barcode labels and paste it at the bottom of the filter paper card. Do not cover up or touch any part of the pre-printed circles.
  - Take the **third barcode label** from the ***same row*** on the sheet of barcode labels and paste it on the Blood Sample Transmittal Sheet for the cluster in which you are working.
  - **DO THE ABOVE STEPS CAREFULLY.** The barcode label is the only means of identifying the blood sample and for linking the malaria, antimalarial drug

resistance, HbA1c, and Vitamin D test results to the interview data. Mistakes will result in mismatches later on. **CHECK THAT THE THREE MATCHING BARCODE LABELS HAVE BEEN PLACED ON THE FILTER PAPER CARD, THE BIOMARKER QUESTIONNAIRE, AND THE TRANSMITTAL SHEET BEFORE YOU PROCEED TO COLLECT BLOOD DROPS FROM THE RESPONDENT.**

**6) Note that the blood collection and test order for combined blood glucose, haemoglobin, and DBS collection is as follows:**

After pricking the finger:

- First large blood drop: wipe away.
- Second blood drop into the glucose strip.
- Third blood drop into the microcuvette.
- Fourth, fifth, sixth, seventh, and eighth blood drops on the filter paper card. Wipe off excess blood on skin.

**Obtaining Blood from the Finger as follows:**

- 1) Follow the steps for producing a finger stick blood sample as described in Chapter 4. Use a sterile gauze pad to wipe away the first blood drop. While maintaining a firm grip on the finger, press gently on the side of the finger from which you are taking the blood sample to form a second drop (Figure 8.5). Be careful to **avoid ‘milking’ or ‘squeezing’ the finger** as this could affect the test results. Allow the second drop of blood to touch the correct end of the glucose strip. Wipe away any excess blood on the skin using the sterile gauze. Apply gentle pressure to form a third blood drop which will be collected into the microcuvette for haemoglobin measurement in the HemoCue Hb 201+ device. Check the microcuvette for air bubbles. Clean the sides of the microcuvette as described in Chapter 7, place the microcuvette in the microcuvette holder, and close the holder. Immediately continue collecting blood for filling the circles on the filter paper cards.



**Figure 8.5 Large drop of blood**

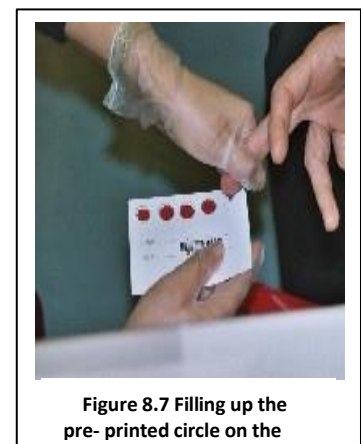


## 2) Position of Filter Paper Card

- Move the card underneath the finger, with the pre-printed side of the card facing the pricked finger.
- The card must not be pressed against the prick site on the finger. Make sure that the respondent's finger does not touch the card at any point when you are collecting the blood spots.

## 3) Blood Collection on the card:

- Wait until the drop is large enough to fill one of the pre-printed circles. Let the blood drop fall freely in the centre of the pre-printed circle. In case the blood drop does not fall readily, you may touch the filter paper gently against a **LARGE blood drop** (but not the skin). In one step, a **large blood drop** should be allowed to soak through and completely fill the circle.
  - You must continue to collect drops of blood until you have fully saturated all circles on the filter paper card (Figure 8.6). All five blood spots are obligatory (Figure 5).
  - To enhance blood flow, gently apply intermittent pressure to the area surrounding the prick site to get a third drop. Allow sufficient time for a large blood drop to form before filling the next circle on the filter paper card. Again, avoid milking or squeezing the finger.
  - If the blood flow stops or decreases before you fully saturate five circles, you will need to do another finger prick. **Whenever this is necessary, you should explain to the respondent that you were unable to obtain an adequate sample and ask permission to obtain blood from another finger.** Use fresh supplies and a **different finger** for the second finger prick.
  - After collecting five spots on the filter paper card (Figure 8.7), place the filter paper card with the blood spots on the absorbent paper sheet away from other items. Wipe away any excess blood on the skin using the sterile gauze.
- 4) Take an adhesive bandage from its wrapper and apply it to the prick site.
- 5) Record the **blood glucose results** in **Question 374/473**. If a blood glucose measurement was not obtained because the respondent did not consent to the test, or there was a technical problem with the testing, circle the appropriate code



- 6) Record the **haemoglobin results** in **Question 375/474**. If a haemoglobin measurement was not obtained because the respondent did not consent to the test, or there was a technical problem with the testing, circle the appropriate code.
- 7) Place the filter paper card with blood spots in the drying box:
- The drying box should always be placed vertically on a flat surface before opening. After opening it, carefully pick up the filter paper card opposite the wet blood spots and place the card in a horizontal position in one of the slots in the drying rack affixed to the inside of the box. The blood spots should face towards the back of the drying box.
  - The placement of the box is especially important for filter paper cards that have not dried completely. Keep the box in a vertical position so that the cards do not fall out of their slots. To prevent blood that has not dried completely from spreading, place the box vertically.
  - ***Avoid touching or smearing the blood spots on other cards in the box when you are storing a new card. Never put more than one filter paper card in the same slot in the drying rack.*** Allow the blood spots to dry overnight at ambient temperature. ***Never set any materials on top of the open box as they might contaminate the filter paper cards stored inside.***
  - If the collection process in a household is interrupted for any reason, you should close the box to prevent any possible contamination.
  - After the DBS samples for each respondent have been collected, carefully close the box. The drying box should be kept in a position so that the filter paper cards remain in their slots inside the box.
- 8) Collect biohazardous waste
- Place used lancets and microcuvettes in a sharps container and other biohazardous waste (alcohol swabs, gauzes, glucose strip, and gloves) into a clearly labelled 'biohazard' plastic bag, which has been provided for field disposal of these items. Before leaving the enumeration area (cluster) the bags with biohazardous waste must be taken to a health facility and incinerated.
- 9) Record the respondent's haemoglobin and blood glucose results in the appropriate informational brochures.
- 10) Inform the respondent of her/his haemoglobin and blood glucose results and provide the anaemia and blood glucose brochures.
- 11) Provide a written referral to a health facility for treatment for any respondents with severe anaemia (below 9 g/dL for men and pregnant women and below 7 g/dL for children and women who are not pregnant or don't know if they are pregnant).
- 12) Provide a written referral to a health facility for medical evaluation for any respondents with a random blood glucose level  $\geq 200\text{mg/dL}$ .

- 13) All the respondents from whom DBS has been collected will be provided with an information brochure referral form for testing of HbA1c, Vitamin D3 and counselling and medical advice for malaria vitamin D deficiency and diabetes.

(Refer to APPENDIX 9)

### **PRECAUTIONS TO TAKE DURING DBS COLLECTION FOR MALARIA, ANTIMALARIAL DRUG RESISTANCE HbA1c, and VITAMIN D TESTING**

With respect to DBS collection for the above tests, there are a number of precautions that should be strictly followed:

- **Always use the pre-printed side of the card to collect the blood spots.**
  - **Do not ‘layer’ the sample in an attempt to fill in the circle.**
- 
- **Do not overfill the circles.** Overfilling the circles can cause super saturation (top panel of Figure 8.8), which is unacceptable.
  - **Do not place the drying box horizontally until blood dries.** Placing the box horizontally before the blood dries can cause serum rings (bottom panel of Figure 8.8), which is also unacceptable. The blood should not extend beyond the pre-printed area, as shown in Figure 8.8.
  - **Try to have the blood drop fall exactly in the centre of the pre-printed circle..**  
Note: all circles should be uniformly filled.
  - **Protect the filter card from contamination.** Do not allow water or other contaminants to come into contact with the filter paper card before or after collecting the blood samples
  - **Do not place the specimens in the small ziploc bags until the blood has dried thoroughly** (chocolate brown). Insufficient drying adversely affects the quality of the samples and, consequently, the test results.
  - **Taking the filter paper card out of the storage bag.** The filter paper card should be the last item taken out of the package before starting the blood collection procedure.

