The organization of an anthropometric survey includes several components that are crucial for enhancing the quality of anthropometric data:

1.1. Planning
1.2. Sampling
1.3. Questionnaire development
1.4. Training and standardization
1.5. Equipment

1.1. PLANNING

Planning surveys to collect anthropometry data involves various steps to implement measures likely to generate quality data.

This section sets out the key steps in survey planning, identifies critical control points to avoid common faulty practices that may affect data quality and highlights recommendations to prevent these pitfalls.

Key steps to support the survey planning process

a) Initial planning for the survey (survey steering committee/technical working group);
b) Preparing the survey protocol (survey manager, sampling statistician);
c) Selecting the data collection method (survey manager);
d) Preparing a survey manual including an interviewer’s manual (survey manager, fieldwork coordinators);
e) Signing an agreement with government for public release of datasets (survey manager);
f) Defining a timeline (survey manager, sampling statistician);
g) Obtaining ethical approval where necessary (survey manager);
h) Selecting the field team (survey manager);
i) Preparing a plan for field work (survey manager).

Brief overview of planning steps

a) Initial planning for the survey

It is recommended that an expert on anthropometry should be a member of the survey steering committee (see the survey organization chart in Annex 1). When this is not feasible, identify an expert on anthropometry in an external stakeholder group and develop a formal process to allow this expert to contribute to steering committee decisions.

Before starting, establish whether other surveys covering the same topic are being planned during the same period. This is recommended in order to enable joint work, boost efficiency and reduce duplication of efforts. If a survey with anthropometric indicators is needed, the first step is to define its scope (see Note 1), identify the target population and establish main objectives, while bearing in mind the context in which the survey will be carried out. Second, resources should be secured for the entire process, including the purchase of requisite equipment and logistics support, as well as to meet staffing and other financial costs. Third, the survey timeline should be developed. Identify a suitable survey manager1 and organization experienced in undertaking surveys including anthropometric data collection to lead the survey.

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1 See a standardized model of job description in Annex 2.
NOTE 1: RECOMMENDATION ON THE SCOPE OF THE SURVEY (RELATING TO ANTHROPOMETRIC INDICATORS)

Anthropometric indicators underpinning the WHA Global Nutrition Targets 2025 and SDG 2030 (stunting, wasting, and overweight) refer to children aged from 0 to <5 years (i.e. aged 0–59 completed months). It is very important to obtain information on children below 6 months of age and to include them in anthropometric surveys. We recommend including in national surveys:

- all children aged 0–59 in completed months;
- indicators included in the 2025 nutrition targets: stunting, wasting and overweight.

Bilateral oedema assessment in national surveys: this assessment is not recommended as a standard protocol for all surveys as malnutrition with oedema is uncommon in many countries and, more importantly, can be easily misdiagnosed.

If assessment of bilateral pitting oedema is included in the survey, field teams should be appropriately trained with exposure to actual cases. All cases of oedema observed during data collection should be verified by a field supervisor.

When bilateral pitting oedema assessment is part of a survey, the survey report should display separate results for acute malnutrition cases with and without oedema.

TIPS

- Identify the best period to implement the survey to allow comparison with previous surveys (seasonal factors may have an impact on anthropometric indicators);
- Give careful consideration when planning to cover all measurements and questions needed to estimate the prevalence of stunting, wasting and overweight in view of their importance to the Global Nutrition Targets and SDGs.

TOOLS

- An Excel file to calculate a survey budget can be found in the MICS toolkit (Appendix A, Budget Calculation Template).

b) Preparing the survey protocol

The survey manager, working with other stakeholders, should supervise the process of preparing the survey protocol for validation by the survey steering committee. The survey manager should define the analytical plan with support from a survey statistician: this includes defining the indicators, data needed to calculate them, the target population, requisite disaggregation categories and other specifications that are required to achieve the survey objectives. The survey manager’s tasks include:

- overseeing the design of the questionnaire and a local events calendar which can be used to work out the date of birth for children when this is unknown;
- pre-testing the questionnaire and drafting an interviewer’s manual to provide instructions on how to complete the questionnaire and correct procedures for anthropometry measurements (see Section 1.3 on Questionnaire development for further details);
- identifying human resources required (number of teams and rotating supervision personnel required as well as mapping and listing teams during the sampling stages);
- working out specific material and equipment needs: where data collection is computer assisted, electronic weighing equipment may be able to transmit data directly to the tablet so as to avoid data entry errors (see Section 1.5 on Equipment for required specifications);
- standardizing the technical equipment.
c) Selecting the data collection method
To improve data quality and facilitate data sharing, many agencies recommend using computer-assisted data collection in the field. Experience has shown that adopting this approach instead of relying on paper-based questionnaire improves the quality of collected nutrition survey data (6). Data collection using computers or smartphones as opposed to conventional paper-based systems has the following advantages:

- it is more user-friendly;
- team performance can be monitored more easily and in a more timely manner;
- collecting and digitizing data at the source makes data entry more efficient and precise, leading to more consistent data;
- no mobile internet connection is required at the time of collection;
- standardized questionnaires are readily programmable for computer-based data collection and can be reused in any setting;
- error control can be tightened with ranges and restrictions set to the needs of the survey, and data easily transferred to other software;
- results are obtained within days, rather than weeks.

TOOLS
• A model survey protocol can be found in the MICS toolkit (MICS survey plan template) along with various tools for estimating required supplies (MICS Listing and Fieldwork Duration, Staff and Supply Estimates Template);
• For more information on the advantages and disadvantages of computer-assisted interviews see DHS Survey Organization Manual 2012, p. 19.

d) Preparing a survey manual including an interviewer’s manual
The manual should include a clear description of field data collection procedures adapted for use by the survey teams. It should include specific instructions for the interviewer on local customs and how to introduce the team to primary sampling unit (PSU) representatives, identify sampled households, initiate call-backs based on the protocol for full completion of the questionnaire and perform anthropometry measurement procedures correctly, etc. A chapter describing how to perform supervision tasks and conduct standardization procedures to ensure quality assurance during data collection should also be included in this manual.

e) Signing an agreement with government for public release of datasets
The team implementing the survey should reach a collective agreement with government that the raw dataset will be made publicly available for sharing and dissemination once the survey is complete. Open availability of entire and raw datasets is recommended.

f) Defining a timeline
Sufficient time should be allocated for recruiting personnel. Various factors have to be considered when making accurate predictions of the timeline required to organize an appropriate survey: these include the survey design, ethical review and approval if required, developing an appropriate recruitment process for field teams, sampling stages (including household mapping and listing operations), training including standardization exercises, procurement of equipment and other logistics and, not least, time required for field work, data processing and report writing. The survey manager is responsible for ensuring that the survey process follows the timeline and that each aspect of the survey progresses smoothly.

TOOLS
• A model survey timeline can be found in the DHS Survey Organization Manual 2012, page 8.

g) Obtaining ethical approval where necessary
UNICEF and WHO recommend that even if a country does not require ethics approval for a protocol involving a household survey that reports on malnutrition rates, survey organizers should seek ethical approval. If local ethics review boards
are not available or would not require ethical approval for such a protocol, approval from an international ethics review board should be sought. The national ethics review board (or the international board) should indicate whether the survey team should refer children identified with severe wasting for treatment depending on available services in country. If referral for treatment of severe wasting is to be part of the survey protocol, the interviewer/measurer should not inform the caregiver during the household interview/measurements as they should not be aware of z-scores for any child during household interviews/measurements. The caretaker of affected children should be informed about the referral for treatment by the field supervisor or other survey team member before the team leaves the PSU.

**TOOLS**

- An example of ethical standards in data collection can be found in a [UNICEF procedural document](#).

h) Selecting the survey team

The roles and job profiles of all members of the field team including the data manager and data processors should be fully specified (see Annexes 1 and 2 for the organization chart and job descriptions). Determine how many team members need to be recruited to make up an adequate team and allocate sufficient time for the recruitment process, which should generally take place several weeks before survey training starts. Team members should be clearly informed about the requirements of the survey: time needed for field work and ensuring commitment, local conditions (lodgings, transportation, per diem, remuneration), security issues and the length of the working day or week in order to limit drop-outs. Consideration should also be given to specific contextual factors (cultural beliefs, gender issues) that might affect the collection of anthropometry data. Depending on the setting, gender balance within the survey teams may also be an important factor.

The recruitment process should include a test to confirm that the prospective team members can handle numbers and read measurements accurately and are also physically able to perform their tasks (e.g. able to kneel or bend down and carry the equipment) depending on the particular type of anthropometric equipment being used. If a recruitment candidate is unable to conduct anthropometric measurements correctly, he or she should be replaced.

It is good practice to record the characteristics of the individual anthropometrists (age, sex, education, professional training, employment status, past survey experience, etc.) in a database. This information can then be linked to the individual anthropometrist’s identification number (or team ID) once each questionnaire has been completed for performance analysis.

An appropriate number of survey teams should be set up depending on the circumstances (weather, distance, mode of transport, working conditions, length of questionnaire, etc.). Teams must be carefully organized in such a way that a reasonable number of anthropometric assessments can be done each day while avoiding excess workload and fatigue. Team member fatigue will have a negative impact on the quality of measurements. The workload undertaken by the various anthropometrists should be monitored during the first few days of the survey.

**TIPS**

- It is recommended that each field team have a minimum of two trained anthropometrists to measure every child. The two anthropometrists should have defined roles, one acting as the “main measurer” and the other as the “assistant measurer”;
- Remember that survey teams should not be overtaxed with an excessive workload since tired teams are likely to neglect accuracy or enter erroneous data.

**TOOLS**

- A model set of job descriptions is presented in Annex 2;
- DHS uses a data collection form for fieldworkers that may be helpful in assessing anthropometric performance.

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1 Mother/caretaker are used interchangeably in this report.
2 UNICEF Procedure for ethical standards in research, evaluation, data collection and analysis, 2015: this document is a template and likely to require specific adaptation.
i) Preparing a plan for field work

The survey manager should ensure that all requisite material and equipment is available on time in the field. Technical equipment should be purchased and calibrated, and any material prepared. Logistics and human resources should be ready to undertake the planned tasks as per the timeline. Having a contingency plan is advisable: this allows for the rapid replacement of a team member or item of equipment, if necessary.

Authorities at the different levels should be informed in a timely manner when the survey is going to take place. This is especially important for the PSU so that authorities can inform residents from sampled households to stay at home on the day of the survey. This part is further developed in Chapter 2 (Field work).

**TIPS**

- Prepare a contingency plan so that a team member or item of equipment can be replaced at short notice.

