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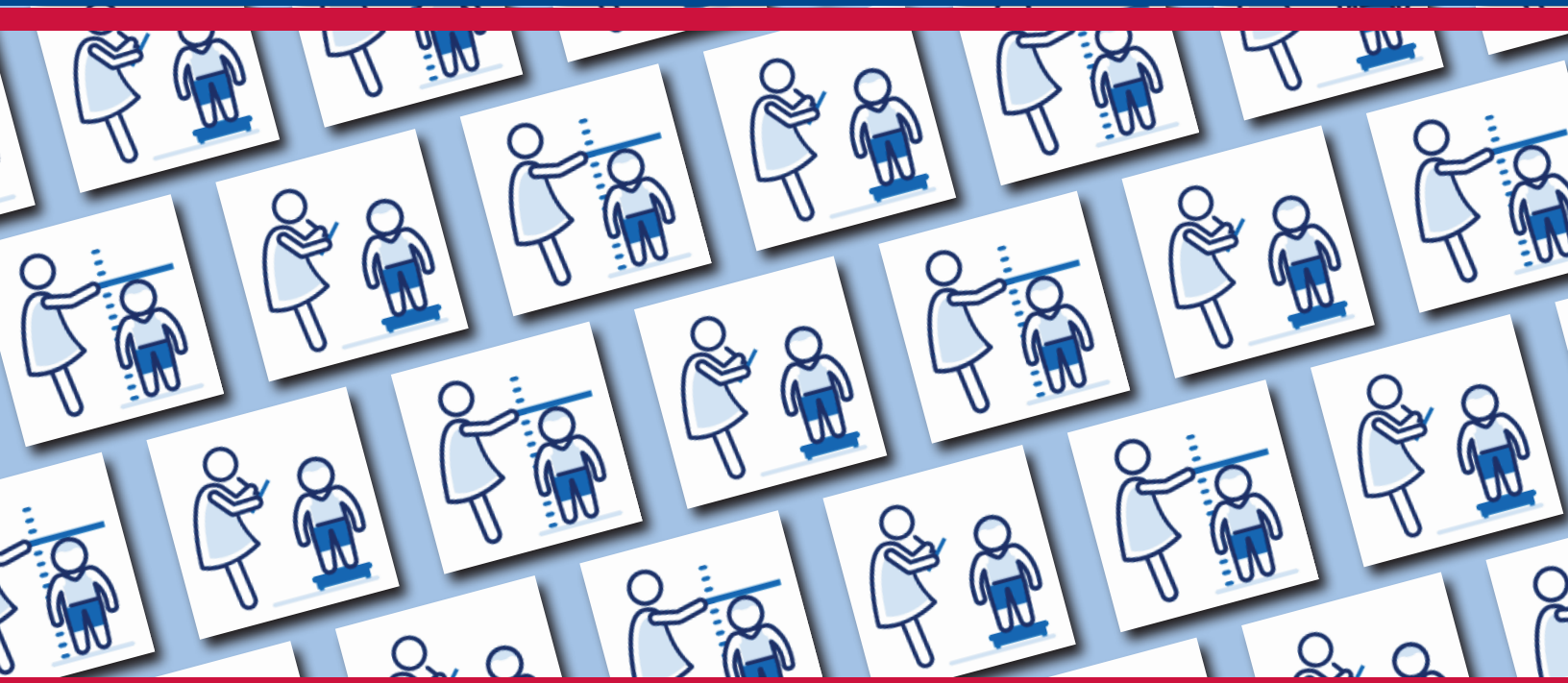
IMPLEMENTATION LESSONS FROM ANTHROPOMETRY: DATA QUALITY PROCEDURES IN DHS SURVEYS



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Implementation Lessons from Anthropometry: Data Quality Procedures in DHS Surveys

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PREFACE

The Demographic and Health Surveys (DHS) Program is one of the principal sources of international data on fertility, family planning, maternal and child health, nutrition, mortality, environmental health, HIV/AIDS, malaria, and provision of health services.

Occasionally DHS is able to supplement surveys with qualitative data collection and analysis to answer specific questions that are better explored using qualitative or mixed method approaches. Such research can also help clarify the interpretation of some complex indicators and improve understanding of measurement issues in DHS surveys. Results from these qualitative studies are made available in the DHS Qualitative Research Studies series.

The topics in this series are selected by The DHS Program in consultation with the U.S. Agency for International Development.

It is hoped that the DHS Qualitative Research Studies will be useful to researchers, policymakers, and survey specialists, particularly those engaged in work in low- and middle-income countries.

Sunita Kishor
Director, The DHS Program

ABSTRACT

Anthropometric data collection at The Demographic and Health Surveys (DHS) Program includes both standardization exercises and child remeasurement, but the settings in which surveys are implemented can affect the quality of anthropometric data. This qualitative study was conducted to understand the elements that foster or hinder the success of current procedures. Semi-structured interviews with (1) 12 staff and consultants from The DHS Program and (2) 17 implementing agency staff from the 2023 Jordan Population and Family Health Survey were conducted. Three observations of child remeasurement were also conducted in Jordan.

Study results suggest that recruiting children works best if implementing agencies know how many children will be required and provide sufficient stipends to caretakers. Working with community organizers, health centers, or the Ministry of Health can help with recruitment. Other factors that may affect the success of training and standardization include location, length of training, age of equipment, size of venue, number of trainers, whether trainees practice on both easy- and difficult-to-measure children, and how well interviewers and technicians communicate during fieldwork practice. Informants suggested alternative approaches to standardization (such as fewer children in the room at the same time) and ways to minimize children's discomfort (such as singing rhymes and avoiding measurements during nap time). Although most trainees pass standardization exercises, incorrect reading of measurements, lack of coordination between measurers and assistants, and children's hairstyles were given as possible reasons for failure.