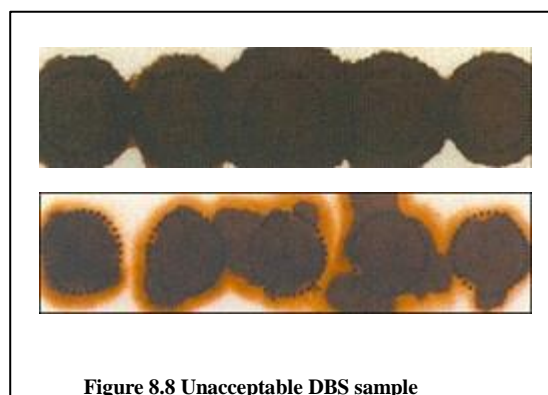


Figure 8.8 Unacceptable DBS sample

## STORING AND TRANSFERRING THE DRIED BLOOD SPOTS

The dried blood spot (DBS) samples must be properly maintained until they are picked up and taken to the laboratory. They should never be exposed to direct sunlight, stored in a humid environment, or exposed to dust, dirt or other environmental contaminants. During storage, it is important to regularly monitor the level of humidity in the stored samples by observing a change in color of the desiccant granules or the humidity indicating card. The following describes the steps that should be followed in storing the DBS samples in the field and their subsequent and transfer to the laboratories.

### 1. Storage:

Each morning, before you go to the field, you must remove the filter paper cards with the DBS samples that you collected on the previous day from the drying box and, if dry, prepare them for storage as follows:

1. Put on a pair of gloves and carefully open the drying box. Check that the blood spots on each filter paper are completely dried (chocolate brown).
2. Remove each filter paper card on which the spots have dried from the drying box separately.  
Be careful not to touch the blood spots.
3. Gently fold the flap on the filter paper card over the blood spots and put one filter paper card into a small (low gas-permeable) ziploc bag. Put 2 desiccant packets and a humidity indicator card behind the filter paper card, with the circles on the humidity card and the 'window' in the desiccant sachet facing out so that the circles on the humidity indicator card, barcode, and granules, respectively, are visible. It is important that the desiccant packet and the humidity indicator card do not touch the blood spots. Close the zipper, gently pushing out any excess air in the bag as you are zipping it, being careful not to press on the blood spots. **DBS samples (the blood spots) should not be allowed to come in direct contact with other DBS samples during handling, shipment, or storage.**
4. Continue to package each of the filter paper cards from the previous day which have dried overnight, putting one filter paper card into one small ziploc bag with one desiccant packet and one humidity indicator card.
5. When you have packed all of the filter paper cards, put them into the large zip-loc bag that has been labelled for the cluster in which the samples were collected (Figure 8.9). Note that the Cluster Sample (ziploc) Bag itself should also contain a few desiccant packets.

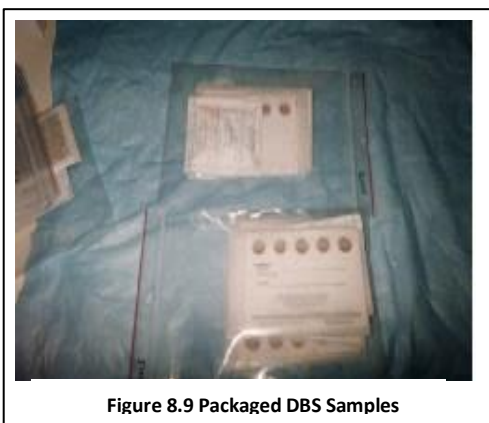


Figure 8.9 Packaged DBS Samples

6. Check the humidity indicator cards for the individually packaged DBS samples that you have previously placed in the Cluster Sample Bag before adding newly packaged DBS samples to an existing Cluster Sample Bag. **The build-up of humidity can damage the quality of the sample.**
  - A bottom circle that is pink (30% humidity) indicates a warning of increasing humidity. If the middle circle (40% humidity) is pink, gently open the small ziploc bag, remove the desiccant packet and replace it with a fresh desiccant packet. Replace the humidity indicator card as well. If the top circle (50% humidity) is pink, examine the DBS cards as this indicates a high build-up of moisture which can degrade the DBS sample. Further, if any of the circles on the humidity indicator card have merged together so that they are not completely separated, remove the indicator card and replace it with a fresh indicator card. Close the zipper, gently pushing out any excess air in the bag as you are zipping it. **Please review the storage instructions, using the humidity card as a guide.**
7. Check the condition of the desiccant packets and humidity indicator card before closing the zipper on the Cluster Sample Bag. Replace as needed.
  - If you have additional Cluster Sample Bags for completed clusters that have not yet been collected by a Field Supervisor, examine all of the samples in those bags in the same manner, every couple of days, as long as they are with your team in the field.

## 2. Transfer:

The purpose of the DBS Transmittal Sheet (see Appendix 9) is to account for the samples that have been collected in each Cluster and to track the samples from the field to the laboratory.

1. Fold the DBS Transmittal Sheet along the dotted lines (so that the barcode labels are not folded), and keep it in the Sample Cluster Bag along with the DBS samples for that cluster.
2. When you have completed the cluster, remove the packaged DBS samples from the Cluster Sample Bag (do not open the small ziploc bags).
3. One by one, check the barcodes on the labels on the filter paper cards against the barcodes affixed to the back side of the DBS Transmittal Sheet. For each DBS sample, put a check mark in the column labelled health investigator for each corresponding barcode found on the transmittal sheet. Count the number of DBS samples and record in the boxes provided in Column (3) on the front side of the transmittal sheet in the column labelled TOTAL COUNT OF BLOOD SAMPLES. If there are any discrepancies, you must attempt to account for them. Use Column (7) to explain. Sign your name in Column (4) and the date in Column (6).

The team's field supervisor will follow behind you, re-verify the samples, and sign his/her name in the FIELD TEAM SUPERVISOR row.

Periodically, a sample pick up person will visit the teams to collect the DBS samples for the completed clusters. When he/she collects the DBS samples, he/she will recount the DBS samples for each of the completed clusters and sign the DBS Transmittal Sheet. **The samples and transmittal sheet will be transported to the ICMR-NARI Pune for logging in and storage within two weeks after collection.**

**Summary of the steps involved in collecting blood for Malaria, Antimalarial drug resistance, HbA1c, Vitamin D testing, haemoglobin, and random blood glucose testing for adults:**

- Check the Biomarker Questionnaire for individuals eligible for testing;
  - o Seek voluntary consent for haemoglobin and blood glucose testing and blood collection for Malaria, Antimalarial drug resistance, HbA1c, and Vitamin D testing from the respondent (if the respondent is age 15-17 and unmarried seek voluntary consent from the parent/responsible adult and the respondent).
- Place the barcode labels from a single row on the barcode sheet in the Biomarker Questionnaire, on a filter paper card, and on the DBS Transmittal Sheet;
- Check the boxes appropriate for HbA1c testing and additional testing;
- Clean and prick the respondent's finger with an adult lancet;
- Wipe away the first drop of blood, use the second for blood glucose and the third for anaemia;
- Test the blood glucose in the glucometer;
- Test the haemoglobin in the HemoCue;
- Fill the pre-printed circles on the filter paper card with the fourth through seventh blood drops;
- Stop the bleeding at the prick site;
- Record the haemoglobin and blood glucose levels on the Biomarker Questionnaire
- Place the filter paper card in the drying box;
- Collect biohazardous waste;
- Inform the respondent of his/her haemoglobin and glucose results and provide an informational brochures on anaemia and blood glucose.
- Provide a written referral for follow-up medical attention for respondents found to be severely anaemic or with random blood glucose levels  $\geq 200\text{mg/dL}$

## CHAPTER 9: BIOHAZARDOUS WASTE DISPOSAL

Any material coming in contact with blood or serum (lancets, microcuvettes, glucose strips, alcohol swabs, gauze, and gloves) is considered to be biohazardous (hazardous to other humans). Safe disposal of such material is very important to prevent the transmission and spread of various blood borne diseases, such as Hepatitis B and HIV, among survey personnel and within the study community. Biohazardous waste has to be collected in special containers during the blood collection and testing, securely stored and transported, and safely disposed at the end of each day of fieldwork.

You will place all biohazardous waste in a sharps container (lancets and microcuvettes) or a red biohazardous waste bag (all other biohazardous material). The sharps containers and the biohazardous waste bags can be securely closed for safe storage and transportation during the fieldwork.