**TABLE 1. FAULTY PRACTICES AND HOW TO AVOID THEM WHEN PLANNING AN ANTHROPOMETRIC SURVEY**

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<th>FAULTY PRACTICES</th>
<th>HOW TO AVOID THEM</th>
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| Unclear purpose, objective and scope | - Determine if there is a recent available survey which has already reported data for global targets (new estimates should be made for anthropometric indicators every three years so that countries can regularly update their progress towards SDG goals);  
- Discuss the survey with local counterparts and ask what they would like to learn from it and how its results might address priority issues in policies and programmes;  
- Make survey objectives are SMART (specific, measurable, achievable, relevant and time-bound);  
- Develop a Memorandum of Understanding (MoU) which all requisite parties sign (e.g. government, data owners, etc.,) to make data files publicly available. |
| Lack of resources: financial or human | - Use an established protocol and consider constraints when developing the budget;  
- Consider suspending the survey if there is no political commitment or financial resources to implement it. |
| Underestimation of the importance of language factors | - Use people thoroughly familiar with the local language when translating questions;  
- Commission a back-translation of the questionnaire to ensure that its questions ask precisely what the survey designers anticipated;  
- Ensure the data collection team includes people who speak and understand the local language. |
### 1.2. SAMPLING

All cross-sectional household surveys that are intended to be representative of a geographically-defined national and/or subnational population should employ standard methods and tools for sampling as outlined in this chapter. Statistically sound and internationally comparable data are essential for developing evidence-based policies and programmes, as well as for monitoring the progress of countries toward national goals and global commitments. Appropriate sampling procedures are a key part of the process for generating accurate estimates. Representative cross-sectional household surveys generally follow a stratified two-stage sampling design. The PSUs identified in the first stage of this design are often based on the most recent population and housing census. The second-stage sampling framework is developed by means of a mapping and listing operation which involves visiting each of the selected PSUs and drawing a location map and sketch map of structures in the PSU: this is essentially a list describing every structure along with related named household heads and other characteristics. The quality of this listing operation is one of the key factors affecting coverage of the target population. Household mapping and listing should be done as a distinct operation and while it represents a significant field cost, it is an essential procedure that guarantees the completeness of coverage of the frame and representativeness of the sample. Fortunately, existing tools can be used to help guide appropriate sampling.

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<th><strong>FAULTY PRACTICES</strong></th>
<th><strong>HOW TO AVOID THEM</strong></th>
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| Long process to obtain ethical approval and other authorizations | • UNICEF and WHO recommends that even if a country does not require ethics approval for a protocol involving a household survey that reports on malnutrition rates, survey organizers should seek ethical approval. If local ethics review boards are not available or would not require ethical approval for such a protocol, approval from an international ethics review board should be sought;  
  • Identify the national or international ethics review board to whom refer to seek ethical approval and be informed about the process;  
  • Allow sufficient time for these matters and have some flexible resources to deal with them. |
| Rushed or too little time for recruitment process | • Draw up a timeline of several weeks for undertaking interviews and completing contractual or administrative procedures before training starts. |
| Survey teams not accepted by local communities | • Contact central and local administration as well as local community leaders prior to the survey and explain its purpose and objectives and the types of measurements required. |
| Insufficient number of anthropometrists (survey team members drop out) | • Consider recruiting at least an additional 15% of anthropometrists above field work requirements for training in view of language needs and possible drop-outs. |
| Delays in arrival of equipment | • Start ordering equipment and supplies as soon as requirements are known, choose a reliable supplier and check with local counterparts about customs clearance for applicable items. |
The steps outlined below are recommended when implementing surveys requiring representative estimates, such as for SDG monitoring, but are not meant to apply to other research or monitoring designs.

**Summary of recommended sampling steps in representative cross-sectional household surveys**

a) Appoint a sampling statistician to develop and implement the sampling plan (survey manager).
b) Develop the sampling plan (sampling statistician);
c) Finalize survey objectives in terms of key indicators and geographic areas for analysis (sampling statistician supported by sector specialists and survey manager);
d) Calculate the sample size (sampling statistician);
e) Identify and review the sampling frame (sampling statistician);
f) Select the primary sampling units (PSUs) (sampling statistician);
g) Organize development of the second-stage sampling frame, i.e., planning and training for the mapping and listing operation (survey manager);
h) Carry out the household mapping and listing operation to create the second-stage sampling frame ahead of the survey (sampling statistician);
i) Select households to be interviewed (sampling statistician);
j) Define household and household members and develop the household roster part of the questionnaire and related interviewer instructions (sampling statistician and survey manager);
k) Train interviewers and other field personnel to follow the sampling plan and survey methodology (survey manager);
l) Write a detailed annex on the sample design and sample implementation (sampling statistician);
m) Calculate weights for households and individuals (sampling statistician).

**Overview of steps and tools for sampling in representative cross-sectional household surveys**

**a) Appoint a sampling statistician to develop and implement the sampling plan**

The sampling statistician should oversee all aspects of the sampling plan from its development through to implementation, calculation of sampling weights and errors, and reporting. Ideally, he or she should come from a local agency such as the National Statistics Office (NSO) if it is involved in the survey. If the NSO or comparable agency is not involved in the survey, engage a sampling statistician from a local agency or hire a consultant sampling statistician to review all sections of the sampling plan and provide oversight and technical guidance at each step of implementation and reporting; the model of terms of reference included in this guide (Annex 2) may help when drawing up a contract for this type of expert.

- **TIPS**
  - Determine whether the National Statistical Office has the capacity to reassign a sampling statistician to support this survey and if not, consider hiring an experienced international consultant.

- **TOOLS**
  - Terms of Reference for a sampling statistician (where national capacity is insufficient) are presented in Annex 2.

**b) Develop the sampling plan including the sections outlined below**

Note that the items below represent the basic areas which should be covered in a national-level sample, although other parameters may need to be considered depending on the scope of the survey. An experienced sampling statistician will be able to identify and address the particular requirements of a survey, e.g., oversampling of households with children under 5 years of age because of low fertility, subsampling, stratification, etc.

- Sampling frame: includes a review and evaluation of the sampling frame and outlines geographic information available for stratification;
Survey objectives and target population: includes survey objectives in terms of key indicators, target population(s) and geographical domains of analysis (e.g. regions, urban/rural at the national level);

Sample size: calculation of sample size based on survey objectives, target population and required level of precision for key indicators by domain;

First-stage sampling: includes a database of PSUs with details such as the number of households in relation to the selected PSU (standard methodology generally involves selecting PSUs systematically with probability proportional to size (PPS) within each stratum);

Preparation for second-stage sampling: includes manuals and other materials (e.g. forms or computer-assisted personal interviewing (CAPI) applications), training, organizing and performing the household listing and mapping operation;

Household selection: includes details related to central office selection of sampled households;

Training of field team members to follow sampling plan;

Documentation and reporting on sampling implementation;

Procedures for calculating sample weights for households and individuals.

• The sampling statistician should be responsible for developing the sampling plan;
• If a MICS, DHS or other national household survey has recently been conducted, review the sample design and results for key indicators from the most recent survey; if it was aligned with section 1.2 of this report, use the same approach to allow comparability.

Sample design appendices in MICS and DHS reports can serve as model sampling plans but need to be adjusted based on the specific objectives of the new survey and its expected outcome. Determine whether a MICS or DHS report exists for your country online; if not look for a survey with similar sampling needs (e.g. where similar design parameters were used for national or sub-national domains, i.e. provincial or district level, urban/rural, etc.: this can be used as a starting point for drawing up a sampling plan for the new survey.

DHS Sampling and Household Listing Manual can be used as a model sampling plan (start at section 5.2.1).

Other useful information can be found on the NHANES sampling design webpage.

c) Finalize survey objectives in terms of key indicators and geographic areas for analysis

Use information about specific reporting needs as well as available resources such as budget and time to define the scope of the survey: is it, for instance, going to be nationally representative or will it also allow for regional or district level estimates? A minimum sample size will need to be determined for each geographical domain that will be separately estimated in the survey tables. A larger number of geographic domains and disaggregation categories (e.g. wealth, maternal education, etc.) will increase the sample size considerably. This will result in higher costs and longer fieldwork duration. The need for and use of information from different levels of disaggregation should therefore be carefully considered.

d) Calculate the sample size

Review outcomes, e.g. prevalence estimates, sampling errors and design effects, in all relatively recent household surveys for indicators which can be fed into the calculation of sample size. Surveys reviewed should be representative of the same population as the upcoming survey and the sampling statistician can help to determine which parameters are appropriate to use. If a MICS or DHS was recently conducted, precision measurements and design effects for key indicators can be found in the appendices of the final report. For a previous stand-alone anthropometry survey, under-5 stunting would be an effective indicator to examine. The link to the sample size calculation templates listed under “Tools” (below) may also help to generate an appropriate sample size for a survey. If an estimate of the under-5 stunting rate is not available from a previous survey, a 50% estimate would yield the largest required sample size. If the survey has multiple indicators, or if there is a need to stratify malnutrition estimates by different background characteristics, other factors or indicators may also need to be considered. The sampling statistician can provide advice on making the best decision.
Determining the sample size needed to achieve a statistically significant difference between only two time points is not recommended, unless the expected difference in prevalence is large enough not to impose a major increase in sample size requirements. The FANTA Sampling Guide has an Excel-based calculator which is able to estimate the required sample size for both surveys and time points under comparison. In most cases, progress towards a goal is best assessed using multiple time points (i.e. more than two): this is possible with the WHO Global Targets Tracking Tool or using the Child anthropometry indicators trends and targets tracking Excel spreadsheet in Annex 11.

TIPS
• MICS and DHS final reports include estimates of sampling errors, confidence intervals and design effects for key indicators which can generate an appropriate sample size;
• Determine geographic and other domains of analysis which will affect sample size requirements.

TOOLS
• MICS sample size calculation template (see sampling tools);
• DHS working paper on two-stage cluster sampling in demographic and health surveys;
• Measure evaluation spreadsheet for weight calculation example

e) Identify and review the sampling frame
The recommended source for the sampling frame is generally the latest official census of population and housing where census enumeration areas serve as PSUs. Many major household survey programmes such as MICS and DHS undertake a periodic review of the national sampling frame and corresponding reports include a description of sampling frame quality: these findings should be used when drafting the survey report to highlight any issues or shortfalls and also to make recommendations for dealing with frame problems when sampling for the survey.