Many informants thought that remeasurement improves data quality and overall, informants agreed that the computer-assisted personal interviewing program for remeasurement works well. However, responses were mixed regarding the fieldwork component of remeasurement. Reported challenges included difficulty returning to households, pressure to complete remeasurements quickly, and rare gaming practices (such as copying original measurements instead of remeasuring). Results also showed a need for strengthening the use of field check tables to monitor remeasurement data quality.

Many of the study recommendations are already being implemented or will be addressed as part of The DHS Program's commitment to collecting quality anthropometric data in surveys.

Key words: anthropometry, standardization, remeasurement, data quality

ACRONYMS AND ABBREVIATIONS

DHS	Demographic and Health Survey
JPFHS	Jordan Population and Family Health Survey
SDG	Sustainable Development Goals
UNICEF	United Nations Children's Fund
WHO	World Health Organization

1 INTRODUCTION

The DHS Program has been a leading source of anthropometric data for nearly 40 years, collecting height/length and weight measurements from children, women and, in some surveys, men. Accurate anthropometric data enable countries to make data-driven decisions and to monitor their progress in improving nutritional status and achieving the Sustainable Development Goals (SDGs).

The DHS Program is committed to producing high-quality data and has several new and updated procedures to improve anthropometry data quality in surveys.[1] Many of these procedures align with the 2019 WHO-UNICEF recommendations on anthropometry data collection among children under age 5.[2] Taking anthropometric measurements of young children is especially challenging, and two key procedures included in DHS surveys are standardization exercises during fieldworker training and remeasurement of children during fieldwork.

Since late DHS-7 (circa 2018), DHS surveys have included standardization exercises and child remeasurement, and both of these have presented opportunities to learn more about how the procedures are implemented. Implementation research helps to unpack the "black box" to better understand the results of a project.[3] While standardization exercises and child remeasurement are standard procedures in DHS surveys, surveys are implemented in a variety of settings, and these settings can impact anthropometry data quality in different ways. This research, therefore, presents a first look at implementation considerations for standardization exercises and child remeasurement in DHS surveys. The aim is to understand elements that foster or hinder the success of these procedures and the intent is to inform these processes in future DHS surveys.

2 METHODS

The study was conducted in two phases.

In phase 1, surveys between 2018 and 2022 that implemented standardization and child remeasurement procedures were systematically identified (Table 1). Key informants included staff or consultants from The DHS Program who were involved in or responsible for the implementation of standardization or the child remeasurement procedures. Key informants were contacted via email to request interviews.

Table 1 Surveys implementing standardization and remeasurement, 2018–22

Côte d'Ivoire 2021
Burkina Faso 2021
Gambia 2019–20
Kenya 2022
Liberia 2019–20
Mauritania 2019–21
Nigeria 2018
Rwanda 2019–20
Sierra Leone 2019
Nepal 2022

In phase 2, key informants were drawn from implementing agency staff and from data collectors who were responsible for or who had performed the remeasurement procedures as part of the 2023 Jordan Population and Family Health Survey (JPFHS). The survey was selected because it was midway through data collection, and so key informants were well experienced with the remeasurement procedures, and because the previous JPFHS survey excluded children's anthropometric data because of data quality concerns.[4]

In both phases, a semi-structured interview guide focused on the informants' perspectives of implementation successes and on the challenges of the standardization exercises and of the child remeasurement (Appendix I). In addition, in phase 2 an observation protocol for fieldwork in Jordan was used (Appendix I). Interviews were conducted virtually (phase 1) and in person (phase 2) in English by Rukundo Benedict of The DHS Program. In Jordan, an interpreter conducted simultaneous English and Arabic translations. The interviews were audio recorded and written notes were taken.

A codebook, based on the interview guide, was developed beforehand. Interview notes were entered into the qualitative data analysis tool, Taguette, and coding and content analysis were conducted iteratively.[5] Audio transcripts were also reviewed and quotes extracted.

The interviewer obtained verbal informed consent from the key informants prior to data collection. In reporting results, no statements are attributed to individuals, although the key informants agreed to their names being listed in the report's appendix. The ICF Institutional Review Board determined that this research was not considered human subjects research as defined by the regulations.

In this report, "informant" refers to those interviewed for this study.

3 FINDINGS

3.1 Key Informants

A total of 12 informants were interviewed in phase 1 (Appendix II). Phase 1 informants included 10 DHS program staff and two biomarker South-to-South consultants. Educational attainment was high, with 27% having a doctorate and 83% a master's or professional degree. The median number of years of survey experience was 18 (range: 2 to 43), and the median number of years of experience supporting the collection of anthropometric data was 15 (range: 1 to 36). The types of experience included training on anthropometry, monitoring anthropometric data collection, developing data collection applications, and processing and analyzing anthropometric data.

A total of 17 informants were interviewed in phase 2, and three observations of remeasurement were conducted. Phase 2 informants included four senior implementing agency staff, seven biomarker technicians, and six field team supervisors. Educational attainment ranged from diplomas (71%) to higher diplomas/bachelor's and master's degrees in various fields (29%). For the majority of biomarker technicians and team supervisors (85%), this was their first experience with survey work, while the experience of implementing agency staff ranged from 10 to 20 years.