There are two options for disposal:

1. Take the biohazardous waste to a nearby health facility that can dispose of the waste in an incinerator (**preferred option**). The health facilities should employ standard procedures for biohazardous waste disposal.
2. Follow the procedures outlined below for burning the waste in the field. This is a last resort.

### MATERIALS AND SUPPLIES

The following items are required in the field for disposal of biohazardous materials:

- Kerosene
- Four percent sodium hypochlorite solution (4% Bleach: Disinfectant)
- Matches
- Spade or other tool for digging a small pit
- Ziploc-type polyethylene bags
- Forceps
- Puncture-resistant container (for example, a wide-mouth plastic jar).
- Scissors

### PROCEDURES FOR FIELD DISPOSAL OF BIOHAZARDOUS WASTE (LAST RESORT)

At the end of each blood collection and testing within the household, all materials used during the testing are to be placed in a sharps container (lancets and microcuvettes) or a biohazard bag (gloves, glucose strips, alcohol swabs, and gauze pads). At the end of each day's work or at least every two days, the biohazardous waste should be disposed of following the procedure below.

Before beginning the biohazardous waste disposal procedure, determine a place where the waste can be safely destroyed. An open field area with loose soil is preferable, since the materials need to be burnt and buried. To reduce the risk of spreading a fire, avoid starting a fire in drought areas, and keep away from other flammable materials.

**Follow the procedure below to safely dispose of biohazardous waste in the field:**

**Step 1:** At the end of each day, bring the sharps container and the biohazard bag with biohazardous materials to the area selected for the waste disposal. Wearing gloves, put the biohazardous material into the plastic jar and add a half litre of 4 percent sodium hypochlorite solution (disinfectant or bleach) into the plastic jar with the biohazardous materials (see Figure 9.1). After adding the hypochlorite solution, close the container (jar) so it is airtight. Keep the jar in an upright position for five minutes. After that, invert the plastic jar and keep in that position for an additional five minutes. This step is necessary to ensure that all of the materials in the plastic jar are disinfected by complete immersion in the 4 percent sodium hypochlorite solution.



**Figure 9.1 Adding sodium hypochlorite**



**Figure 9.2 Transferring contaminated materials**

**Step 3:** A forceps can be used to transfer any material that sticks to the walls of the plastic jar to the polyethylene bag (Figure 9.3).



**Figure 9.3 Removing remaining materials**



**Figure 9.4 Digging a pit for bag**

**Step 4:** Dig a small hole with a spade, and put the polyethylene bag containing the biohazardous materials in the pit (Figure 9.4).



**Step 5:** Use scissors to make a hole at the bottom of the polyethylene bag (Figure 9.5).



**Figure 9.5 Making a hole in the bag**



**Figure 9.6 Draining off hypochlorite solution**

**Step 6:** Drain off the hypochlorite solution from the polyethylene bag (Figure 9.6).

**Step 7:** Put waste paper on top of the polyethylene bag containing biohazardous materials (Figure 9.7).



**Figure 9.7 Putting waste paper on top of bag**



**Figure 9.8 Pouring kerosene on bag**

**Step 8:** Pour kerosene on the bag (Figure 9.8).

**Step 9:** Burn the polyethylene bag containing the biohazardous materials in the pit (Figure 9.9).



**Figure 9.9** Burning contaminated materials



**Figure 9.10** Ascertaining that contaminated materials are completely burned

**Step 10:** Wait until all of the contents are burned (Figure 9.10).

**Step 11:** Cover the pit with soil (Figure 9.11).



**Figure 9.11** Covering the pit with soil

It is the responsibility of the team's field supervisor to ensure proper disposal of biohazardous waste by the health investigators. It is unacceptable that the materials used during the testing in one fieldwork cluster are carried by the team to the next cluster. Biohazardous materials must be destroyed at the end of the day.

## **UNIVERSAL PRECAUTIONS IN THE COLLECTION OF BLOOD SAMPLES**

Universal precautions, as defined by the U.S. Centers for Disease Control and Prevention (CDC), are a set of precautions designed to prevent transmission of the human immunodeficiency virus (HIV), the Hepatitis B virus (HBV), and other blood borne pathogens when providing first aid or health care.

Below are excerpts from two documents on universal precautions: 1) CDC's 'Perspectives in Disease Prevention and Health Promotion Update: Universal Precautions for Prevention of Transmission of Human Immunodeficiency Virus, Hepatitis B Virus, and Other Blood borne Pathogens in Health-Care Settings,'<sup>6</sup> and 2) OSHA's 'Occupational Exposure to Blood borne Pathogens—Precautions for Emergency Responders.'<sup>7</sup>

### **UNIVERSAL BLOOD PRECAUTIONS (U. S. Centers for Disease Control and Prevention (CDC))**

In 1983, CDC published a document entitled Guideline for Isolation Precautions in Hospitals (1) that contained a section entitled Blood and Body Fluid Precautions. The recommendations in this section called for blood and body fluid precautions when a patient was known or suspected to be infected with blood borne pathogens. In August 1987, CDC published a document entitled Recommendations for Prevention of HIV Transmission in Health-Care Settings (2). In contrast to the 1983 document, the 1987 document recommended that blood and body fluid precautions be consistently used for all patients, regardless of their blood borne-infection status. This extension of blood and body fluid precautions to all patients is referred to as Universal Blood and Body Fluid Precautions or Universal Precautions. Under universal pre-cautions, blood and certain body fluids of all patients are considered potentially infectious for human immunodeficiency virus (HIV), Hepatitis B virus (HBV), and other blood borne pathogens.

Universal precautions are intended to prevent parenteral, mucous membrane, and non-intact skin exposures of health-care workers to blood borne pathogens. In addition, immunization with the HBV vaccine is recommended as an important adjunct to universal precautions for health-care workers who have exposure to blood.

Since the recommendations for universal precautions were published in August 1987, CDC and the US Food and Drug Administration (FDA) have received requests for clarification of the following issues: 1) body fluids to which universal precautions apply, 2) use of protective barriers, 3) use of gloves for phlebotomy, 4) selection of gloves for use while observing universal precautions, and 5) need for making changes in waste management programmes as a result of adopting universal precautions.

Universal precautions apply to blood and to other body fluids containing visible blood. Occupational transmission of HIV and HBV to health-care workers by blood is documented. Blood is the single most abundant source of HIV, HBV, and other blood borne pathogens in the occupational setting. Infection-control efforts for HIV, HBV, and other blood borne pathogens must focus on preventing exposure to blood and delivering HBV immunization.

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<sup>6</sup> Morbidity and Mortality Weekly Report 1988; 37(24):377-388.

<sup>7</sup>U.S. Department of Labor, Occupational Safety and Health Administration. 1998 (Revised) OSHA 3106.

Protective barriers reduce the risk of exposure of the health-care worker's skin or mucous membranes to potentially infective materials. For universal precautions, protective barriers reduce the risk of exposure to blood, body fluids containing visible blood, and other fluids to which universal precautions apply. Examples of protective barriers include gloves, gowns, masks, and protective eyewear. Gloves should reduce the incidence of contamination of hands, but they cannot prevent penetrating injuries due to needles or other sharp instruments. Masks and protective eyewear or face shields should reduce the incidence of contamination of mucus membranes of the mouth, nose, and eyes.

Universal precautions are intended to supplement, rather than replace, recommendations for routine infection control, such as hand washing and using gloves to prevent gross microbial contamination of hands. Because specifying the types of barriers needed for every possible clinical situation is impractical, some judgment must be exercised.

The risk of nosocomial transmission of HIV, HBV, and other blood borne pathogens can be minimized if health-care workers use the following general guidelines:

1. Take care to prevent injuries when using needles, scalpels, and other sharp instruments or devices; when handling sharp instruments after procedures; when cleaning used instruments; and when disposing of used needles. Do not recap used needles by hand; do not remove used needles from disposable syringes by hand; and do not bend, break, or otherwise manipulate used needles by hand. Place used disposable syringes and needles, scalpel blades, and other sharp items in puncture-resistant containers for disposal. Place puncture-resistant containers as close to the use area as is practical.
2. Use protective barriers to prevent exposure to blood, body fluids containing visible blood, and other fluids to which universal precautions apply. The type of protective barrier(s) should be appropriate for the procedure being performed and the type of exposure anticipated.
3. Wash hands and other skin surfaces that are contaminated with blood or other body fluids immediately and thoroughly.