A census can generally be used as the sampling frame for household surveys during the 10-year census interval period. Although first-stage sampling becomes slightly less efficient over time as the number of households in the enumeration areas change, the second-stage frame is developed for each survey through a mapping and listing operation that provides a new list of households in sample enumeration areas selected for the survey. If some parts of the country, e.g. the fringes of large urban areas, are subject to a very high growth rate, a partial frame update may be considered. If the last census was held more than 10 years beforehand, or the country has experienced a major change in population distribution due to conflict or natural disasters, other frames such as electoral registries or population registries may be considered, if thought appropriate by the sampling statistician.

It is important to ensure that the PSU frame covers the entire household-based population of the country, and that PSUs are identified on maps with well-defined boundaries. PSUs should be uniquely identified with hierarchical geographic codes, and there should be a frame database (or spreadsheet) with summary information on the number of households or population in each PSU. The relevance of including nomadic populations, if any, should also be considered. If there are parts of the country that are considered inaccessible for the period of the survey (owing to security or other issues), they should be excluded from the frame prior to sample selection; the corresponding number and proportion of households and population excluded should be documented within the survey report for the sake of transparency.

TIPS
• Most countries conduct a census of population and housing every 10 years, which is used as the sampling frame for many national household surveys with enumeration areas serving as PSUs;
• If parts of the country (e.g. fringes of large cities) have experienced very high growth since the sampling frame was developed, a partial frame update may be considered for such areas;
• If the last census is more than 10 years old, or the country has had a major change in population distribution due to conflict or natural disasters, other frames such as electoral registries, population registries, etc., can be considered, if thought appropriate by the sampling statistician;
• Some countries use a master sample approach to select samples for household surveys. The master sample is generally also based on the most recent census frame.
f) Select the Primary Sampling Units (PSU)

PSUs must be selected using a randomized scientific sampling method that allows all PSUs a probability of selection that is proportional to their size (probability proportional to size or PPS) within each stratum. Generally, sample PSUs in each stratum are selected using systematic PPS sampling, which also ensures representative geographical sample dispersion. There are alternative methods to PPS but they are generally less effective. The sampling statistician will suggest the optimum method depending on the specific context of the survey. Ideally, PSUs are selected by a sampling statistician at the NSO, even if this office is not involved in conducting the survey it is recommended that the NSO implement this step. If the NSO is unable to do so, the relevant person at the NSO should share the sampling frame with the survey’s own sampling statistician who, in turn, should provide the final sample to the NSO for review. In most countries the NSO is also involved in generating the official sampling frame based on the most recent census and maintains maps of all PSUs in the frame. For the household listing operation, a map will be required for each sampled PSU.

All PSUs and households should be included within the frame: do not select specific groups (e.g. citizens but exclude non-citizens) if the aim is to report on progress towards SDGs and WHA global nutrition targets which aim to leave no one behind.

TIPS

- PSU selection must be based on a probability sampling procedure whereby all PSUs in the frame have a known probability of selection;
- The most effective sampling procedure is to select PSUs with a probability of selection that is proportional to their size (i.e. probability proportional to size);
- Alternative methods to PPS exist but are generally more complicated and unnecessary; The sampling statistician will suggest the method best suited to the context;
- Software such as SPSS Complex Samples or Excel applications can be used to select PSUs by PPS within each stratum.

g) Organize development of the second-stage sampling frame

Mapping and listing each structure and household in every sampled PSU using standard procedures is a critical operation for creating the second-stage sampling frame and is essential to allow selection of a representative sample of the current household population.

Procedures described in one of the various manuals under “Tools” below may be of assistance when developing a plan for the household mapping and listing operation based on standard protocols; they include tools, a training programme and supervision and oversight procedures. A listing coordinator should be hired to plan and oversee the listing exercise. If a computer-assisted personal interviewing device (CAPI) application is to be used for the listing operation, it will need to be developed and tested before training begins. If CAPI is not used, appropriate listing forms such as those displayed in the manuals under “Tools” should be prepared. Since mapping and listing require specialized skills, personnel with appropriate background should be hired to perform this step. Obliging one team to take on too many responsibilities may compromise the quality of some of the tasks: it is therefore recommended that mapping and listing be handled by a team working independently of the survey interview process. There may however be some overlap in personnel between teams and operations. Listers and mappers with cartographic skills should be hired. Field supervisors for the mapping and listing teams should also be hired for various tasks including planning and organizing fieldwork logistics, reviewing completed household listing forms and maps and ensuring they are safely stored at the central office, checking that each PSU has been fully covered and listed and verifying that the quality of work is acceptable.
The number of teams and field supervisors to be hired for the listing operation depends on the number of sample PSUs, and they should be hired for long enough to allow for completion of the checks and supervisory tasks outlined in step h (see MICS templates under “Tools” for help when calculating household mapping and listing needs).

Ideally, cartographic staff from the NSO, if available, should assist in the training of mapping and listing team, including on the interpretation of the census maps. The training should include a practical listing exercise in the field before the actual listing activities for the survey commence.

For MICS and DHS surveys, in some countries the listing operation in each sample PSU is conducted by a team consisting of one mapper and one lister, with a field supervisor assigned to a number of teams (e.g. one field supervisor for every 3 teams). Plans should be made for field level quality checks on mapping and listing, which will be carried out by listing team field supervisors, the listing coordinator and the survey manager. Plans should also be made for quality checks by the central office.

Note: it is not recommended to develop a second-stage sampling frame based only on households with children under five years of age: all households should be listed regardless of the household composition. The sample should then be selected from all households in the PSU and children to be measured identified during the survey interview (see Chapter 2).

**TIPS**

- Best practice includes mapping and listing the households in a separate operation conducted in advance of survey interview field work by specially trained teams with quality checks by field supervisors as well as in the central office;
- Mappers and listers should be thoroughly trained including practical exercises in the field;
- National Statistics Office (NSO) staff should ideally help to train listers and mappers including on interpreting census maps.

**TOOLS**

- MICS templates for calculating listing duration and listing staff requirements;
- DHS Sampling and Household Listing Manual;
- MICS Manual for Mapping and Household Listing (see sampling tools);
- Other useful information can be found on the NHANES sampling design webpage.

**h) Carry out the household mapping and listing to develop the second-stage sampling frame**

Conduct household mapping and listing with the trained teams to generate the second-stage sampling frame following the survey-specific household mapping and listing procedures developed in the manual (which should coincide with steps in DHS and/or MICS manuals under “Tools”). Be aware of challenges in listing such as gated communities and locked buildings which in some cases can be overcome by compiling a listing based on mailboxes; even such solutions may not always allow for a complete list. Ideally, listing should be conducted one to three months prior to the survey interviews, thereby allowing ample time to review completed listing forms and re-list any PSUs that fail to meet agreed standards while avoiding significant household changes. Depending on the characteristics of the population, listing may in some cases take place up to six months before survey interviews, while in other circumstances (e.g. PSUs affected by insecurity, conflict and/or high migration rates), the time frame may be shorter than a month before survey interviews. The optimal timing of the listing exercise should be determined by the sampling statistician.

There are three main checking stages:

i. by the field supervisor: all lists and maps of all PSUs held by teams are checked (paper-based checks);
ii. by the field supervisor, listing coordinator and survey manager: a random sample of 10% of all lists and maps of all PSUs held by teams are physically checked (physical checks/field visits);
iii. at the central office: all lists and maps of all PSUs held by teams are checked once forms have been returned (paper-based checks).
i) **By field supervisor (paper-based checks)**

Field level supervision of mapping and listing teams should occur on a daily basis during the mapping and listing operation. The field supervisor should check maps and lists of all PSUs once they are completed. When the field supervisor receives the final sketch map and listing sheets (or CAPI files) for an individual PSU from a listing team, he or she should compare the sketch map to the census base map to confirm that dwelling units near all PSU boundaries have been covered, and that there are no gaps in coverage. The field supervisor should also check that the mapper has identified the route of the listing within each PSU on the sketch map. If the listing operation is GPS-based, the field supervisor should check the GPS tracker of the mapping and listing team and retrace the path taken to ensure that the team covered all households within the boundaries of the PSU. When monitoring the quality of the mapping and listing operation, the field supervisors should be in regular communication with the listing coordinator who in turn should be regularly liaising with sampling and cartographic personnel in the central office. An important source of information for monitoring listing completeness is the sampling frame from the previous census, which includes information on the number of households enumerated in each census enumeration area. The field supervisor should check to see whether the absolute difference between the number of households listed and the corresponding number from the census frame is larger than a predetermined threshold (e.g. 20%). In cases where the threshold is exceeded, the field supervisor should first try to determine whether there is an explanation for this difference, e.g. several households moving out of an area or a new housing development. If the field supervisor concludes that the listing did not follow the correct boundaries or that many households were missed, then the PSU should be assigned for re-listing.

ii) **By field supervisor, listing coordinator and survey manager (physical checks/field visits)**

The field supervisors, listing coordinator and survey manager should also visit a randomly selected sample of at least 10% of all PSUs once they have been mapped and listed in order to conduct quality checks. These include a physical check of households near all PSU boundaries to make sure they have been included in the listing and any new dwelling units that have been identified. On visits to sample PSUs, the field supervisor should check the route highlighted by the mapper to ensure that it covers all the various sectors of the PSU, including the boundaries. If stickers or chalk marks on doorposts are used by the mapping and listing team to identify dwelling units, the field supervisor can also check for these marks and verify they are present in the 10% sample of PSUs where physical verification is undertaken. If any major or systematic problems are found, another random sample of 10% of PSUs should be visited and reviewed.

iii) **At the central office (paper-based checks)**

The central office team should perform paper-based checks on all PSUs once all maps and lists have been returned. These checks (e.g. comparing sketch map to census base map) are identical to those performed above by the field supervisor and do not require field visits. They should determine whether the listing operation needs to be repeated in any PSU or if the lists are clear for use in step i: selecting sample households.

**TIPS**

- Mapping and listing all households in selected PSUs using standard procedures in “Tools” is a critical operation: without this step a representative sample cannot be guaranteed;
- The optimal timing for the listing exercise should be worked out by the sampling statistician: it is generally about one to three months prior to survey interviewing in order to avoid significant household changes;
- Supervision in the field and checks at central level are essential for ensuring the quality of lists and maps of sampled PSUs since these will serve as the second-stage sampling frame;
- At least 10% of all sampled PSUs should be visited by field supervisors, the listing coordinator and the survey manager for physical verification after maps and lists have been completed by the mapper and lister.