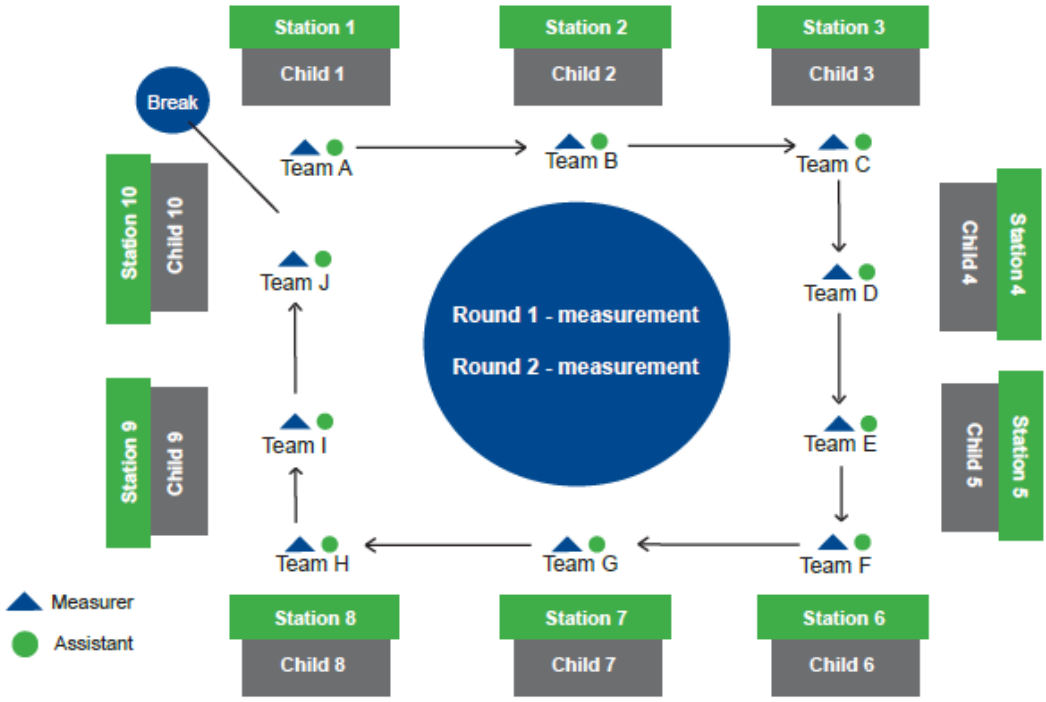
3.2 Standardization

3.2.1 Overview

In DHS surveys, standardization exercises are conducted as part of biomarker technicians' training. To pass the standardization exercise trainees must achieve an acceptable technical error of measurement (TEM) for accuracy and precision. The TEM for accuracy is calculated by comparing the trainee's measurements with the expert anthropometrist's measurements, while precision is calculated by comparing the trainee's replicated measurements. A training session is held prior to standardization to provide trainees with a detailed explanation of the TEM principles of accuracy and precision and the criteria for acceptability.

The standardization exercise takes place after trainees have practiced measurement techniques with adults and children. For the standardization exercise, two trained biomarker technicians—the measurer and an assistant—work together to perform two independent height/length measurements on 10 children (Figure 1). An expert trainer (an anthropometrist) also obtains two height/length measurements for each child, and these measurements serve as the reference value. Trainees are provided with a data entry sheet and move around the stations to complete their first round of measurements. After trainees have measured all 10 children, the first data entry sheet is turned in to the trainer. The trainer then hands the trainees a second data entry sheet so that they can repeat the process with a second round of measurements. While trainees are taking measurements, the trainers move around the room watching the trainees and the trainers make notes on any challenging children and on the trainees' techniques.

Figure 1 Room set up for a standardization exercise



The trainers enter the results of the expert anthropometrists' and trainees' measurements into the height standardization tool, which calculates the measurers' TEM for accuracy and precision. Trainees who do not achieve an acceptable TEM for accuracy and precision during standardization undergo retraining and are restandardized. Since 10 children are needed to standardize 10 measurers, several standardization exercises are often required.

3.2.2 What works and what are the challenges in recruiting children

Recruitment works well when the implementing agency is prepared. Recruitment starts from the beginning of the survey process when the implementing agency understands the purpose of the standardization exercise and its requirements. Thus, it is important to discuss details with the implementing agency prior to a survey pretest. The implementing agency needs to know how many children of different age groups are required per day, and an adequate budget is needed to cover meals, stipends/transportation costs, and amenities for children and their caretakers.

The stipends are provided to caretakers as a recognition of their time commitment since standardization exercises can take several hours. Informants agreed that the amount of the stipend should be sufficient to reflect caretakers' time costs but also needed to be balanced so as not to be coercive. One informant also mentioned that even though the recruitment of children is in the implementing agency's scope of work, provisions such as amenities, meals, and transportation costs are sometimes not made or delayed for children and their caretakers.

> *"I need to make an agreement early on with the implementing agency of what the needs are. For example, how many kids we need for each day, what age ranges. And give them [the implementing agency] enough time to prepare." (R10)*

"[Standardization] is a pretty significant time commitment. . . and increasing the amount of money that is paid to the mothers would maybe help them feel more inclined to stay." (R10)

"The way the recruitment is done makes me uncomfortable. Some of the [caretakers] might be willing to attend because there is some money involved." (R9)

Some implementing agencies have experience recruiting children (from DHS and other surveys) and are easily able to engage with local communities through, for example, community organizers or health centers. Other implementing agencies do not have this experience and need to work with the Ministry of Health, nutrition units, and other partners to recruit adequate numbers of children. Informants said that identifying people who will be responsible for child recruitment from within the implementing agency or from partners is crucial.

"They had a community organizer working with the implementing agency, and we made demands last minute, and she miraculously had plenty of kids available. And I don't know how much of this is because of the context." (R1)

"At the implementing agency you may find somebody who does not know or who does not want to understand. . . and it makes life difficult, but, because usually you have 1–2 people you work with all the time, if one person is not cooperating, the other usually will help you." (R8)

The location of the training can also facilitate or hinder access to children. Multiple informants described examples where training locations were outside of major cities and were closer to communities with children readily available. They also described other examples where training was conducted in central business districts where it was harder to find children. In the latter case, informants stressed the importance of managing transportation logistics to either bring children to training venues or to take the trainees to where the children were.