Gloves should reduce the incidence of blood contamination of hands during phlebotomy (drawing blood samples), but they cannot prevent penetrating injuries caused by needles or other sharp instruments. The likelihood of hand contamination with blood containing HIV, HBV, or other blood borne pathogens during phlebotomy depends on several factors: 1) the skill and technique of the health-care worker, 2) the frequency with which the health-care worker performs the procedure (other factors being equal, the cumulative risk of blood exposure is higher for a health-care worker who performs more procedures), 3) whether the procedure occurs in a routine or emergency situation (where blood contact may be more likely), and 4) the prevalence of infection with blood borne pathogens in the patient population. The likelihood of infection after skin exposure to blood containing HIV or HBV will depend on the concentration of virus (viral concentration is much higher for Hepatitis B than for HIV), the duration of contact, the presence of skin lesions on the hands of the health-care worker and, for HBV, the immune status of the health-care worker. Although not accurately quantified, the risk of HIV infection following intact-skin contact with infective blood is certainly much less than the 0.5% risk following percutaneous needle stick exposures (5). In universal precautions, all blood is assumed to be potentially infective for blood borne pathogens, but in certain settings (e.g., volunteer blood-donation centres) the prevalence of infection with some blood borne pathogens (e.g., HIV, HBV) is known to be very low. Some institutions have relaxed recommendations for using gloves for phlebotomy procedures by skilled phlebotomists in settings where the prevalence of blood borne pathogens is known to be very low.

Institutions that judge that routine gloving for all phlebotomies is not necessary should periodically re-evaluate their policy. Gloves should always be available to health-care workers who wish to use them for phlebotomy. In addition, the following general guidelines apply:

1. Use gloves for performing phlebotomy when the health-care worker has cuts, scratches, or other breaks in his or her skin.
2. Use gloves in situations where the health-care worker judges that hand contamination with blood may occur; for example, when performing phlebotomy on an uncooperative patient.
3. Use gloves for performing finger or heel sticks on infants and children.
4. Use gloves when persons are receiving training in phlebotomy.

*Selection of Gloves.* The Center for Devices and Radiological Health, FDA, has the responsibility of regulating the medical-glove industry. Medical gloves include those marketed as sterile surgical gloves or non-sterile examination gloves made of vinyl or latex. General-purpose utility ('rubber') gloves are also used in the health-care setting, but they are not regulated by the FDA since they are not promoted for medical use. There are no reported differences in barrier effectiveness between intact latex and intact vinyl, which are used to manufacture gloves. Thus, the type of gloves selected should be appropriate for the task being performed. The following general guidelines are recommended:

1. Use sterile gloves for procedures involving contact with normally sterile areas of the body.
2. Use examination gloves for procedures involving contact with mucous membranes, unless otherwise indicated, and for other patient care or diagnostic procedures that do not require the use of sterile gloves.
3. Change gloves between patient contacts.
4. Do not wash or disinfect surgical or examination gloves for reuse. Washing with surfactants may cause wicking, i.e., the enhanced penetration of liquids through undetected holes in the gloves. Disinfecting agents may cause deterioration.
5. Use general-purpose utility gloves (e.g., rubber household gloves) for house-keeping chores involving potential blood contact and for instrument cleaning and decontamination procedures. Utility gloves may be decontaminated and reused but should be discarded if they are peeling, cracked, or discoloured, or if they have punctures, tears, or other evidence of deterioration.

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## **STANDARD PRECAUTIONS AGAINST BLOOD BORNE PATHOGENS (U. S. Occupational Safety and Health Administration (OSHA))**

Universal precautions are designed to protect health-care workers and patients from exposure to blood borne pathogens and other potentially infectious body substances. They are mandated by the United States Occupational Safety and Health Administration (OSHA) and include the following.

1. Wear personal protective equipment (aprons, gowns, gloves, goggles, face shields, masks, and CPR devices) when exposure to blood, blood droplets, and other body fluids is anticipated; these precautions are always mandated during invasive procedures.
2. Wear gloves when doing patient care if skin is cut, abraded, or chapped; when collecting or handling specimens or body fluids; cleaning specimen containers; or decontaminating. If you anticipate contact with mucous membranes, non-intact skin, GI or GU tract, or active bleeding wounds; or anticipate invasive procedures such as venipuncture or vascular access procedures, then universal precautions must be observed.
3. Gowns, aprons, scrubs, or lab coats must cover exposed skin areas when there is a potential for splashing blood or body fluids on clothing; however, this protection is not required for routine-care situations in which blood or body substances are not likely to be present. Perform all procedures in such a way such that splashing, spattering, or droplet formation is minimized.
4. Prevent injuries that can be caused by needles, scalpels, and other 'sharps.' Dispose of all these in puncture-resistant containers. Do not recap, bend, break by hand, or remove needles from disposable syringes. Tape 'piggyback' needle devices in place to prevent accidental dislodging.
5. Remove torn or punctured gloves promptly. Wash hands and other skin surfaces immediately and thoroughly if contaminated with blood or other body fluids.
6. Eating, drinking, applying cosmetics or lip balm, and handling contact lenses are not permitted in work areas where there is a reasonable likelihood of exposure to blood or other body substances.
7. Health-care workers should protect and always take care of themselves first. Presume that all patients have hepatitis B or HIV. In cases of suspected HIV or hepatitis B (HBV) exposure, identify, obtain consent, and test for exposure if the patient consents to testing. If the patient refuses consent or outcome is positive, the health-care worker must receive HIV-antibody testing immediately. Advise HIV-negative person who has been exposed to seek medical evaluation of any acute febrile illness within 12 weeks of exposure to HIV and to retest in 6 to 12 weeks and 6 months after exposure. Some institutions offer prophylactic drug therapy or hepatitis B vaccinations to their employees. If exposed or injured, the healthcare worker must make the decision to accept drug therapy within a few hours of the incident.

8. The following are definitions of infection-control terminology:

**Blood borne pathogens:** Organisms that can be transmitted from one person to another by exposure to the infected person's blood. The major pathogens include hepatitis B virus, hepatitis C virus, human immunodeficiency virus (HIV; the AIDS virus), and treponemes that cause syphilis.

**Body substances:** Any fluids or solids that come out of or off of the human body. Examples include saliva, sputum, urine, faeces, wound drainage, and all the fluids referred to as 'other potentially infectious materials' (see later).

**Exposure incident:** The contact of blood or other body substances with an employee's mucous membranes (eyes, mouth), non-intact skin (skin with cuts, abrasions, dermatitis, or other); or contact by piercing or puncturing mucous membranes or skin with a contaminated item.

**Regulated (infectious) waste:** Items caked or saturated with blood, or other potentially infectious materials; contaminated sharps; pathologic and microbiologic waste.

**Other potentially infectious materials (OPIM):** Body substances specifically designated by the CDC and OSHA that may transmit blood borne pathogens include semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, amniotic fluid, saliva in dental procedures, or any body substance that is visibly contaminated with blood, and all body substances in situations for which it is difficult or impossible to determine whether blood is present.



## APPENDIX1: BIOMARKER TESTING CONSENT STATEMENTS

### CONSENT FOR BLOOD PRESSURE MEASUREMENT

I would like to measure your blood pressure. This will be done three times, with an interval of about five minutes between measurements. This is a harmless procedure. It is used to find out if a person has high blood pressure. If it is not treated, high blood pressure may eventually cause serious damage to the heart. The results of this blood pressure measurement will be given to you after the measurement process is completed. I will explain the meaning of your blood pressure numbers. If your blood pressure is high, we will suggest that you consult a health facility or doctor since we cannot provide any further testing or treatment during the survey. You can also decide at any time not to participate in the blood pressure measurement. The result will be kept strictly confidential and will not be shared with anyone other than members of our survey team.

Do you have any questions?

You can say yes to the test or you can say no. It is up to you to decide.

**Will you allow me to measure your blood pressure?**

### CONSENT FOR ANAEMIA MEASUREMENT

As part of this survey, we are asking people all over the country to take an anaemia test. Anaemia is a serious health problem that usually results from poor nutrition, infection, or chronic disease. This survey will assist the government to develop programs to prevent and treat anaemia.