**TOOLS**

- DHS Sampling and Household Listing Manual;
- MICS Manual for Mapping and Household Listing (see sampling tools);
- Other useful information can be found on the NHANES sampling design webpage.
i) Select households to be interviewed
Household selection must make use of a randomized scientific method to allow all households in each selected PSU to have at least a non-zero probability of selection (ideally an equal probability of selection). Once the lists and maps have been cleared by the central office, the sampling statistician should use the lists to select a random sample of households using a sampling tool such as the MICS household selection template listed under “Tools”. The standard sampling procedure for selecting households from the listing is systematic random sampling. It is recommended that household selection be done in the central office, and only performed in the field in extreme cases (see Note 2).

TIPS
• Households should be selected in the central office for quality control (not in the field).

TOOLS
• DHS Sampling and Household Listing Manual:
• MICS Systematic Random Selection of Households Template (see sampling tools);
• Other useful information can be found in the NHANES sampling design webpage.

NOTE 2: HOUSEHOLD SELECTION IN SPECIAL SITUATIONS
If the situation in some PSUs does not allow for the mapping and listing exercise to be undertaken by a separate team of listers and mappers, as may be the case in some PSUs with security issues but which remain accessible (and therefore not already excluded from the frame), and the second-stage sampling frame has been developed by the survey interview team just ahead of interviewing, every effort should be made to send the second-stage frame for these PSUs to the central office for a quick review of maps and lists, followed by selection of households to be interviewed at central level. With proper planning and communication, the central office should be able to return the list of selected households to the field team on the same day.

If, however, connectivity issues preclude confirmation of household selection by the central office, then sample households can be selected in the field following a manual listing operation. In this scenario a household selection table can be used by the survey interview team supervisor to identify a systematic random sample of households based on the total number of listed households. Selection of households from the listing by the supervisor should be the exception and not the rule and applies only to a very circumscribed area and not all PSUs (e.g. a PSU with specific security issues which prevented listing during the listing operation but remains accessible for survey interviewing). In this scenario, the survey interview team supervisor should select the sample of households; the interviewers and/or anthropometrists should never be involved in this procedure.

j) Define household and household members and develop the household roster part of the questionnaire and related interviewer instructions
A household and a household member in a survey need to be clearly defined and the household roster should be part of the questionnaire (see Annex 3 for a model household questionnaire). Related interviewer instructions need to be developed on the basis of these definitions. A household is often defined as consisting of a person or group of persons, related or unrelated, who live together in the same dwelling unit, acknowledge one adult male or female as the head of household, share the same living arrangements and are considered as a unit. In household surveys, the two main definitions of a household member are:

- A de jure household member is a usual resident of the household, regardless of whether that person stayed in the house on the night before the interview. It does not include visitors;

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A *de facto* household member is a person who stayed in the house on the night before the interview. This definition includes visitors who stayed the previous night but excludes usual residents who did not stay in the house on the previous night, even though they are usual residents and present at the time of the interview.

Some surveys (e.g. MICS) collect data only on the de jure population, while other surveys (e.g. DHS) collect data on both *de jure* and *de facto* populations, and then present results for either population (*but not both combined*), depending on the indicator of interest. For anthropometric indicators, for instance, the *de facto* sample is used. Other surveys collect data only on the *de facto* population. It is recommended that the NSO definition of a household be used in NSO-supported household surveys for the country where the survey is being planned. The sampling statistician and other experts working for the survey can help to identify the optimal definition of household members and should review related questionnaire forms and interviewer instructions to confirm that they are accurate and clear.

Selected definitions for household and household member need to be clearly stated in the sampling plan and survey report. The definition of household should follow criteria issued by national bodies such as NSO and a rationale provided for any deviation from the country standard. Selected definitions are also a key input for calculating correct sample weights, validating the weighted total population and providing transparent data quality reports. The household roster part of the questionnaire and related interview instructions need to allow all eligible persons in the household to be listed in accordance with the selected household member definition (see the model household questionnaire and roster in Annex 3 and “Tools” below for interviewer instructions on *de jure* and *de facto* samples). If household members are not clearly defined and instructions for completing the roster on the household questionnaire are not accurate and clear or, worse still, entirely absent, interviewers may fail to list all eligible household members: this will affect the accuracy of survey results as well as transparency of data quality reporting.

There may be very little difference between *de facto* and *de jure* children: in most surveys, there is a greater than 90% overlap between *de jure* and *de facto* populations (i.e. > 90% of the sampled children will be the same under both definitions). The key point is that the household member definition needs to be clearly expressed in the sampling plan and questionnaires and instructions developed in a manner that enables correct listing of all eligible members for the survey (Note 3).

**NOTE 3: WHAT CAN HAPPEN IF A HOUSEHOLD MEMBER IS NOT DEFINED?**

If the situation in some PSUs does not allow for the mapping and listing exercise to be undertaken by a separate team of listers and mappers, as may be the case in some PSUs with security issues but which remain accessible (and therefore not already excluded from the frame), and the second-stage sampling frame has been developed by the survey interview team just ahead of interviewing, every effort should be made to send the second-stage frame for these PSUs to the central office for a quick review of maps and lists, followed by selection of households to be interviewed at central level. With proper planning and communication, the central office should be able to return the list of selected households to the field team on the same day.

If, however, connectivity issues preclude confirmation of household selection by the central office, then sample households can be selected in the field following a manual listing operation. In this scenario a household selection table can be used by the survey interview team supervisor to identify a systematic random sample of households based on the total number of listed households. Selection of households from the listing by the supervisor should be the exception and not the rule and applies only to a very circumscribed area and not all PSUs (e.g. a PSU with specific security issues which prevented listing during the listing operation but remains accessible for survey interviewing). In this scenario, the survey interview team supervisor should select the sample of households; the interviewers and/or anthropometrists should never be involved in this procedure.
NOTE 4: IF NON-RESPONSE IS EXPECTED TO BE HIGH.

Standard sample weighting procedures generally adjust for non-responses from households and individual children. This approach is based on the assumption that the characteristics of the non-responding households and children are similar to those interviewed. If the non-response rate is expected to be high (e.g. if it was high in a similar previous survey), a structured analytical plan for studying non-responses can be developed. This needs some forward planning before conducting the survey in order to ensure that the same data are collected in the field for non-responding households as for responding households. This allows for estimates of the non-response bias, but it requires information about the number of interview attempts. In surveys where the non-response is expected to be high at either household or individual level, it is useful to collect information for reporting on non-responder characteristics. For non-responding households, such information might entail completing only those parts of the questionnaires that do not require access to the interior of the home or a respondent (roof or wall material of dwelling and type of dwelling, e.g. condo, detached home, slum, etc.). Other environmental information can be gathered from observation of the exterior of the dwelling which ought to bear some relation to household wealth. If such information is obtained for non-responding households, it should be based on skip patterns in the regular questionnaire which allow the interviewer to complete these items based on observation. Collecting the GPS coordinates of non-responding (and responding) households, if permitted in the survey country, may be beneficial as these data can be analysed to determine factors such as the average distance of non-responding households (vs responding households) to major facilities (e.g. average distance to the closest school, closest health facility, etc.). For responding households with eligible children from whom anthropometric measurements could not be obtained, other aspects of the survey questionnaires may provide useful information for reporting on bias and should still be collected (e.g. data on mother’s education, child’s date of birth, etc.). More research is needed on the impact of non-responders on malnutrition estimates.

TIPS

• Clearly define household and household member in the survey sampling plan;
• Ask the sampling statistician and other experts to review the roster part of the questionnaire and related instructions for clarity and accuracy;
• Without a roster listing all eligible household members in line with the selected definition of household member for the survey, it will not be possible to calculate correct sample weights, validate the weighted total population or provide transparent reports on sample implementation and other data quality parameters;
• Where only one child aged under five years is to be randomly selected per household, ensure that the protocol is made available in the interviewer instructions and during training, and also that sample weights have been developed by the sampling statistician based on this design.

TOOLS

• A model household questionnaire including a household roster (Annex 3);
• DHS interviewer instructions (pages 27-32) (de facto and de jure collection);
• MICS supervisor instructions (pages 6-15) (de jure);
• MICS interviewer instructions (pages 16-21) (de jure).

k) Train interviewers and other field personnel to follow the sampling plan and survey methodology

Ensure that field team members are aware of and can follow the sampling plan (households should not be replaced in the field for any reason), perform call-back procedures (a recommended minimum of 2 call-backs at different times of the day if the initial visit did not provide a completed interview) and complete the household questionnaire. It is also important to stress why it is necessary to have a household questionnaire for each sampled household, whether or not the interview was completed; the cover page of the questionnaire also needs to be filled in since it contains data which are crucial for the survey database. Similarly, in all households where questionnaires were completed, a separate questionnaire must be produced for each eligible child, whether or not the interview was completed;
again, the cover page of the questionnaire needs to be filled in since it contains data which are crucial for the survey database. The model questionnaire in Annex 3 and example guides in Table 2 can be used to develop tools and used during interviewer training.

**If only one randomly sampled child is being measured**

Many household surveys sample all children in the age range (i.e. all under-five year olds), in which case all children from the household roster (either de jure or de facto according to the agreed household member definition) under the age of 6 years old have the questionnaire administered and those under 5 years are weighed and measured. Some surveys may opt however to select only one random child under the age of five in the household for anthropometry. In such an event, the sampling statistician should develop the protocol to enable interviewers to implement random selection at the household level and provide appropriate sample weights for analysis of results in step m. Even with this type of subsampling, all eligible children (following the selected definition of household member) need to be recorded in the household roster: this information is needed to develop sample weights and also serves as the basis for selecting a random child.

- It is important to ensure quality of geographic and sample identification codes;
- Geographic information system (GIS) data can support accurate identification of sampled households;
- Do not permit replacement of non-responding households;
- Train field team members to complete a questionnaire for each sampled household to allow for transparent reporting on non-response bias. At minimum, the cover sheet (including information about the number and timing of call backs) needs to be completed for each sampled household. Similarly, an individual child questionnaire needs to be completed for each eligible child on the household roster for households with completed interviews.

**TOOLS**

- Sample household questionnaire including household roster (Annex 3);
- MICS interviewer instructions (pp; 5-7 and 16-21);
- DHS interview instructions (pp; 8-25)
- NHANES interviewer instructions (pp. 1-7 to 1-9 and 3-1 to 3-21).