In rare cases, implementing agencies may be unwilling or unable to find enough children for practice and standardization. In such cases, where trainees are not able to practice and undertake standardization exercises with children, the implementing agency and The DHS Program must discuss whether or not to include anthropometry for children in the survey.

3.2.3 What works and what are the challenges in practice

The training process leading up to the standardization exercise is a critical period for trainees to familiarize themselves with the equipment. It is where trainees learn how to correctly take height/length and weight measurements. Depending on the country, trainees may have some prior exposure to anthropometry measurement. As one informant explained, sometimes trainees arrive believing that they know how to properly take measurements since taking anthropometric measurements is part of their clinical work. But in many cases, trainees must be taught how to take the measurements correctly for a population-based survey. This is because in clinical settings there is often no standardized protocol for training on how to take height/length and weight measurements or there is no appropriate certification. In addition, in clinical settings equipment is often old and not as robust and reliable as the new equipment used in survey settings.

"Take time to let the measurers know that this is the right way to measure. . . . Most of the nurses are used to taking measurements in their facility. . . so there should be a kind of a process to make them. . . unlearn and relearn." (R3)

Typically, trainees start with a classroom portion that provides them with background on why they are taking the measurements, introduces them to the equipment, discusses its maintenance, and demonstrates its use. Thereafter trainees move on to practicing weighing and measuring objects, measuring adults (including one another), and then finally measuring children under age 5. Trainees are also instructed on the Biomarker Questionnaire and how to record the measurement results. Although informants described slightly different approaches to organizing the practice with adults or children, all explained that these sessions were hands-on and interactive and that trainees received individual and group feedback on techniques. The hands-on aspect is especially important because it allows trainees to understand exactly what they are doing wrong and how to course correct. The informants also explained the importance of having enough trainers to provide this type of support.

"First the TOT [training of trainers, which happens during the pretest] makes it easy so there are people to help supervise during main training." (R2)

"[Trainees] have the opportunity to do hands-on [practice] over and over among themselves even before measuring children." (R3)

An example of an interactive session is having trainees work in small groups or pairs measuring the same child and then comparing their results. Informants liked the group approach because it allows the trainees to learn from each other. Other informants described setting up standardization-like settings. Trainees did not have cell phones or other papers apart from their recording sheet, so they could practice under standardization-like conditions including conducting practice standardizations with adults.

"We put them [trainees] in groups or pairs. Then we make them practice amongst each other or, for example, everybody would take the same weight and height of one person, and then we compare." (R9)

Measuring children of different ages (under age 2 and age 2 to 4) is required so that trainees can practice measuring children lying down and standing up and so that trainees can be comfortable with the different techniques. Experience measuring easy-going and difficult children prior to the standardization was seen as beneficial for trainees. Informants also explained that practice can be noisy on days when there are several children.

"If you have children who are very naughty and fidgety children and children who are very quiet, that also gives them [trainees] exposure on how to handle children." (R11)

During practice, as with standardization, children get anxious, which may make it more challenging to take measurements. Different approaches were described to help reduce children's anxiety, including providing candy, having a toy or fluffy animal at the measuring stations, projecting age-appropriate cartoons in the room where practice is taking place, and having children spend no more than 2 to 3 hours at the training venue. Some informants preferred not to give candy at all to children during the exercises to minimize

potential choking hazards, or they preferred to give candy at the end of the standardization as a treat for children.

> *"She came with kid stuff like tattoos, little toys, candy. The magical one was playing cartoons through YouTube. That was the magic because she just put it on all those children's songs, Coco-melon, all those things. The kids all wanted to look at the projector and were even dancing before their turn to be measured and after measurement they would sit up again and keep watching and that took their attention very well." (R3)*

Some informants felt the implementing agencies failed to fully understand the space requirements for the practice session. The venue space is often too small for practice. Sharing pictures of the training venue, including room capacity and available audiovisual equipment, was described as one way to address this issue. In addition, a few informants described going to the health facilities for practice, for example during child vaccination days when there are many children under age 5 for trainees to practice taking measurements.

A few informants found that the time allocated for practice was insufficient. Typically, surveys include anthropometry and anemia testing, but some surveys include additional biomarker testing relevant to children, such as malaria and micronutrients. When there are several biomarkers to be trained on, more training days are needed to ensure that trainees have sufficient time to master anthropometry techniques in addition to the techniques required for the other biomarkers.

> *"You go through the theoretical part and you start the practice and then you go on to the next. I always feel like we don't have enough time for the anthropometry. You don't have enough time for the practice." (R9)*

In a few cases, informants described trainees who had physical challenges such as poor eyesight and difficulty getting into certain positions, which prevented them from being able to adequately perform measurements. Informants described solutions such as providing eyeglasses, but sometimes they had to explain to trainees that they would not be able to cope with the physical demands of the work. These conversations were usually well received, and the trainees would exit the training.

During training, the biomarker technicians also practice fieldwork processes. During the fieldwork, data collection teams are composed of a supervisor, interviewers, and biomarker technicians. The interviewers use information from the Household Questionnaire and, for children, the Woman's Questionnaire to complete a portion of the Biomarker Questionnaire. This includes information that enables those eligible for biomarker collection to be identified and linked to the household. Biomarker technicians double-check this information, take the measurements of the eligible respondents, record the data in the Biomarker Questionnaire, and return the completed Biomarker Questionnaire to the interviewers. The interviewers then enter the data captured in the Biomarker Questionnaire into their tablet computer. To complete this process efficiently, interviewers and technicians need to communicate well and work together.

A few informants discussed how the biomarker training and interviewer training happen in parallel, and this can then be challenging when the groups come together to practice as a team. One strategy suggested to overcome this challenge was to link together fictional scenarios for interviewers and biomarker technicians. Using fictional scenarios is becoming common in surveys, and coordinating the training in this

manner requires advance preparation so that the timing between the interviewer and biomarker training aligns.