For the anaemia testing, we will need a few drops of blood from a finger. The equipment used to take the blood is clean and completely safe. It has never been used before and will be thrown away after each test. The blood will be tested for anaemia immediately, and the result will be told to you right away. The result will be kept strictly confidential and will not be shared with anyone other than members of our survey team.

Do you have any questions?

You can say yes to the test, or you can say no. It is up to you to decide.

**Will you take the anaemia test?**

### **CONSENT FOR RANDOM BLOOD GLUCOSE TESTING**

As part of this survey, we are also measuring the level of sugar in the blood. If it is not treated, a high level of blood sugar may increase the risk for heart disease and stroke. For the blood glucose testing, we will need a few drops of blood from a finger. The equipment used to take the blood is clean and completely safe. It has never been used before and will be thrown away after each test.

The blood will be tested for glucose immediately, and the result will be told to you right away. The result will be kept strictly confidential and will not be shared with anyone other than members of our survey team. The results of this blood glucose test will be given to you with an explanation of the meaning of your blood glucose numbers. If your blood glucose is high, we will suggest that you consult a health facility or doctor since we cannot provide any counselling, further testing or treatment during the survey.

Do you have any questions about the blood glucose measurement so far? If you have any questions about the procedure at any time, please ask me.

You can say yes or no to having your blood glucose measured now.

**Will you allow me to proceed to take your measurement?**

### **CONSENT FOR DBS COLLECTION**

As part of the survey we also are asking people all over the country to take a Malaria, Antimalarial drug resistance, HbA1c, Vitamin D test. HbA1c is a form of haemoglobin that is measured to estimate the three month average plasma glucose concentration in the blood. For the tests, we need a few (more) drops of blood from a finger. The equipment used to take the blood is clean and completely safe. It has never been used before and will be thrown away after each test. No names will be attached so we will not be able to tell you the test results. No one else will be able to know your test results either.

Do you have any questions?

You can say yes to the test, or you can say no. It is up to you to decide.

**Will you take the tests?**

### **CONSENT FOR ADDITIONAL TESTING**

We ask you to allow (NAME OF AGENCY) to store part of your blood sample at the laboratory for additional tests or research. We are not certain about what additional tests might be done. The blood sample will not have any name or other data attached that could identify you. You do not have to agree. If you do not want the blood sample stored for additional testing you can still participate in the tests in this survey.

**Will you allow us to keep your blood sample stored for additional testing?**

APPENDIX 2: NFHS-5 BLOOD PRESSURE REFERRAL FORM

**National Family Health Survey (NFHS-5): Blood Pressure Referral Form**

**(Blood Pressure Referral Form to be given when adult's systolic pressure is greater than 140 mmHg and/or diastolic pressure is greater than 90 mmHg)**

During NFHS-5 \_\_\_\_\_ (NAME)'s blood pressure was measured on \_\_\_\_/\_\_\_\_/\_\_\_\_.

His/her systolic pressure was \_\_\_\_ and his/her diastolic pressure was \_\_\_\_\_ mm/Hg, which is elevated.

**THIS PERSON NEEDS MEDICAL ATTENTION FOR HIGH BLOOD PRESSURE IN A HEALTH FACILITY.**

Date \_\_\_\_\_ Signature \_\_\_\_\_

-----CUT HERE-----

**National Family Health Survey (NFHS-5): Blood Pressure Referral Form**

**(Blood Pressure Referral Form to be given when adult's systolic pressure is greater than 180 mmHg and/or diastolic pressure is greater than 109 mmHg)**

During NFHS-5 \_\_\_\_\_ (NAME)'s blood pressure was measured on \_\_\_\_/\_\_\_\_/\_\_\_\_.

\_\_\_\_\_. His/her systolic pressure was \_\_\_\_\_ and his/her diastolic pressure was \_\_\_\_\_ mm/Hg, which is **severely elevated**.

**THIS PERSON NEEDS MEDICAL ATTENTION FOR HIGH BLOOD PRESSURE IN A HEALTH FACILITY RIGHT AWAY.**

Date \_\_\_\_\_ Signature \_\_\_\_\_

APPENDIX 3: NFHS-5 ANAEMIA REFERRAL FORM

**National Family Health Survey (NFHS-5): Anaemia Referral Form**

**(Anaemia Referral Form to be given when adult's haemoglobin level is less than 7.0 g/dL for women and children or less than 9.0 g/dL for men and pregnant women)**

During NFHS-5 \_\_\_\_\_ (NAME), was tested for anaemia on \_\_\_\_/\_\_\_\_/\_\_\_\_.

His/her level of haemoglobin was \_\_\_\_ . g/dL, which indicates he/she has severe anaemia.

**THIS PERSON NEEDS MEDICAL ATTENTION FOR THE ANAEMIA IN A HEALTH FACILITY RIGHT AWAY.**

Date \_\_\_\_\_ Signature \_\_\_\_\_

-----CUT HERE-----

**National Family Health Survey (NFHS-5): Anaemia Referral Form**

**(Anaemia Referral Form to be given when adult's haemoglobin level is less than 7.0 g/dL for women and children or less than 9.0 g/dL for men and pregnant women)**

During NFHS-5 \_\_\_\_\_ (NAME), was tested for anaemia on \_\_\_\_/\_\_\_\_/\_\_\_\_.

His/her level of haemoglobin was \_\_\_\_ . g/dL, which indicates he/she has severe anaemia.

**THIS PERSON NEEDS MEDICAL ATTENTION FOR THE ANAEMIA IN A HEALTH FACILITY RIGHT AWAY.**

Date \_\_\_\_\_ Signature \_\_\_\_\_

APPENDIX 4: NFHS-5 RANDOM BLOOD GLUCOSE REFERRAL FORM

**National Family Health Survey (NFHS-5): Blood Glucose Referral Form**

**(Blood Glucose Referral Form to be given when adult's random glucose level is greater than 200mg/dL)**

During NFHS-5 \_\_\_\_\_(NAME)'s random blood glucose level was tested on \_\_\_\_/\_\_\_\_/\_\_\_\_.

His/her random blood glucose level was \_\_\_\_mg/dL, which is abnormally high.

**THIS PERSON NEEDS MEDICAL ATTENTION FOR HIGH BLOOD GLUCOSE IN A HEALTH FACILITY.**

Date \_\_\_\_\_ Signature \_\_\_\_\_

-----CUT HERE-----

**National Family Health Survey (NFHS-5): Blood Glucose Referral Form**

**(Blood Glucose Referral Form to be given when adult's random glucose level is greater than 200mg/dL)**

During NFHS-5 \_\_\_\_\_(NAME)'s random blood glucose level was tested on \_\_\_\_/\_\_\_\_/\_\_\_\_.

His/her random blood glucose level was \_\_\_\_mg/dL, which is abnormally high.

**THIS PERSON NEEDS MEDICAL ATTENTION FOR HIGH BLOOD GLUCOSE IN A HEALTH FACILITY.**

Date \_\_\_\_\_ Signature \_\_\_\_\_

## APPENDIX 5A: REFERRAL TO HEALTH FACILITY

(**LETTER NUMBER**)

Date: \_\_\_\_\_

To  
**The Incharge**  
(DH), *Address*

**Subject: Referral Letter for HbA1c testing**

Dear **Sir/Madam**,

Presently the fifth National Family Health Survey (NFHS-5) is being conducted under the stewardship of the Ministry of Health and Family Welfare (MOHFW). The International Institute for Population Sciences (IIPS), Mumbai, is designated as nodal agency for coordinating the NFHS-5 project and (**ORGANIZATION**) is conducting the fieldwork for NFHS-5 in (**STATE**).

As a part of this survey, health investigators visit sampled households in selected villages, towns and cities throughout India. During the survey, women and men in randomly selected household are asked to give a capillary blood sample from a fingerstick for HbA1c testing in NARI. The HbA1c prevalence results from the tests will be used by the Ministry of Health and Family Welfare for further refining programme strategies.

The HbA1c testing in NFHS-5 is anonymous, i.e., no individual identifiers are associated with the blood samples or test results and, therefore, respondents will not be provided with information about their own HbA1c status. However, we are giving this referral letter to respondents to receive a HbA1c test at a health facility, so that they will have an opportunity to receive HbA1c testing at a health facility without charge if they desire.