1) Write a detailed annex on the sample design and sample implementation

Survey reports should include detailed information on the sample and survey characteristics in order to provide a transparent account of how well the sampling and quality control procedures were followed. Clear information should be provided on the interview status of each sample household, indicating reasons for any non-interview (see Chapter 3 sections on data quality and harmonized reporting and Annex 10 for the report checklist). A report and review should also be provided on the interview and anthropometry measurement status of all eligible children from the household roster. A section of the report should include details on sample and survey characteristics like other surveys, e.g. MICS sample plan annex and tabulation plan or Chapter 5 of DHS sampling and household listing manual. If the non-response rate was particularly high, it might be useful to develop a structured analytical plan for studying non-response (see Note 4).

- Report on non-responses for households as a whole in addition to non-responses for anthropometric measurements: the individual response rate is multiplied by the household response rate;
- If the non-response rate was particularly high, it might be useful to develop a structured analytical plan for studying non-response;
- The harmonized reporting recommendations in Chapter 3 should be followed; see also the reporting checklist in Annex 10 to verify that sampling is reported in compliance with standards.
m) Calculate sample weights for households and individuals

It is the task of the sampling statistician to calculate sample weights. Sample weights compensate for different selected variables, adjusting for differential sampling probabilities and even for non-responses, so as to produce representative estimates of the population as a whole.

<table>
<thead>
<tr>
<th>TOOLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MICS Sample Weight Calculation Template (see sampling tools);</td>
</tr>
<tr>
<td>Measure Evaluation Spreadsheet for weight calculation example;</td>
</tr>
<tr>
<td>United Nations Statistics Division: construction and use of sample weights (Chapter 6).</td>
</tr>
</tbody>
</table>

TABLE 2. FAULTY PRACTICES AND HOW TO AVOID THEM WHEN SAMPLING IN AN ANTHROPOMETRIC SURVEY

<table>
<thead>
<tr>
<th>FAULTY PRACTICES</th>
</tr>
</thead>
<tbody>
<tr>
<td>The survey manager develops the sampling plan</td>
</tr>
<tr>
<td>A previous list of households more than a year old is used</td>
</tr>
<tr>
<td>Lists and maps are updated using key informants</td>
</tr>
<tr>
<td>Household mapping and listing and/or household selection along with the survey interview is applied as the rule rather than the exception</td>
</tr>
<tr>
<td>Questionnaire and/or interviewer instructions fail to provide clear household member definition</td>
</tr>
<tr>
<td>Selected households are replaced in the field</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HOW TO AVOID THEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hire an experienced sampling statistician to develop, implement and report on the sampling plan.</td>
</tr>
<tr>
<td>Develop the second-stage sampling frame using the standard protocols outlined in steps g to i.</td>
</tr>
<tr>
<td>Develop the second-stage sampling frame for selected PSUs before each survey using the standard protocols for the mapping and listing operation outlined in steps g to i.</td>
</tr>
<tr>
<td>Plan and implement mapping and listing as a stand-alone operation ahead of survey field work; Arrange for household selection to be conducted at a central level, as outlined in steps g, h and i, noting any exceptions where these steps were not carried out separately.</td>
</tr>
<tr>
<td>Articulate the definition of a household and household member in clear terms early in the planning stages. Ensure that the sampling statistician reviews the household roster and associated interview instructions to check for accuracy and clarity.</td>
</tr>
<tr>
<td>Follow the sampling plan as provided by the central office and do not replace any selected households in the field. Use a blank questionnaire and complete the information identifying each selected household; Document the time at which call-backs are initiated, and if it proves impossible to conduct the interview in spite of the call-back protocol, select the result code signalling why the household was not interviewed, and provide additional explanation if necessary.</td>
</tr>
</tbody>
</table>
1.3. QUESTIONNAIRE DEVELOPMENT

The survey questionnaire is based on a list of the key items of information required to meet survey objectives. A standard paper-printed or computer-based questionnaire helps to ensure that all sampled households are subject to the same visit and call-back procedures, a record is kept of all sampled households (whether interviews are completed or not) and respondents are asked the same questions using the same set of instructions. This enables easy and rapid tabulation of the survey responses. The questionnaire may need to be translated into local languages: it is important that translated questionnaires are back-translated into the original language by another translator and compared to the original questionnaire. Field teams need to be trained in how to use translations appropriately.

Key steps to support the survey planning process

a) Designing or customizing the household and child questionnaires;

b) Developing local event calendars;

c) Pre-testing the questionnaire;

d) Developing the interviewer's manual;

e) Training the survey team.

Brief overview of steps for developing an anthropometric questionnaire

a) Designing or customizing the household and child questionnaires

Two questionnaires—a household and a child questionnaire—are recommended when the aim is to gather data relating only to child anthropometry. The household questionnaire is required in order to establish an outcome for each sampled household (e.g. completed, refused, destroyed, etc.), and where a household interview is duly completed to produce a list of all children under 6 years of age who meet the household member definition. The child questionnaire is used to gather demographic information for children under 6 years of age, and anthropometric data for children under 5 years of age. The reason for collecting demographic information for all children under 6 years of age, and anthropometric data for children under 5 years of age. The reason for collecting demographic information for all children under 5 years of age, and anthropometric data for children under 5 years of age, is to foster inclusion of all under-5 year olds in the anthropometric measurements and assess for out transference of children nearing age 5. However, there are other means of dealing with this issue (e.g. if a survey has a target group for a different questionnaire of 5-17 year olds) and the way in which an individual household survey will deal with this issue may be different. The child questionnaire should be properly designed or adapted from a standard model to facilitate collection of all information required to calculate malnutrition estimates and assess data quality.

Customization (or adaptation) refers to the process of tailoring a standard questionnaire to the population or setting in which a survey is being conducted using established criteria and approaches, while ensuring that indicators derived from the collected data remain globally comparable. When customizing a questionnaire, it is also important that lessons learned from previous data collection activities are properly applied and tools tested whenever feasible before final decisions are made.

Some recommendations for designing or customizing a questionnaire:

1. Give due consideration to the length of the interview, including the oral information and consent process, delivering the questionnaire and time required for the anthropometric assessment. The longer the questionnaire, the higher the risk of interviewee fatigue and erroneous entries (see Note 5).

2. Encourage translation and back-translation of questions into and from the local languages of the survey country.

Recommended standard models for the household questionnaire and child anthropometry questionnaire are presented in Annexes 3 and 4. These questionnaires are based on the MICS standard questionnaires. They have been modified to include specific recommendations for improving data quality when collecting data in the field.

TOOLS

• For customizing see the MICS guidelines on customization of MICS questionnaires;

• For more information on translating and back-translating questionnaires see the DHS Survey Organization Manual 2012, p. 18;

• A model household questionnaire and child anthropometry questionnaire are presented in Annexes 3 and 4.
NOTE 5: QUESTIONNAIRE LENGTH AND INTERVIEW DURATION

A systematic literature review and meta-analysis of health studies reporting response rates and data quality in relation to questionnaire length (Rolstad et al. in 2011) concluded that, in view of the inherently problematic nature of comparing questionnaires of various lengths, it is preferable to base decisions on the use of instruments on questionnaire content rather than length per se (8).

The review indicated that the response rate does not depend on the interview length, but that when participants become tired they pay less attention and respond more quickly, which can have an impact on data quality. This can be an important factor in surveys collecting anthropometry data if the caretaker has to provide information on children's dates of birth using a local events calendar.

b) Developing local events calendars

Proper determination of the child’s age is essential to generate accurate and precise age-related anthropometry indicators (length/height-for-age, weight-for-age). In many countries, vital registration is not universal and documentary evidence of the date of birth may not be available in the household; the actual date of birth may be unknown. In such cases it is necessary to obtain at least the month and year of birth using a local event calendar.

This document describes the concept of using a local events calendar to estimate the child’s month and year of birth rather than estimating the child’s age in months.

Some key points to consider when developing a local events calendar are the following:

− Specify the calendar’s timeline: if data collection lasts more than one month, adding a new month and deleting the last eligible month should be anticipated and discussed when developing the events calendar;
− Local events calendars should NOT include the age in months: they should refer only to calendar months and years, which are then to be recorded in the questionnaire;
− The local events calendar should be tested and adapted based on the outcomes of these tests prior to the survey data collection. When testing, the events calendar should include children whose date of birth is known in order to verify that it functions properly;
− In order to be able to estimate accurately each child’s date of birth, field teams must be properly trained on how to use the local events calendar, during both theoretical training and the field test.

c) Testing the questionnaire

Before the questionnaire is finalized it should be tested for content and length: the different questions asked should gather the requisite information and be easily understood by both interviewers and respondents. Interviews should be carried out during testing, and the questionnaire revised based on responses and comments from the survey teams undertaking the interview.

d) Developing the interviewer’s manual

It is essential that the survey manual include a guide for survey teams undertaking the interviews which provides clear instructions on their roles and responsibilities as well as information on how to identify sampled households, initiate the call-back protocol, identify eligible children, conduct and handle interviews and complete the questionnaires.

For more information on how to develop a local events calendar, see the IFAD/FAO publication (2008) “Guidelines for estimating month and year of birth in young children”.

Tools:
- Instructions for interviewers (MICS);
- DHS Interviewer’s manual.
e) Training the survey team

Training field staff is a vital step in the survey process: accurate and meaningful information can be collected only if interviewers are thoroughly familiar with all the field instructions and procedures. When all the field materials have been prepared and finalized and field staff have been hired, interviewers and supervisors should meet in a central location for joint training in survey procedures, e.g. how to identify sampled households, implement the call-back protocol, identify eligible children, collect data and complete the questionnaire. A methodology for accurate measurement of children's weight and height is an important part of the training. If the actual survey is delayed for more than three weeks following training, a refresher will be required. Further details are provided in the following section (Training).

1.4. TRAINING AND STANDARDIZATION

This section highlights the importance of training and standardizing anthropometrists to support the collection of high quality anthropometric data. Training should be organized and delivered by an expert trainer experienced in undertaking surveys to collect anthropometry data who also has an extensive background in training.

Training for anthropometric data surveys should include:

1. Proper interview techniques: training should include guidance on how to explain to caretakers what their role is in the measurement process and how to handle a child in order to render the experience less traumatic and obtain more accurate data;
2. Practising anthropometric measurements;
3. Standardization exercises: comparing their own measurements to an expert's benchmarks (accuracy) and their own repeat readings (precision);
4. Pilot tests: putting into practice all techniques and field procedures learned during training in a field setting.

Key steps to ensure data quality during training and standardization

a) Organizing the training;
b) Determining the duration and schedule of the training
c) Identifying the content of the training;
d) Implementing the training;
e) Organizing the standardization exercises;
f) Implementing pilot tests in the field.

Brief overview of steps for training and standardization

a) Organizing the training

To assist in the collection of high quality anthropometric measurements, an acknowledged expert anthropometrist trainer should be employed to lead the training (9).