3.2.4 Conducting standardization exercises

Different approaches to the process

Standardization exercises can be implemented in different ways that maintain rigor while allowing for flexibility. Informants described how the expert anthropometrist and a trained assistant moved around each station taking children's initial height/length measurements before repeating the process a second time (see Figure 1). Alternative methods mentioned by some informants for taking the expert anthropometrist measurements included taking the two measurements back to back rather than going around the room a second time or having a separate room where children are brought in individually to be measured. However, such approaches may not be ideal.

One informant preferred to have five children in a room at a time (instead of all 10) because it might make children less anxious and the children are able to spread out more. In this scenario, the expert anthropometrist took one round of measurements from the five children at the station and then had the trainees complete one round of measurement. Then the expert anthropometrist took a second measurement before having the trainees complete their second round of measurements. This process was then repeated with the next group of five children. Organizing the standardization in this manner requires having either more than one room or several days for a standardization. In the example described, there were 4 days for standardization and 27 trainees. The trainees were separated into three groups, and a group was standardized each day with morning and afternoon sessions. On the fourth day, restandardization was held.

> *"Measuring a small number of children makes it easier for children and adults. It's less stressful for the children, but it takes time and may not always be cost efficient." (R2)*

When the expert anthropometrist is taking the measurements, the trainees are ideally in another room. Only after the expert anthropometrist has taken two rounds of measurements, as per standard procedures, do the trainees enter the room and begin to take their first round of measurements. However, for a variety of reasons, the ideal is sometimes not possible. One reason is limited space. A few informants described how trainees remained in the room while the expert anthropometrist took measurements, but the trainees were too far from the stations and could not hear or see the measurements being taken.

For the standardization, trainees work in pairs, with one trainee the measurer and the other the assistant. If both trainees are to be standardized, the process is repeated with a new group of children and the roles of the trainees swapped. For example, in a survey with ten teams there are typically at least 20 trainees and a minimum of two standardization exercises are planned. Ten trainees act as measurers in the first exercise, with the other 10 acting as assistants. In the second standardization exercise, the trainees exchange roles. A third standardization exercise may be offered, with those who are not successful on the first try in the measurer role making a second attempt. Although this results in more standardized measurers than required for a survey, it offers more flexibility for pairing biomarker technicians according to strengths in other biomarker data collection tasks. It also makes it easier to move technicians between teams when one leaves service before the end of a survey. And it provides an additional opportunity for trainees to build skills beyond the strict needs of the survey, thus strengthening capacity.

A few informants described how standardization varies by survey. For example, sometimes new children are not brought in when the trainees swap positions. This was often the case when there were many trainees to be standardized and the implementing agency did not recruit enough children. In other surveys, the interviewers acted as assistants during the survey data collection. The interviewers received a half to a whole day of training (including practice with children), but then did not participate in the standardization exercises since the training sessions for interviewers and biomarker technicians are held in parallel. In such cases, as described, the trainees who act as measurers in one standardization exercise are assistants in the next.

Standardizing a large group of trainees requires good planning, multiple expert anthropometrists, and sufficient space to conduct the standardization exercises. In one standardization, with over 50 trainees to be standardized over 2 days, there were five expert anthropometrists for six groups of eight to 10 trainees each. The training took place in a hotel with one very large room for the standardization and a large waiting room where caregivers and children could wait. There were multiple standardization exercises each day, and the implementing agency was careful not to have children and caregivers wait too long before their turn. There were also a few coordinators to facilitate registration of children and to escort groups to the room for standardization. In this example, when working with multiple expert anthropometrists there is the risk that some trainees could interpret their failing of the standardization as the fault of the expert anthropometrist. However, informants did not find this to be the case, especially as all expert anthropometrists were trainers during the session. Moreover, the expert anthropometrists had significant experience conducting anthropometry training.

In another example, the standardization exercises were timed to allow for multiple standardizations in a single day. Trainees were given between 3 and 5 minutes to measure a child. This amount of time was based on how long it took the expert anthropometrist to measure 10 children. The informant said that if the measurements took any longer, it would increase the likelihood of children becoming agitated. During the standardization, the expert anthropometrist used a stopwatch to let trainees know when it was time to move to the next child. Meanwhile, the group of trainees who were not measuring were assigned to complete the Biomarker Questionnaire using several fictional scenarios.

> *"These are people you have trained, so you know their timing. So, every 5 minutes you are supposed to have finished a child and move to the next child. I have a stopwatch that subtly rings the bell every 5 minutes." (R3)*

Location of exercises

Every survey is unique, and important factors to consider for standardization include the proximity of the children, travel time to the venue for children and their caregivers or trainees, and adequate space for efficiently completing the exercise. Standardization exercises mostly took place at residential training facilities or at hotels where survey training was organized. However, space for standardization can be an issue. Some informants even described using shaded verandas if there was not enough space indoors. In other surveys, the location for standardization was away from the training venue. For example, one informant explained that the standardization took place at a venue outside the city limits because there was more access to children there. However, because of a lack of transportation, the standardization started several hours later than planned, leading to a loss of precious time. In another case, the standardization took place at a health facility because the training venue was too small. The standardization happened over 3

days, with groups of 10 trainees at a time taken to the health facility for standardization. This format for the standardization required additional days and transportation and so increased the overall budget.

> *"The [location] was really far. But the problem was we would not be able to find enough children in the urban areas. So, we have to go a little bit outside of the capital." (R9)*

Retaining children for the duration

Standardization exercises can be long and stressful for children, and it is important to minimize the duration of the exercise and use strategies to relieve anxiety. While standardizations are not easy, they have been performed successfully in many surveys. Several informants explained strategies used to help relieve children's anxiety, including projecting cartoons. Other examples were ensuring that standardization rooms were not crowded, reducing the number of trainees measuring the children, singing children's rhymes, making the height/length boards interesting with stickers, and placing stuffed toys on the wall. But informants also mentioned that having too many toys could be problematic as children of this age are not good at sharing.