**The bearer of this letter Ms./Mr. -----was eligible for anonymous HbA1c testing in NFHS-5 and hence may please be provided with necessary services for voluntary counselling and testing for HbA1c free of charge.**

**If you have any questions about the NFHS-5 survey, you may contact:**

**(ADD CONTACT INFORMATION FOR FIELD AGENCY CONDUCTING NFHS-5)**

Thanking you and with regards,  
Yours sincerely,

(**In-charge of Organization**)  
(Organization)

## APPENDIX 5B: REFERRAL TO HEALTH FACILITY

(**LETTER NUMBER**)

Date: \_\_\_\_\_

To

**The Incharge**

(PHC/CHC/RH/DH), *Address*

**Subject: Referral Letter for Malaria testing**

Dear **Sir/Madam**,

Presently the fifth National Family Health Survey (NFHS-5) is being conducted under the stewardship of the Ministry of Health and Family Welfare (MOHFW). The International Institute for Population Sciences (IIPS), Mumbai, is designated as nodal agency for coordinating the NFHS-5 project and (**ORGANIZATION**) is conducting the fieldwork for NFHS-5 in (**STATE**).

As a part of this survey, health investigators visit sampled households in selected villages, towns and cities throughout India. During the survey, women and men in randomly selected households are asked to give a capillary blood sample from a fingerstick for Malaria testing in NIMR. The Malaria prevalence results from the tests will be used by the Ministry of Health and Family Welfare for further refining programme strategies.

The Malaria testing in NFHS-5 is anonymous, i.e., no individual identifiers are associated with the blood samples or test results and, therefore, respondents will not be provided with information about their own Malaria status. However, we are giving this referral letter to respondents to receive a Malaria test at a health facility, so that they will have an opportunity to receive Malaria testing at a health facility without charge if they desire.

**The bearer of this letter Ms./Mr. -----was eligible for anonymous Malaria testing in NFHS-5 and hence may please be provided with necessary services for voluntary counseling and testing for Malaria free of charge.**

**If you have any questions about the NFHS-5 survey, you may contact:**

**(ADD CONTACT INFORMATION FOR FIELD AGENCY CONDUCTING NFHS-5)**

Thanking you and with regards,

Yours sincerely,

**(In-charge of Organization)**

(Organization)

## APPENDIX 5C: REFERRAL TO HEALTH FACILITY

**(LETTER NUMBER)**

Date: \_\_\_\_\_

To

**The Incharge**

(PHC/CHC/RH/DH), *Address*

**Subject: Referral Letter for Vitamin D3 testing**

Dear **Sir/Madam**,

Presently the fifth National Family Health Survey (NFHS-5) is being conducted under the stewardship of the Ministry of Health and Family Welfare (MOHFW). The International Institute for Population Sciences (IIPS), Mumbai, is designated as nodal agency for coordinating the NFHS-5 project and **(ORGANIZATION)** is conducting the fieldwork for NFHS-5 in **(STATE)**.

As a part of this survey, health investigators visit sampled households in selected villages, towns and cities throughout India. During the survey, women and men in randomly selected household are asked to give a capillary blood sample from a fingerstick for Vitamin D3 testing in NIMR. The Vitamin D3 prevalence results from the tests will be used by the Ministry of Health and Family Welfare for further refining programme strategies.

The Vitamin D3 testing in NFHS-5 is anonymous, i.e., no individual identifiers are associated with the blood samples or test results and, therefore, respondents will not be provided with information about their own Vitamin D3 status. However, we are giving this referral letter to respondents to receive a Vitamin D3 test at a health facility, so that they will have an opportunity to receive Vitamin D3 testing at a health facility without charge if they desire.

**The bearer of this letter Ms./Mr. -----was eligible for anonymous Vitamin D3 testing in NFHS-5 and hence may please be provided with necessary services for voluntary counseling and testing for Vitamin D3 free of charge.**

**If you have any questions about the NFHS-5 survey, you may contact:**

**(ADD CONTACT INFORMATION FOR FIELD AGENCY CONDUCTING NFHS-5)**

Thanking you and with regards,

Yours sincerely,

**(In-charge of Organization)**

(Organization)



## APPENDIX 6: NFHS-5 BLOOD PRESSURE AND DIABETES BROCHURE FOR ADULTS

### What IS Diabetes?

Diabetes is a set of metabolic disorders characterized by **elevated blood glucose** levels due to defective insulin secretion and/or ineffective insulin action.

### What is MEASURED?

The level of glucose in blood is measured (usually on more than one occasion) to determine if the person has diabetes. The measurement is usually done on a **fasting blood sample**, about 8 to 12 hours after eating, or on a **random blood sample**.

### What CAUSES diabetes?

In most cases the cause of diabetes is not known. Some of the possible causes are:

- ◇ Poor diet
- ◇ Obesity
- ◇ Viral infection
- ◇ Age
- ◇ Stress
- ◇ Smoking
- ◇ Family history
- ◇ Genetics
- ◇ Lack of physical activity

### TEST RESULTS

Date \_\_\_\_\_

Name: _____			
<b>BLOOD GLUCOSE (Random)</b>			
_____ mg/dL			
<b>Blood glucose category</b>			
	<i>Normal</i>	<i>Abnormal</i>	<i>Referral</i>
Random Blood glucose	< 200 mg/dL	≥ 201 mg/dL	No Yes

BLOOD PRESSURE				
SYSTOLIC		DIASTOLIC		
BLOOD PRESSURE CATEGORY	Systolic (mm Hg)		Diastolic (mm Hg)	Referral: Recheck within
Normal (Optimal)	<120	And	<80	1 Year
Normal (Mildly high)	<130	And	<85	1 Year
Normal (Moderately high)	130 - 139	And/Or	85 - 89	2 Months
Abnormal (Mildly elevated)	140 - 159	And/Or	90 - 99	1 Month
Abnormal (Moderately elevated)	160 - 179	And/Or	100 - 109	1 Week
Abnormal (Severely elevated)	≥180	And/Or	≥110	Immediately

**Note!!!** Your blood pressure was measured by a trained examiner. These measurements were obtained as part of a survey and do not represent a medical diagnosis. Interpretation of these measurements must be made by a physician.

### What IS Blood Pressure?

Arterial blood pressure is the force exerted by the blood on the walls of the arteries as the heart pumps (contracts) and relaxes.

Elevated high blood pressure is dangerous because it can lead to serious health problems such as kidney failure, and death from coronary heart disease and stroke.

### What is MEASURED?

The **systolic pressure** is the maximum pressure in an artery at the moment when the heart is beating and pumping blood through the body.

The **diastolic pressure** is the lowest pressure in an artery at the moments between beats when the heart is resting.

A person is considered to have high blood pressure (hypertension) if either one of the two pressures is above normal.

### What CAUSES high Blood Pressure?

The exact causes of high blood pressure are unknown, but several factors may play a role in its development including:

- ◇ Smoking
- ◇ Overweight / Obesity
- ◇ Lack of physical activity
- ◇ Family history
- ◇ Genetics
- ◇ High salt and/ or alcohol intake
- ◇ Older age
- ◇ Stress

### MEASURES OF PREVENTION.....

#### Can Diabetes be PREVENTED?

Diabetes can be prevented by:

- ◇ Reducing carbohydrates in the diet
- ◇ Regular exercise

#### Can high Blood Pressure be PREVENTED?

High blood pressure can be prevented by:

- ◇ Reducing weight
- ◇ Increasing physical activity
- ◇ Increasing consumption of fruits and vegetables
- ◇ Reducing salt and alcohol consumption
- ◇ Stopping smoking

### IMPLEMENTING AGENCY



INTERNATIONAL INSTITUTE FOR  
POPULATION SCIENCES (IIPS),  
Mumbai - 400088

### NATIONAL FAMILY HEALTH SURVEY (NFHS-5)

Name \_\_\_\_\_ Date \_\_\_\_\_

International Institute for Population Sciences (IIPS) is conducting the National Family Health Survey in which testing of blood glucose and measuring of blood pressure are included. The study will help us identify whether there are problems with diabetes and hypertension among women and men in India.

We appreciate you allowing us to interview and test you.

Thank you for your cooperation.

*Please look inside  
for the results of your  
blood glucose and  
blood pressure tests.*

## APPENDIX 7: NFHS-5 ANAEMIA BROCHURE FOR WOMEN AND CHILDREN

### TEST RESULTS

Date \_\_\_\_\_

#### What IS Anaemia?

Anaemia is a serious health condition in which there are not enough red blood cells or haemoglobin in the blood.