To encourage the collection of accurate data regarding the child's date of birth, sufficient time should be set aside for careful review of the questionnaire and instructions, and if local event calendars are used an additional period of time for practical exercises on their use. Organizing practical demonstrations by skilled anthropometrists can help to demonstrate accurate anthropometric techniques and familiarize trainees with the equipment.

Materials, including dolls and props for practising measurements and data collection forms, etc., should be obtained well ahead of the training. Arrangements should also be made to have a sufficient number of children of different ages present for the hands-on training: the age range of these children should include a sufficient number of infants under 3 months, 3-5 months as well as 6-11 months of age.

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1. The caretaker role should be clearly explained to avoid misinterpretations such as assuming that she is to serve as assistant measurer, which is not recommended.
Training sessions should be provided on how to take anthropometric measurements, fill in the household and child questionnaires, initiate the call-back protocol and other aspects of the survey programme. Fieldwork coordinators and field supervisors should also attend these trainings including on how to identify sampled households and attend separate trainings on use the anthropometry checklist, cluster control forms and other protocols which they are responsible for implementing and supervising.

An additional 15% of anthropometrists should be trained as a small stand-by pool in the event that team members drop out during the standardization exercises or field work.

It is recommended that anthropometry trainers be anthropometrists of demonstrated expertise based on recent experience.

b) Determining the duration and schedule of the training

Training should take place ideally as close as possible to data collection. Its duration depends on the number of trainees, length of the questionnaire, number of working hours per day, etc. The schedule should be flexible enough to allow for a few extra days should trainers decide that the field teams are not yet ready to start the data collection process and need to repeat the standardization exercises. A useful rule of thumb is to have at least one trainer for every 10 trainees. Annex 5 sets out a proposed content for an anthropometry training along with a timetable.

If tablets or mobile devices are to be used for the survey, sufficient time should be set aside during training to ensure field teams handle them appropriately when capturing, saving and sending data to the server, and that built-in quality checks exist (i.e. an acceptability range for a given question).

c) Identifying the content of the training agenda

Another factor that is crucial for collecting high quality anthropometric data is to standardize the training for anthropometrists in surveys using a training manual. This can be adapted from existing standard training manuals in order to serve as a standard operating procedure for the various critical steps before, during and after measurements.

Critical issues which should be considered in the training content are selecting a site in the household for measurements, preparing and positioning of the anthropometric equipment, explaining specific role of the mother, proper handling and positioning of the child during measurement, using and reading the instrument and recording measurements.

For field supervisors/fieldwork coordinators: the training content should draw attention to how the sampling plan should be followed and implemented at the field level, logistic arrangements, methods for calibrating equipment and data checks. Training should include reviews of the sampling plan and anthropometric data quality checks (using field checklists, etc).

For fieldwork coordinators, field supervisors and anthropometrists: training should include guidance on explaining to caretakers their role in the measurement process and how to handle a child in order to render the experience less traumatic and thereby obtain more accurate data. It should also include guidance on techniques for standardizing anthropometric measurements, including how to perform calibration procedures and maintain equipment and procedures for quality assurance.

d) Implementing the training

The proposed training lasts seven days for anthropometrists and eight days for fieldwork coordinators and field supervisors. The overall plan and exact timing of the may vary depending on the target audience and context: the trainer should adapt the suggested agenda to suit participants’ needs. More time may be needed depending on the number of trainees.

The aim of the first day is to provide a survey overview, setting out the objectives and organization of the survey, the role of the survey team and how communities should be approached. Field procedures should be explained including

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how to identify sampled households and participants and conduct the interview in the household. Information should be provided on how to record the questionnaires (household questionnaire and child anthropometry questionnaire). Time should be set aside for providing instruction on accurate determination of the date of birth and using the local events calendar when an official document is not available.

The second day should start with a few theoretical considerations, e.g. finding a spot where the equipment can be set up safely, recognizing different scenarios and settings that might be encountered and calibrating and maintaining the equipment. The theory and background of anthropometric measurements should be introduced before shifting to in-class practice of anthropometric measurements using dolls, along with other items of known dimensions such as sticks. The aim of this session is for trainees to be able to position the child’s body correctly, read measurements accurately and record them properly. It is important to demonstrate examples of good practice and have trainees repeat the exercise. This also applies to data recording (paper and electronic).

Some advice should also be provided on how to avoid common field errors in anthropometric measurements, and on correct data entry.

Following this theoretical introduction, the next couple of days should be given over to hands-on anthropometric measurement exercises on children. A sufficient number of children of different ages, none of whom should be ill, should be recruited for these exercises. The duration of this section will depend on the experience of the anthropometrists. Since special attention should be paid to measuring the length of children below 2 years of age, a number of infants aged < 3 months, 3-5 months and 6-11 months should be present for anthropometric measurement. Different age groups of infants have unique challenges and need to be handled differently from older children and anthropometrists should be coached in the appropriate techniques to put them in the correct position. A sufficient amount of time should be set aside for explaining to anthropometrists how to handle children gently when taking measurements and explain the measurements to the caretaker so that their assistance can be sought to calm the child if necessary.

When the anthropometrists are ready, a first series of standardization exercises can be organized. If the anthropometrists fail this test, retraining should be organized and followed up by a second series of standardization exercises prior to pilot tests in the field.

For field supervisors and fieldwork coordinators, an extra day of training is recommended. The content of this extra day should include clear instructions on how to organize supervisory activities and perform checks in the field to ensure that procedures are being followed. Additional guidance should be provided on communication flows between the central office and survey teams. More details can be found in the section 2.4 on Quality Assurance during data collection in Chapter 2.

**Hands-on training for measuring length in young infants:** special attention should be given in the training for measuring length in children below 2 years of age: ideally infants under 3 months, 3-5 months and 6-11 months of age should be present for the practical sessions since taking measurements in each of these sub-age groups has unique challenges and all measurers should have practice on different sub age groups;

**Anthropometrists should practice on dolls before they practise on children, and before they take part in the standardization exercises. They can also do elementary practice exercises with other items such as sticks of known length.**

e) Organizing the standardization exercises (days 4 and 5 in Annex 5)

All survey team members serving as “main measurer” anthropometrists during fieldwork are required to undergo and pass the standardization exercises. An “assistant measurer” cannot act as the “main measurer”, even if this proves necessary during field work, without passing the standardization exercise. In the standardization exercise, the main measurer needs to work with an assistant measurer, ideally someone who is going to take on the role of “assistant measurer” for the survey field work. It is recommended that no more than ten main measurers be standardized per standardization exercise (9). **A minimum of a half-day** is required to complete each standardization exercise. Accordingly, **two half-days should be set aside for standardization in the training agenda.** This should allow enough time to carry out the first standardization exercise, retraining of those who performed poorly in the first exercise, and organization

7 Refer to Annex 2 for job descriptions for “main measurer” and “assistant measurer”
of a second standardization exercise for those retrained to give them another chance to pass the standardization test. Depending on the number of anthropometrists required for field work, several standardization exercises will have to be performed in parallel or sequentially, thus adding extra days to the training agenda.

The standardization exercises allows a quantitative method to be applied for assessing whether teams can measure accurately and precisely under ideal situations. The exercise also serves as an opportunity for demonstrating to anthropometrists the importance and rigour they should apply to measurements in the field when conditions become more difficult. It enables the trainer to observe each trainee’s performance in a systematic manner and evaluate measurement techniques.

Standardization exercises for measuring length/height are essential in view of the challenges faced in accurately taking measurements, especially in children aged under 5 years. Since survey teams often perceive measuring weight to be a straightforward measurement, whenever feasible weight can also serve as part of the standardization exercise in order to correct this misperception. One of the outcomes of training should be to make it clear to teams that errors in weight measurement can have even more impact on quality than errors in height measurement. However, since the weight of children can potentially vary during the standardization exercise and is time consuming, the use of weight measurement to evaluate anthropometrist performance is not required.

The standardization exercise should ideally take place in a calm location, preferably at the training location with subjects recruited from a nearby community. When organizing the standardization exercise, local transport and incentives should be provided (either monetary or in-kind), and practical considerations should be planned for (e.g. healthy snacks, extra diapers, water for children and their caretakers). Decisions on the type of incentives provided should be context specific.

An anthropometric measurement standardization exercise requires a minimum of 10 children under 5 years of age who should be measured twice by each measurer; half of these children should be under the age of 2 years. It is recommended that additional children be recruited for every standardization exercise and remain for the duration of the exercise in the event that a child has to be removed from the exercise while it is ongoing. When a child has been replaced by another, all anthropometrists as well as the expert anthropometrist (who serves as the benchmark) have to measure the new child twice and discard any data recorded for the previous child. A caretaker should accompany and remain with the child during the entire exercise.

It is recommended to keep the children and their caretakers at a fixed station with their own set of anthropometric equipment and rotate the trainees from station to station. The trainees can rotate clockwise or counter clockwise. Alternatively, the trainees can move to any open station as long as they confirm they are recording the measurements for the correct child in their form. Figure 2 provides an illustrative example of how a standardization exercise can be arranged. The anthropometrist undergoing the standardizing exercise should measure at least 10 children (aided by the other person serving as “assistant measurer”) and then re-measure the same children a second time without being able to consult the results of the first measurement. An expert anthropometrist (usually the trainer) should undergo the same procedure in order to serve as the benchmark or reference. A break is recommended based on judgement call or when the child and caretakers need it.

Different sets of at least 10 children should be prepared for each group of 10 main measurers in order to avoid overstressing the children (even if the standardization exercise is planned for a different group of measurers on another day).

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8 Half the children should be aged under two years and the other half over two years since the standardization exercises should include children at ages similar to those measured in the field and determining the technical error of measurement to define what constitutes passing a standardization exercise (as described below) is based on the average technical error of measurement for length and height derived from this source: Reliability of anthropometric measurements in the WHO Multicentre Growth Reference Study. WHO Multicentre Growth Reference Study Group. Acta Paediatrica Suppl 450: 2006. p. 43 [http://www.who.int/childgrowth/standards/Reliability_anthro.pdf?ua=1]
For each anthropometrist undergoing standardization, precision is calculated by comparing the difference between the first and second reading. Accuracy, by contrast, is calculated by averaging the anthropometrist’s first and second readings and comparing the absolute difference between this average measurement and the benchmark measurement of the expert anthropometrist. Because the expert anthropometrist’s reading serves as the reference or “gold standard” value for accuracy in the standardization exercise, the expert anthropometrist must have demonstrated the ability to obtain precise and accurate measurements in order to take on this role.