With respect to retaining children for the duration of the standardization, one suggestion was to not keep the children for too long and to avoid keeping them beyond their nap times or mealtimes. Sometimes the trainers also had to persuade mothers to remain longer so that the standardization could be completed. This did not always work, and a few informants described having to complete standardizations with nine children instead of 10. For most surveys, two extra children are recruited as backups in case caregivers leave with their children, but sometimes even this may not be sufficient. A few informants described having to use both backup children for the standardization exercises.

> *"Usually you want to bring children before noon and you do not want to keep them for too long. But once you get to noon, children start fidgeting and they want to eat and it becomes messy." (R8)*

Feedback to trainees

A key component of standardization is sharing the precision and accuracy results with trainees and then discussing approaches to overcome challenges. After the standardization exercises are completed, the trainers complete the height standardization tool that calculates trainees' precision and accuracy TEM. Informants reported that the tool was easy to use, and one informant noted that it is important to complete the tool and review the results for each child before the children leave the venue. This requires entering the data into the tool as soon as the data entry sheets are turned in by trainees. This allows the trainers to identify if there are outliers between the expert anthropometrist's measurements and the trainees' measurements and to act as needed, for example, by having the expert anthropometrist take another measurement from a child. Once the height standardization tool is completed, trainers provide feedback to trainees using the results from the standardization tool and observations from the standardization and practice.

Feedback sessions are mostly in a group setting, and trainers review the accuracy and precision graphs with trainees. Sometimes photos from the standardization exercise are included, and trainers reinforce key points based on the observations during standardization. Since trainees may face difficult children during data collection, during the standardization exercise children who are challenging to measure are also discussed as are approaches to overcoming the challenges. For the trainings described by informants, information on

who passed or failed the standardization was usually presented in this group setting. One informant shared this information privately with the trainees. Another approach is to share the anonymized results with the group and then to meet with each trainee to share individual results. Overall, informants described that providing feedback does not take long. However, if there are significant issues to address, such as misunderstanding of procedures, this can take longer.

> *"I try to be really careful when we were presenting teams as a group. I do not list who passed and who failed in a group setting. I didn't want their peers to see their name next to the word fail on standardization." (R1)*

3.3 Restandardization

Restandardization gives trainees who fail the initial standardization an opportunity to address their weaknesses and improve their skills. Some informants explained that trainees often fail due to incorrect reading of measurements, lack of coordination between the assistant and the measurer, and, sometimes, children's hairstyles interfering with measurements. Trainers re-review procedures with trainees and encourage them to practice with their colleagues. If children are available, trainees practice with them again before the restandardization; however, this was rare and one informant thought that more time was needed for restandardization, even if it is an extra day, so that trainees can get more practice.

> *"For those who fail, we review all the procedures and conduct practical exercises with them again before they move to remeasurement the next day." (R2)*

Most trainees pass the restandardization, but this is not always the case. Trainees who fail twice should generally be released, but it depends on the survey. Sometimes trainees cannot be released because there are no backup trainees, and the trainers can suggest that those who fail twice be assistants. Trainers also examine why trainees fail; if the reason is an issue where trainers feel that there is room for improvement, the trainers will work with the trainees who failed the restandardization. For the rest of the training, the trainees will practice until the trainer is comfortable that they can perform the measurements. A few informants described not conducting a restandardization exercise because they had enough trainees pass the initial standardization and the time saved could be spent on other activities.

Selection for fieldwork and field replacements

The selection process of trainees for fieldwork is comprehensive, and DHS staff work closely with the implementation agency to discuss team composition. Trainers review numerous metrics, and examples described by informants include results from the quizzes, performance during classroom practice and standardization, performance of other biomarkers included in the survey, language, performance during field practice, teamwork, interactions with others, comportment, tardiness, and truthfulness. Since trainees work in pairs during fieldwork, trainers will shuffle pairs throughout training to see who works well together. Ultimately, the implementing agency decides on the final teams. However, sometimes the agency makes changes at the last minute just before fieldwork, for various and sometimes unavoidable reasons such as language factors.

> *"A combination of practical and written exams. . . and some intangibles [were used,] like people who were maybe. . . consistently showing up late or that type of thing." (R10)*

After fieldwork has begun, biomarker technicians may drop out for a variety of reasons including other job opportunities, family obligations, and their own health. For this reason, it is critical to have biomarker technicians on reserve who can replace those who drop out. Most informants explained that often replacement changes are not communicated to DHS staff, but this is survey dependent. During training, extra trainees are trained and those who are not selected for fieldwork will be ranked and placed on a waiting list. These potential replacements have usually passed the standardization exercise during the main training, so the local trainers simply need to facilitate refresher training that includes practicing with adults and children rather than conducting a standardization exercise. In some surveys the data quality monitors, who were trained and standardized during the pretest, are assigned to regions so that if someone is sick, they can act as replacements. In other surveys, there may be no time or funding to retrain or standardize replacements, and trainees go off with no additional training.

> *"The local staff are able to refresh the people on the waiting list…. That's why the ToT [training of trainers, which happens during the pretest] is important." (R2)*

3.4 Child Remeasurement

Child remeasurement is performed during data collection in DHS surveys. The procedures involve taking repeat height/length and weight measurements from a random set of children (random remeasurement) and from children with an unusual first measurement (flagged remeasurement). Random remeasurements are used to assess a biomarker technician's level of precision during data collection, while flagged remeasurements reduce the number of incorrect measurements. The DHS currently flags *z* scores at below minus three standard deviations (−3 *SD*) or above three standard deviations (+3 *SD*) based on the WHO Child Growth Standards reference population.[2]

3.4.1 Impact of child remeasurements

Many informants thought remeasurement improves data quality because biomarker technicians took more care with measurements when they knew they were being monitored. In Jordan, informants explained how they were initially wary about remeasurement because it was new and they were concerned how it would impact overall response rates. However, given the poor anthropometry data quality in prior Jordan surveys, informants were committed to implementing all data quality measures. (Anthropometric data for children were excluded from the DHS final reports due to data quality issues in the 2007 and 2017–18 Jordan DHS surveys.)