Haemoglobin is a substance in the blood that carries oxygen to the brain, muscles, disease-fighting organs and other parts of the body. Iron is important for making haemoglobin.

#### What are the SYMPTOMS of Anaemia?

Some of the symptoms of anaemia are:

- tiredness
- headaches
- dizziness
- poor appetite
- heart palpitations
- shortness of breath

#### Why is Anaemia DANGEROUS?

Anaemia is dangerous because it reduces one's resistance to infections.

- severe anaemia can lead to heart failure
- during childbirth, anaemic women are more likely to die from excessive bleeding
- anaemic children have low birth weight, poor learning capacity, and less resistance to infections than other children

Woman	Child 1	Child 2	Child 3
_____	_____	_____	_____
<b>Haemoglobin level (write) and Anaemia Classification (circle one)</b>			
_____ g/dl	_____ g/dl	_____ g/dl	_____ g/dl
<b>Severe</b> (less than 7.0 g/dL)	<b>Severe</b> (less than 7.0 g/dL)	<b>Severe</b> (less than 7.0 g/dL)	<b>Severe</b> (less than 7.0 g/dL)
<b>Moderate</b> (7.0-9.9 g/dL)	<b>Moderate</b> (7.0-9.9 g/dL)	<b>Moderate</b> (7.0-9.9 g/dL)	<b>Moderate</b> (7.0-9.9 g/dL)
<b>Mild</b> (not pregnant) (10.0-11.9 g/dL) (pregnant) (10.0-10.9 g/dL)	<b>Mild</b> (10.0-10.9 g/dL)	<b>Mild</b> (10.0-10.9 g/dL)	<b>Mild</b> (10.0-10.9 g/dL)
<b>Normal</b> (not pregnant) (12.0 g/dL or more) (pregnant) (11.0 g/dL or more)	<b>Normal</b> (11.0 g/dL or more)	<b>Normal</b> (11.0 g/dL or more)	<b>Normal</b> (11.0 g/dL or more)
<b>Height (cm)</b>			
_____	_____	_____	_____
<b>Weight (Kg)</b>			
_____	_____	_____	_____
<b>Waist Circumference (cm)</b>			
_____	_____	_____	_____
<b>Hip Circumference (cm)</b>			
_____	_____	_____	_____

**Severe Anaemia:** You have a seriously low level of haemoglobin in your blood. You need to see a doctor or visit a health centre immediately for treatment. Eat more foods rich in iron and treat malaria and worms immediately.

**Moderate Anaemia:** Your anaemia may be caused by iron deficiency, worms, excessive bleeding or malaria. You should visit a doctor or health centre as soon as possible. Eat more foods rich in iron.

**Mild Anaemia:** You need more daily iron. Treat malaria and worms immediately. Eat more foods rich in iron.

#### Iron Rich Foods



**dark green leafy vegetables**  
(spinach, kale, mustard, beet, parsley, amaranth)



**meat, liver or fish**



**lentils and beans**

To increase the body's use of iron, eat more fruits and vegetables rich in vitamin C:



**vegetables:** green peppers, cabbage

## TEST RESULTS

Date \_\_\_\_\_

### What IS Anaemia?

Anaemia is a serious health condition in which there are not enough red blood cells or haemoglobin in the blood.

Haemoglobin is a substance in the blood that carries oxygen to the brain, muscles, disease-fighting organs and other parts of the body. Iron is important for making haemoglobin.

### What are the SYMPTOMS of Anaemia?

Some of the symptoms of anaemia are:

- tiredness
- headaches
- dizziness
- poor appetite
- heart palpitations
- shortness of breath

### Why is Anaemia DANGEROUS?

Anaemia is dangerous because it reduces one's resistance to infections.

- severe anaemia can lead to heart failure
- during childbirth, anaemic women are more likely to die from excessive bleeding
- anaemic children have low birth weight, poor learning capacity, and less resistance to infections than other children

Man	Child 1	Child 2	Child 3
_____	_____	_____	_____
<b>Haemoglobin level (write) and Anaemia Classification (circle one)</b>			
_____ g/dl	_____ g/dl	_____ g/dl	_____ g/dl
<b>Severe</b> (less than 9.0 g/dL)	<b>Severe</b> (less than 7.0 g/dL)	<b>Severe</b> (less than 7.0 g/dL)	<b>Severe</b> (less than 7.0 g/dL)
<b>Moderate</b> (9.0-11.9 g/dL)	<b>Moderate</b> (7.0-9.9 g/dL)	<b>Moderate</b> (7.0-9.9 g/dL)	<b>Moderate</b> (7.0-9.9 g/dL)
<b>Mild</b> (12.0-12.9 g/dL)	<b>Mild</b> (10.0-10.9 g/dL)	<b>Mild</b> (10.0-10.9 g/dL)	<b>Mild</b> (10.0-10.9 g/dL)
<b>Normal</b> (13.0 g/dL or more)	<b>Normal</b> (11.0 g/dL or more)	<b>Normal</b> (11.0 g/dL or more)	<b>Normal</b> (11.0 g/dL or more)
<b>Height (cm)</b>			
_____	_____	_____	_____
<b>Weight (Kg)</b>			
_____	_____	_____	_____
<b>Waist Circumference (cm)</b>			
_____	_____	_____	_____
<b>Hip Circumference (cm)</b>			
_____	_____	_____	_____

**Severe Anaemia:** You have a seriously low level of haemoglobin in your blood. You need to see a doctor or visit a health centre immediately for treatment. Eat more foods rich in iron and treat malaria and worms immediately.

**Moderate Anaemia:** Your anaemia may be caused by iron deficiency, worms, excessive bleeding or malaria. You should visit a doctor or health centre as soon as possible. Eat more foods rich in iron.

**Mild Anaemia:** You need more daily iron. Treat malaria and worms immediately. Eat more foods rich in iron.

### Iron Rich Foods



**dark green leafy vegetables** (spinach, kale, mustard, beet, parsley, amaranth)



**meat, liver or fish**



**lentils and beans**

To increase the body's use of iron, eat more fruits and vegetables rich in vitamin C:



lemons



guavas



mangoes



oranges

vegetables: green peppers, cabbage



## APPENDIX 9: NFHS-5 MALARIA, VITAMIN D3 AND HbA1c BROCHURE

### What does VITAMIN D do?

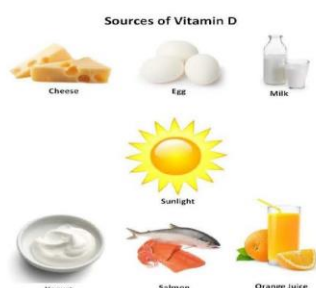
Vitamin D keeps your bones and teeth healthy and strong by maintaining the calcium level in your blood. Not enough vitamin D leads to bone diseases such as rickets and osteoporosis.

### What is VITAMIN D deficiency?

Having a vitamin D deficiency means there is a low level of vitamin D in your blood. It can affect people of all ages including adults, children and babies. It is diagnosed with a blood test.

### Where does VITAMIN D come from?

Ninety percent of the vitamin D your body needs comes from skin exposure to the sun and 10 percent comes from food sources.



### What are the problems with VITAMIN D deficiency?

#### In children:

- Fits due to low calcium levels in the blood—hypocalcaemia seizures.
- Soft bones which lead to bent limbs—rickets.

#### In adults:

- Thinner, less dense bones—osteoporosis; fractures
- Soft bones—osteomalacia
- Body pains
- Muscle weakness
- Low vitamin D levels have also been linked with diabetes, multiple sclerosis, poor mental health

All of these problems can be prevented with treatment of the vitamin D deficiency.

### What is the treatment of vitamin D deficiency?

Vitamin D tablets, mixture or drops. The amount you need to take will depend on your vitamin D level. Talk to your doctor or midwife.