The technical error of measurement (TEM), which is defined as the square root of measurement error variance, is an indicator used to assess precision and accuracy in anthropometry.

\[ TEM = \sqrt{\frac{\sum D^2}{2N}} \]

where \( D \) is the absolute difference between measurements from the same individual and \( N \) equals the total number of subjects being measured. \( D \) can either be the absolute difference between the first and second measurement made by the same trainee (precision) or the difference between the readings of the expert anthropometrist and trainee (accuracy).

It is recommended that acceptable TEM cut-offs for length/height be set at TEM < 0.6 cm and < 0.8 cm for precision and accuracy, respectively. These criteria applied to pass a standardization exercise for length/height measurement are based on precision and accuracy (see Note 6). If the expert anthropometrist’s precision TEM is ≥ 0.4 cm during the standardization exercise, his or her measurements cannot serve as reference values. In such cases, the criterion for trainee anthropometrists passing a standardization exercise must be based on precision alone. The accuracy of the individual trainee anthropometrist should not be assessed by using the mean for all anthropometrists participating in the standardization exercise because anthropometrists have been found to have consistently lower length/height values compared to benchmarks in WHO MGRS. Further research is needed on the use of the anthropometrists’ mean before this approach can be adopted.

Notes to Figure 2: a) the expert anthropometrist measures each child twice; b) the “main measurer” anthropometrist measures each child twice; and c) although there may be fewer than 10 teams measuring children, there should always be 10 children in the standardization exercise along with some additional children in the event that replacements are required.
NOTE 6: HOW CUT-OFF TEMS FOR THE STANDARDIZATION EXERCISE WERE DEVELOPED

The proposed acceptable length/height TEM cut-offs of < 0.6 cm for precision and < 0.8 cm for accuracy were derived by first obtaining the average intra-observer TEM (precision) using data from all field workers’ standardization exercises (initial and bimonthly) conducted at WHO Multicentre Growth Reference Study sites. Length and height TEMs were reported separately for each study site and thus had been averaged to obtain a mean TEM value combining length and height in all study sites. The resulting TEM was 0.3 cm across all MGRS study sites, equivalent to the expert TEM at the MGRS. Following MGRS procedures, intra-observer TEM was then multiplied by 2 for precision and 2.8 for accuracy to allow for a 95% margin of error when deriving acceptable TEM cut-offs (10).

To substantiate whether the acceptable cut-offs for precision and accuracy as described above were feasible in the field, a review was undertaken using data from five large-scale surveys in which a total of 11 standardization exercises had been conducted (10). An average failure rate of 25% was found for precision and accuracy, using a TEM of 0.6 and 0.8 cm, respectively. In these five surveys there was a wide variation in the failure rate between surveys: the poorest performing teams were reported to have had limited practice on children prior to the exercise. As more standardization results from surveys become available, more reliable information will be forthcoming on the anticipated number of individuals who need to undertake a re-standardization exercise. For the time being, failure rates may be expected to vary depending on the setting.

The acceptable length/height TEM cut-off for the “benchmark” or “reference” anthropometrist obtained during the standardization exercise to allow calculation of trainee anthropometrists’ accuracy was also based on WHO Multicentre Growth Reference Study sites (10). The value selected is the mid-point between the experts’ TEM and the TEM of the trained anthropometrists for precision of < 0.4 cm.

After the standardization exercise has been completed, the trainer should present the results of the standardization exercise and discuss observations with the trainees. Trainees with the most precise and accurate results should be selected as “main measurers” for survey data collection. If an insufficient number of trainees demonstrate an acceptable performance level in the standardization exercise, further training should be provided on anthropometric measurement techniques and the standardization exercise repeated before the individual anthropometrists are allowed to collect anthropometry data in the field. Outcomes for the standardization exercise should be included in survey reports to help data users have a better understanding of the quality of the anthropometry data.

**TIPS**

- Allocate adequate time to recruit and prepare children and their caretakers for the standardization exercises;
- It is important to consider the welfare of the children when organizing and planning the standardization procedure as it is a repetitive and tiring exercise. Small toys, games or a separate area for children to play should be provided while they wait to go to the area used for the standardization exercises.

**TOOLS**

- [DHS Height Standardization tool](Annex 13)

f) Setting up pilot tests in the field

One-day pilot testing in the field is essential for each team. This should be arranged immediately after the training and once a sufficient number of main measurers have passed the standardization exercises. Pilot testing enables main measurer anthropometrists selected for fieldwork to put into practice all the techniques and procedures they have learned in the course of their training, and for their competency to be tested in a field setting. This is the final

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10 Personal communication with Sorrel Namaste
opportunity for the survey manager to rectify any misunderstandings about the survey procedures before actual survey data collection begins.

### TABLE 3. FAULTY PRACTICES DURING THE TRAINING OR STANDARDIZATION EXERCISES FOR ANTHROPOMETRY DATA COLLECTION SURVEYS AND HOW TO AVOID THEM

<table>
<thead>
<tr>
<th>△ FAULTY PRACTICES</th>
<th>✅ HOW TO AVOID THEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rushed or too little time for training</td>
<td>• Define a clear timeline which allows a set amount of time for training and review of the standardization exercise outcome (e.g. seven days for anthropometrists and eight days for fieldwork coordinators and field supervisors: see Annex 5).</td>
</tr>
<tr>
<td>Not enough training</td>
<td>• Do not assume that if the members of the survey team have been trained once they will remember everything;</td>
</tr>
<tr>
<td>No standardization exercise organized for “main measurer” anthropometrists</td>
<td>• Conduct a standardization exercise with at least 10 children measured twice by the main measurer trainee in order to assess the measurer ability to obtain quality of measurements;</td>
</tr>
<tr>
<td>Rushed or too little time for the standardization exercise</td>
<td>• Define a clear timeline which allows a half-day for each standardization exercise; and plan for a second half-day should poor results from the first test require a further standardization exercise;</td>
</tr>
<tr>
<td>Unhealthy or ill under 5-year-olds being used for the standardization exercise or insufficient number of children 0 to &lt;2 years and 2-5 years recruited</td>
<td>• Provide full information to local community leaders of neighboring villages about the criteria for choosing children to participate in the standardization exercise.</td>
</tr>
<tr>
<td>Standardization test in a noisy or busy environment</td>
<td>• Choose a location where children will feel at ease with their caretakers with plenty of shade and adequately spaced stations.</td>
</tr>
<tr>
<td>Too many trainees participating in the standardization exercises</td>
<td>• Plan standardization exercises carefully if there is a large number of trainee anthropometrists (parallel or sequential sessions for groups of 10 anthropometrists) so that every anthropometrist can measure 10 children twice.</td>
</tr>
<tr>
<td>Unable to find a “lead anthropometrist trainer” for training and standardization</td>
<td>• Once a survey has been confirmed, start searching to find a locally experienced anthropometrist who can act as “lead anthropometrist trainer”.</td>
</tr>
</tbody>
</table>
Faulty Practices

Not enough time spent practising anthropometric measurements
• Include at least a day for trainee anthropometrists to practise with dolls and other objects (e.g. sticks) and at least a day for hands-on training with children.

Lack of diversity in the age group of young infants present for training and standardization
• Make every effort to ensure that children attending practical training sessions include a number of children (at least two to three) aged less than 3 months, 3–5 months and 6–11 months: each age group has unique challenges and practice essential to ensure a reliable measurement.

Anthropometrists not trained because they are considered “experienced” enough
• If you are planning a survey, organize training for all anthropometrists regardless of prior experience. Include a session on how to handle children gently and explain measurements to the caretaker so that additional assistance in calming the child can be sought if needed.

1.5. Equipment

This section provides a description of the equipment recommended for anthropometric measurements (weight, length/height) that is to be of sufficient precision and accuracy. For surveys which are conducted in settings where transport by carrying is not required, or extreme conditions in transport will not be encountered, the equipment briefly described in the NHANES Anthropometry Procedures Manual would be recommended.

For field conditions requiring robust and resilient equipment, please see the minimum product requirements below. Reuse of anthropometric equipment is not recommended (see Note 7). If the equipment proves to be faulty, it should be replaced immediately.

Minimum recommended requirements are:

**Portable weighing scale for children 0–4 years old**

The following specifications pertain to surveys where transport of weighing and measuring equipment requires transport over rough terrain and variable weather patterns, and involves individuals carrying the equipment from house to house, often walking for hours.

**Minimum recommended product specifications:**

− Digital weighing scale (hanging spring-type or bathroom scales are not recommended since they are not accurate enough);
− A high-quality scale specifically designed for anthropometric measurements;
− Adult/child scale; weighing up to 150 kg with 100 g graduations; This scale allows child's weight to be measured while it is being held by an adult through use of a tare function;
− Battery-powered equipment; Replacement batteries should be provided with the equipment; A solar-powered scale can be used in settings where the light intensity is sufficient to operate the device and as a back-up for a battery-powered scale;
− Measuring range: 0 to no less than 150 kg;
− Graduation: 100 g minimum;

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- Accuracy: better than ± 0.15% / ± 100 g;
- Portability: defined as a maximum weight of 4.0 kg (including batteries) and maximum dimensions of 360 mm length, 400 mm width and 70 mm height;
- Taring: the device should allow taring without the need to bend over (e.g.; taring can be done using kick-off buttons which can be activated by foot12);
- The main on/off button should not serve any other purpose and have a feature to prevent accidental switching on or off and should be easily accessible on the top or side of the scale;
- The base of the scale should be fitted with adjustable feet so that it can be stabilized if it is set up on an uneven floor.
- Operating conditions: the scale must be hard-wearing to meet a range of operating conditions which include all kinds of climactic conditions (heat, cold, humidity, dryness, light, dust and moisture) as well as modes of transportation and terrain (e.g. vehicular or personal transport over sometimes bumpy and difficult terrain).

Testing:
- The scale must be able to function with required accuracy after application of the following conditions for a minimum of 72 hours:
  - Operation temperature: minimum range 0°C to 45°C;
  - Storage temperature: minimum range -20°C to 65°C;
  - Humidity: 80% at 40°C;
  - Light: 100% illumination at 40°C;
  - Corrosion: 80% at 40°C;
  - Dust: IP5x degree of protection testing.