> *"I think that they [biomarker technicians] will try to get it right [the] first time…. It is beneficial that they know there is an extra focus on the measurements." (R4)*

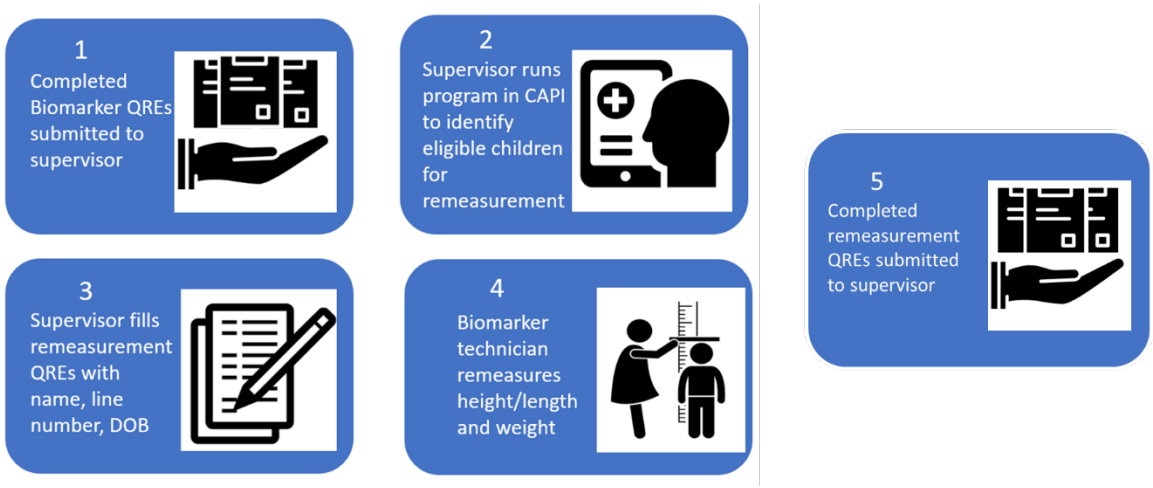
> *"The biomarker technicians focus more on the first measurement…. They are more careful the first time." (R14)*

> *"We were afraid of the remeasurement, because here in Jordan each survey we face, the rejection would be high. Even in this survey, I was afraid, but we agreed that [remeasurement] is one of the data quality procedures. Especially what happened in the 2017 [survey]." (R13)*

3.4.2 Computer-assisted personal interviewing procedures

The remeasurement procedures involve the interviewers, the team supervisor, and the biomarker technicians. Briefly, after all anthropometry data in a cluster from the Biomarker Questionnaire have been entered into the computer-assisted personal interviewing (CAPI) program by interviewers, the team supervisor runs the remeasurement program. The program identifies children eligible for flagged remeasurement and selects 10% of children at random for random remeasurement (this often translates to one or two children per cluster). The team supervisor then fills out the relevant sections of the Remeasurement Questionnaire for all children eligible for remeasurement and gives it to the biomarker technicians. Biomarker technicians return to the households to take the height/length and weight measurements of the child, and this information is entered into the Remeasurement Questionnaire. Subsequently, the biomarker technicians return the completed questionnaire to the team supervisor, who enters the data into the CAPI system (Figure 2). Importantly, the entire team is blinded as to the reason for the remeasurement. To minimize data entry errors, the program requires the measurements to be double entered. The date that the remeasurement took place is also recorded given that this information is useful to understand if teams routinely conduct remeasurement on the same day as regular data collection, as this could create an opportunity for copying the initial measurements if technicians still have access to the original Biomarker Questionnaires (see gaming section).

Figure 2 Schematic of remeasurement process



Overall, informants reported that the CAPI system for remeasurement works well. One informant who worked on a survey that used an early version of the CAPI program described that the current version streamlines the process and that many of the original bugs in the program have been corrected and training manuals adapted. One minor challenge that a few informants had initially experienced was entering the nonresponse code when biomarker technicians were not able to remeasure the children because, for example, the children were not at home. However, as soon as the problem was identified, informants said that they were able to easily amend the country program to allow for this code. Since then, The DHS Program has updated the standard program to include a nonresponse (that is, not present) option. In another setting, informants described how team supervisors could not work out how to close the cluster in CAPI (that is, get past error messages) without entering remeasurement data. In this case, the team supervisors went against procedures and reentered the original measurements. During supervision, when identical first

and remeasurement values were detected, the teams explained that they did not have time to conduct remeasurement and were unsure of how else to close the cluster. The Remeasurement Questionnaire (and CAPI) has options for nonresponse, refusals, and "other," and team supervisors were instructed to use the "other" code when a team was not able to conduct remeasurement because of time constraints. The experience highlighted a training gap that has since been addressed.

> *"I think it's good that it is blinded if they [biomarker technicians] don't know if it's a random or remeasurement or flagged or random remeasurement." (R7)*

Field observations in Jordan confirmed that team supervisors were following the standard procedures, filling out the top section of the Remeasurement Questionnaire, and entering the completed questionnaires back into CAPI. Entering the remeasurement data into CAPI usually happened outside the household and took less than 5 minutes. The team supervisors were also not able to see the initial measurements in CAPI. This is important because it reduces the opportunity to copy over the initial measurements, which defeats the purpose of the remeasurement.