#### Vitamin D Levels (25-hydroxyvitamin D)

< 30 ng/ml < 75 nmol/L	Deficient
30-50 ng/ml 75-125 nmol/L	Insufficient
50-70 ng/ml 125-175 nmol/L	Optimal
70-100 ng/ml 175-250 nmol/L	Cancer and heart disease therapy
> 100 ng/ml > 250 nmol/L	Excess

## National Family Health Survey (NFHS-5)

### What is HbA1c?

The term HbA1c refers to glycated haemoglobin commonly used in relation to diabetes. HbA1c reflects the average plasma glucose levels over the previous 8-12 weeks. HbA1c test can be performed at any time of day and does not require any special preparation such as fasting. Higher levels of blood glucose will result in higher HbA1c values.

### What is the importance of HbA1c?

It has been commonly used to detect long term control of blood glucose level among diabetes patients over a period of past three months. Its level is a good indicator of adequacy of diabetes treatment and effectiveness of exercise and diet control measures. High HbA1c levels have been associated with higher risk of complications of diabetes like cardio vascular diseases, nephropathy, neuropathy, and retinopathy.

HbA1c level of 6.5% or above is indicative of diabetes mellitus.

HbA1c level of 5.7-6.4% is indicative of prediabetes.

HbA1c level of less than 5.7% is considered normal.

Among type 2 diabetics, the generally accepted HbA1c target value to be achieved is 7-8%.

### What is Malaria?

Malaria is a serious and, at times, fatal disease caused by a parasite which commonly infects certain types of mosquitoes which feed on human beings.

### What are the SYMPTOMS of Malaria?

- Fever
- Chills
- Headache
- Nausea and vomiting
- Muscle pain and fatigue

### How Malaria is transmitted?

People get malaria by being bitten by an infective female Anopheles mosquito. When it bites an infected person, a small amount of blood, containing malarial parasites, is taken. These parasites in the next blood meal of the mosquito then mix with the saliva of the mosquito and are injected into the person being bitten.

### Is Malaria DANGEROUS?

Malaria is the most significant vector borne disease of public health importance especially in pregnant women and children. The incubation period in most cases varies from 7 to 30 days.

### Types of Malaria

*P. falciparum* is the most common malaria parasite, which causes the most malaria-related deaths worldwide. It multiplies very quickly, causing clogged blood vessels.

*P. vivax* species can lie dormant, and then rise up to infect your blood months or years after the mosquito bite.

### Implementing Agency



(स्थापना / Established in 1956)  
बेहतर भविष्य के लिए समता निर्माण  
Capacity Building for a Better Future

International Institute for Population Sciences (IIPS),  
Mumbai-400 088.

### How can I Prevent Malaria?

#### 1. Keep the surroundings dry



#### 2. Use Insecticide treated Mosquito Nets



## National Family Health Survey (NFHS-5)

3. For fever with chills, Consult a doctor and get blood tested for malaria: it can be malaria



4. Use Gambusia fish in water logged areas - This fish feeds on mosquito larvae.



5. Protect yourself from mosquito bite. Wear full cloths while sleeping and Use mosquito repellents.

## CALIBRATION LOG - MEASURING BOARDS

Month and Year:						
Equipment ID	Day of Month	Cluster Number	Measurement in cm	Condition/Remarks	Not in use (check)	Technician ID
	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
	12					
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	28					
	29					
	30					
	31					

## APPENDIX:11

## CALIBRATION LOG - WEIGHING SCALES

Month and Year:						
Equipment ID	Day of Month	Cluster Number	Measurement in kg	Condition/Remarks	Not in use (check)	Technician ID
	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
	12					
	13					
	14					
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	31					

## APPENDIX 12: NFHS-5: DRIED BLOOD SPOT (DBS) TRANSMITTAL SHEET

### NFHS-5: Dried Blood Spot (DBS) TRANSMITTAL SHEET (FRONT)

KEEP IN LARGE ZIPLOC BAG WITH SAMPLES UNTIL FINAL SIGNATURE OBTAINED

HEALTH INVESTIGATOR CODE					CLUSTER NUMBER	
<div style="border: 1px solid black; display: inline-block; width: 100px; height: 20px; margin: 2px;"></div> <div style="border: 1px solid black; display: inline-block; width: 20px; height: 20px; margin: 2px;"></div> <div style="border: 1px solid black; display: inline-block; width: 20px; height: 20px; margin: 2px;"></div> <div style="border: 1px solid black; display: inline-block; width: 20px; height: 20px; margin: 2px;"></div> <div style="border: 1px solid black; display: inline-block; width: 20px; height: 20px; margin: 2px;"></div> <div style="border: 1px solid black; display: inline-block; width: 20px; height: 20px; margin: 2px;"></div>					<div style="border: 1px solid black; display: inline-block; width: 30px; height: 20px; margin: 2px;"></div> <div style="border: 1px solid black; display: inline-block; width: 20px; height: 20px; margin: 2px;"></div> <div style="border: 1px solid black; display: inline-block; width: 20px; height: 20px; margin: 2px;"></div>	

PERSON SENDING/ RECEIVING SAMPLES	TIME TO FILL IN FORM	TOTAL COUNT OF BLOOD SAMPLES	SIGNATURE CONFIRMING THAT EACH BLOOD SAMPLE IS PRESENT—SEE BACK OF FORM	SIGNATURE CONFIRMING THAT THE NUMBER OF BLOOD SAMPLES MATCHES COL. 3	DATE	NOTES (NOTE ANY DISCREPANCY IN NUMBERS OF SAMPLES)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
HEALTH INVESTIGATOR	WHEN CLUSTER IS COMPLETED	<div style="border: 1px solid black; display: inline-block; width: 40px; height: 20px; margin: 2px;"></div>				
FIELD TEAM SUPERVISOR	AFTER INTERVIEWER HAS DONE HIS/HER COUNT	<div style="border: 1px solid black; display: inline-block; width: 40px; height: 20px; margin: 2px;"></div>				
SAMPLE PICK UP PERSON	WHEN SAMPLES ARE PICKED UP IN FIELD	<div style="border: 1px solid black; display: inline-block; width: 40px; height: 20px; margin: 2px;"></div>				
RECEIVER AT [LABORATORY]	UPON ARRIVAL AT [LABORATORY]	<div style="border: 1px solid black; display: inline-block; width: 40px; height: 20px; margin: 2px;"></div>				

**HEALTH INVESTIGATOR:** Upon completion of a cluster, verify that the barcode label on each blood sample (filter paper card) collected and stored in the large ziploc bag labeled with the cluster number corresponds to a barcode number pasted to the back of this transmittal sheet (and vice-versa). Note any discrepancies in Column (7). Count and record the total number of blood samples in Column (3). Sign your name in Column (4) and the date in Column (6). Fold and store this transmittal sheet in the large ziploc bag.

**FIELD TEAM SUPERVISOR:** After the interviewer has verified the blood samples, you will conduct a second verification. Count the number of blood samples, record the total in Column (3). Verify that the barcode number on each blood sample (filter paper card) collected and stored in the large ziploc bag labeled with the cluster number corresponds to a barcode number pasted to the back of this transmittal sheet (and vice-versa) and sign Column (4). Verify that your count of blood samples is the same as the number reported by the interviewer and sign Column (5). Note any discrepancies in Column (7). Record the date in Column (6). Now scan the barcodes on the transmittal sheet into CAPI. Fold and store this transmittal sheet in the large ziploc bag.

**SAMPLE PICK UP PERSON:** Before leaving a cluster, you will verify the number of blood samples collected in the completed cluster. For the completed cluster, count and record in Column (3) the total number of blood samples stored in the large ziploc bag labeled with that cluster number. Note any discrepancies in Column (7). Sign your name in Column (5) and the date in Column (6). Fold and store this transmittal sheet in the large ziploc bag.

**RECEIVER AT [LABORATORY]:** Upon receiving blood samples from the project office, verify that the barcode number on each blood sample (filter paper card) collected and stored in the large ziploc bag labeled with the cluster number corresponds to a barcode number pasted to the back of this transmittal sheet (and vice-versa). Note any discrepancies in Column (7). Count and record the total number of blood samples in Column (3). Sign your name in Column (4) and the date in Column (6). Photocopy both sides of this form and return the original to the project office.

**Note:** This form will be destroyed under the direction of the Laboratory Director after all blood samples have been completely processed and the final test results have been determined for each usable sample.

**NFHS-5: DBS TRANSMITTAL SHEET (BACK)**

NO.	SAMPLE BARCODE	HEALTH INVESTIGATOR	LAB
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20			
21			
22			

↑  
Fold here

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