- The scale must comply with the following International Protection Rating (IP) and IK codes:
  - IP5x regarding degree of protection testing against dust according to IEC 60529;
  - IPx3 regarding degree of protection testing against spraying water according to IEC 60529;
  - IK09 regarding degree of protection testing against external mechanical impacts according to IEC 62262;
  - complies with the immunity requirement of EN 60601-1-2 and OIML R76-1 against electrostatic discharge (EN 61000-4-2), radiated, radio-frequency electromagnetic field (EN 61000-4-3), electrical fast transient/burst (EN6100-4-4), surges (EN 61000-4-5), conducted disturbances, induced by radio frequency fields (EN 61000-4-6) and voltage dips, short interruptions and voltage variations.

- Warranty: the set of scales should be purchased with a warranty for a minimum period of two years dating from the time of purchase which displays contact information and local service locations (when available) for repair and recalibration.

### Portable length/height measuring board for children 0–4 years old

A portable infant/child measuring board should provide accurate and reliable length/height measurements of human subjects (infants as well as children up to 5 years of age), be safe for subjects being measured, transportable over long distances by a single person and sturdy under field conditions with rough terrain and variable weather patterns.

**Minimum recommended product specifications:**
- A flat board with an attached metric rule in the form of a fixed and stable tape which is easy to read;
- Units of measure on the tape: centimetres, with numbering for every centimetre increment;
- Smallest graduation: 0.1 cm (i.e; showing millimetre increments): a separate line should indicate each millimetre increment with a longer line indicating the 5 mm midpoint;
- Measurement range: 0–135 cm (minimum)
- Accuracy: ± 0.2 cm (2 mm);
- Precision: ± 0.2 cm (2 mm);

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1 The reason that the specification recommends not requiring the measurer to bend over is because a measurer who is directly at the foot of the person being weighed may cause the subject discomfort especially in some settings.
Moveable measurement piece: an easily moveable measuring slide or wedge which glides smoothly over the length of the apparatus and is lockable or has a friction feature to avoid reading parallax and assure accurate and precise measurement; It should have a maximum wobble of 0.2 cm over the full length of the device, allowing repeated accurate readings;

Able to measure length (in a horizontal position) and height (in a vertical position); For length (horizontal position), it should have an immovable headpiece at a right angle to the tape and a moveable footpiece perpendicular to the tape; For height (vertical position), it should have an immovable footpiece at a right angle to the tape and a movable headpiece perpendicular to the tape;

Board width: approximately 25 cm; The foot-piece needs to be wide enough to provide a stable base for the people to stand on it for height measurement, but not excessively wide so as to allow easy transportation; This is an important factor since a common weak point in portable measuring boards is a small base: this may make the apparatus unstable or prevent it being fully perpendicular to the floor;

The base of the board should be fitted with adjustable feet so that it can be stabilized if it is set up on an uneven floor;

Material: contact surfaces should be smooth and easy to clean using a damp cloth and non-toxic disinfectant; Equipment with a rough surface or unsealed joints and crevices cannot be cleaned and is not suitable;

Operating conditions: the measuring board must be hard-wearing to meet diverse operating conditions which include all kinds of climactic conditions (heat, cold, humidity, dryness, dust and moisture), modes of transportation and terrain (e.g. vehicular or personal transport over sometimes bumpy and difficult terrain);

Portability: a single adult should be able to carry the measuring board and the scale over a long distance (walking for up to an hour);

Desirable: a numerical output (e.g. digital reader) with auto download capability. In the case of a digital device, the testing and compliance ratings noted under the weighing scale specifications would need to be included.

**Calibration and maintenance**

Calibration should be performed as soon as the equipment is purchased, and the procedure repeated during fieldwork (see the section 2.2 on Interview and measurements for details on the calibration and standardization of anthropometric equipment and Annex 6).

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**NOTE 7: RECOMMENDATION TO AVOID REUSING ANTHROPOMETRIC EQUIPMENT**

Reuse of anthropometric equipment, especially if extensively used in previous large-scale surveys (e.g. DHS or MICS), is not recommended. If the purchase of new scales is not feasible, the used equipment should be recalibrated by the manufacturer before reuse. In this event, the used equipment should be dispatched to the manufacturer for recalibration before return to the country in question with a warranty that the equipment has been properly recalibrated to its original standard. Regarding length/height boards, it is sometimes difficult to notice small defects due to the wear and tear that make them unstable; it should also be borne in mind that wood expands and contracts depending on climate, and that this phenomenon may produce inconsistent variations in measurement. In this event, regular calibration exercises should be performed on the device (e.g. measuring sticks of different known lengths to test if the apparatus is reliable over its entire length). It is also very important to verify the condition of the measuring tape on the height board: it should be intact, attached over its full length to the board and display visible gradation marks, etc. These types of variations may go unnoticed especially if new and old equipment is used in tandem. **Reuse of any anthropometric equipment is therefore not recommended.**
SUMMARY OF RECOMMENDATIONS AND BEST PRACTICES

Section 1.1 - PLANNING

Recommendations (must)
- Expert on anthropometry to be part of survey steering committee;
- Bilateral pitting oedema assessment is not recommended as a standard protocol;
- Determine whether other surveys are planned in similar timeframe to avoid duplication;
- UNICEF and WHO recommend that all national surveys undergo for ethical approval, either by national committees or international ones when national committees are not available;
- At least two trained anthropometrists (including one main measurer who passes the standardization exercise) should be planned per field team.

Good practices (optional)
- Use computer-assisted data collection technology to improve data quality and facilitate data sharing;
- A survey manual should be prepared to include clear data collection procedures;
- The team implementing the survey should sign an agreement with the government requiring release of raw datasets to the public;
- Allocate sufficient time for recruiting personnel;
- Include all children aged 0-71 months in the household questionnaire as well as the child questionnaire (to avoid losing children close to 59 months) then include only those aged 0-59 months for measurements; alternatively have a means of assessing out-transference of children close to 5 years of age.

Section 1.2 - SAMPLING

Recommendations (must)
Follow the 13 steps in section 1.2, some key points follow:
- Hire a sampling statistician to develop and oversee implementation of the sampling plan and on its reporting;
- All PSUs and households should be included within the frame: do not select specific groups (e.g. citizens but exclude non-citizens) if the aim is to report on progress towards SDGs and WHA targets which aim to leave no one behind;
- Select PSUs using a randomized scientific sampling method that allows all PSUs a probability of selection that is proportional to their size (probability proportional to size or PPS) within each stratum;
- Employ the National Statistic Office to select PSUs through systematic PPS sampling using the national frame recognized (e.g. census frame) for first stage;
- Conduct the listing and mapping operation using a specially trained team that works independently of the survey interview process using standard protocols for planning, training, implementation and field and central checks;
- Draw the sample of households to be interviewed at central office (only at field level in extreme cases in select PSUs);
- Never replace sampled PSUs or households at field level as this can have implications in the sampling representativeness;
- Use the National Statistics Office definition of “household” and clearly define household member and included related details in the survey report;
- Include detailed information on the sample and survey characteristics in the survey report using MICS and DHS sampling annexes as an example.

Good practices (optional)
- If the National Statistic Office is not able to do it, then the sampling statistician should select PSUs through systematic PPS sampling using the national frame recognized (e.g. census frame) for first stage;
Determining the sample size needed to achieve a statistically significant difference between only two-time points is not recommended, unless the expected difference in prevalence is large enough not to impose a major increase in sample size requirements.

Section 1.3 – QUESTIONNAIRE

Recommendations (must)
- Use a separate questionnaire for each sampled household (household questionnaire) and each eligible child (anthropometry questionnaire);
- One household questionnaire must be filled for each sampled household and include a full list of household members, following the definition agreed on “household member”;
- Record the time and date or all call-backs on the household questionnaire for the requisite 2 call backs;
- Use one questionnaire for anthropometry for each child under 6 years of age but undertake weight and length/height measurements only for children under 5 years of age;
- The date of birth should be determined using an official certificate; Only when this is not available, an event calendar should be used to identify at least the month and year of birth;
- Do not record the age in months on the questionnaire.

Good practices (optional)
- Follow the model questionnaire for anthropometry in Annex 4 which includes instructions to prompt correct measurement position and space to record the reason if the measurement is taken in alternate position. Also includes space to record if the child is not undressed to the minimum

Section 1.4 – TRAINING AND STANDARDIZATION

Recommendations (must)
- The trainer for anthropometry must have demonstrated expertise based on recent experience;
- Special attention should be given in the training for measuring length in children below 2 years of age: infants under 3 months, 3 to 5 months as well as 6 to 11 months of age should be present for the practical sessions since taking measurements in each of these sub-age groups requires different techniques
- The standardization exercises is recommended for height/length measurement only;
- Ten children (half under 2 years of age and half 2-5 years of age) are required for the standardization exercise per 10 main measurers; a new set of children is needed per standardization exercise;
- Use TEM cut offs of <0.6 cm for precision and < 0.8 cm for accuracy to pass the standardization exercise when assessing anthropometrist performance;
- If the expert anthropometrist’s precision TEM ≥ 0.4 cm, he/she cannot serve as reference and can only assess main measurers against precision;
- If an insufficient number of trainees demonstrate an acceptable performance level in the standardization exercise, further training should be provided on anthropometric measurement techniques and the standardization exercise repeated;
- One-day pilot testing in the field is essential for each team, immediately after the training and standardization;
- Budget half a day to standardize a group of up to 10 measurers plus extra half day in case of need to standardize (with time to provide re-training between the exercises);
- Results of the standardization exercise should be provided in the survey report.

Good practices (optional):
- Training should take place ideally as close as possible to data collection;
- Have at least one trainer for every 10 trainees for anthropometry;
- Anthropometrists should practise on dolls before they practise on children, and before they take part in the standardization exercises; They can also do elementary practice exercises with other items such as sticks of known length;
- For field supervisors and fieldwork coordinators, an extra day of training is recommended. In addition to other training topics for supervisors and fieldwork coordinators, training on use of the anthropometry checklist should be provided.
For the standardization exercises:
- recruit additional children in case any have to stop during the test;
- keep child and caretaker at one station with measurers rotating

Section 1.5 – EQUIPMENT

Recommendations (must)
For weight:
- Portable with taring function;
- “hard wearing” with specifications related to dust and moisture permeability;
- Precision better than ± 0.15 % / ± 100 g across entire 0-150 kg load range Base fitted with adjustable feet;
- The scale must comply with the required International Protection Rating (IP) and IK codes.

For length/height:
- Accuracy: 2 mm; Precision: 2 mm; Graduation with demarcations at every 1 and 5 mm and numbers at every 1 cm

Good practices (optional):
- Desirable: auto data download;
- Warranty: the set of scales should be purchased with a warranty for a minimum period of two years dating from the time of purchase which displays contact information and local service locations (when available) for repair and recalibration.