> *"[The CAPI program for remeasurement] is super easy. There are no challenges at all." (R17)*

3.4.3 Fieldwork remeasurement procedures

There are multiple variables that can impact how remeasurement is implemented, including team composition, number and type of biomarkers collected, and the amount of time spent in the cluster. There were mixed responses about the fieldwork component of the remeasurement process. Some informants described that the process worked well, for example biomarker technicians' good rapport with households, priming households for a potential return visit, and placing the original paper Biomarker Questionnaires in a large envelope at the end of each day so that biomarker technicians do not have access to them during remeasurement.

> *"We would tell them [at the first visit] that there is a possibility that they will get a remeasurement and we will come back, and they were saying welcome." (R19)*

Other informants detailed how having the team supervisor and biomarker technicians travel together for remeasurement was advantageous because it saved time (in the cluster) for the severe acute malnutrition (SAM) referral. The SAM referral is filled out by team supervisors after they enter the remeasurement data into CAPI and the program identifies any children with severe acute malnutrition. The biomarker technicians then deliver the completed SAM referral to households. In Jordan, there was one biomarker technician per field team; the team supervisor acted as the technician's assistant for remeasurement, and so they traveled together to households. In other surveys where there were two biomarker technicians, the team supervisor sometimes traveled with them for remeasurement.

Informants also described challenges with returning to the households for remeasurement. Some households were concerned that something could be wrong with the child or that the remeasurement visit also included a lengthy reinterview with the Woman's Questionnaire. Other households indicated that they did not have time, there had already been some difficulty in taking the first measurement, or there had been other biomarkers, such as hemoglobin, that the household had already been reluctant to consent to and did not

want taken again. In such cases, the households could decline a second measurement. Solutions discussed by informants included ensuring proper sensitization in the community for the biomarkers (in addition to the overall survey), explaining the purpose of the remeasurement visit and that it included only anthropometry, priming households for potential return visits, and having the supervisor and biomarker technicians travel together so that the supervisor could help explain the reason for a return visit and complete the severe acute malnutrition referral if needed.

> *"I think it's a little confusing when we go back to one household and just measure one child, not all the children who were initially eligible [for] biomarkers. I think that's a little confusing to respondents. Like what's wrong with this kid, you know? But I don't know if that makes any difference." (R7)*

Another challenge raised by a few informants was that biomarker technicians wanted to take remeasurement data before all anthropometry data in the cluster had been collected and entered into CAPI. A few reasons were described. One was that if the children are visitors in the household, they may not be present for remeasurement. Another reason is that the team can be under pressure to complete data collection in the cluster and so may run the CAPI program when there are only one or two households left in the cluster. In some cases, biomarker technicians were blamed by interviewers for not doing their job well and delaying the team's departure from the cluster. Suggestions to overcome these challenges were to consider allowing replacement children for random remeasurement (although this would unblind the reason for remeasurement), to go over the remeasurement process earlier in the interviewers' training to ensure that the explanation is not rushed and is well understood, and to incorporate remeasurement into the field practice so that teams have some experience before data collection. The latter two training suggestions have already been made a standard practice in DHS surveys.

> *"Sometimes CAPI chooses children for remeasurements, but they are [a] visitor at the home. On the day of the remeasurement, they will not be there." (R21)*

> *"Find a way how to train [interviewers] on remeasurement, because it comes late and there's not even time to explain it." (R8)*

> *"We had a case where the team supervisor was rushing others. . . . I told the team supervisor that the biomarker will do their task. It is not allowed to say hurry." (R14)*

3.4.4 Time to close cluster

Informants had mixed views on the amount of time it takes to close the cluster because of remeasurement. Some did not feel the additional time spent on remeasurement was an issue, and informants described teams being able to complete remeasurement within the number of days allocated to spend in a cluster. Remeasurement can sometimes involve multiple trips to a household. Some informants described keeping a cluster open and moving on to the next cluster before the remeasurements were done but scheduling appointments for the weekend since children were more likely to be present. Team supervisors and biomarker technicians would then return to the previous cluster on the weekend for remeasurement and to close the cluster. This worked well in urban settings where clusters were located close to each other but may be less feasible when clusters are spread far apart. Other informants felt that remeasurement required increased time because the surveys were overloaded (with multiple biomarkers). With proper planning and

when anthropometry occurs in a subsample, much of the delay after the cluster is closed can be avoided. Informants explained this is because the biomarker technicians can start the remeasurement process once the subsample of households eligible for anthropometry has completed data collection, but a few highlighted that even with good planning this may not always save time.

> *"It doesn't add much time. It's a few hours since it's like one or two children you need to remeasure." (R8)*

> *"It's. . . a very heavy survey, a lot to do and we were asking a lot for our biomarker technicians." (R7)*

> *"You can't assume that all the biomarker households will go first because some people may not be home, or even if they are, the kids are at school and so you have to come back and do it." (R7)*

> *"We do the measurements like the kid who wasn't available, on Saturday because it's a holiday. Saturday, we do the remeasurements. For those who aren't available, we put them on Saturdays. Sometimes we go to two clusters at the same time on Saturdays." (R22)*

Fieldwork observations in Jordan showed that completing the remeasurement itself was quick (on average less than 5 minutes); however, depending on the location of the household, travel time to and from the household, building rapport for the revisit, availability of the child, and completing the Remeasurement Questionnaire and entering it into CAPI, the overall process can take much longer.

3.4.5 Gaming the process

Most informants did not report any experience with gaming, for example copying the initial measurements instead of taking a second measurement during remeasurement. One informant explained that there was a level of trust placed on the data collectors and that if they were not following protocol, it reflected deeper issues with the survey, such as fieldworkers not being paid on time or having too few days in a cluster to complete measurements. Providing the right incentives to teams (such as incentives focused on data quality) instead of the wrong ones (such as incentives for completing clusters in a very short period) could prevent gaming. Another suggestion was to reduce the number of random remeasurements biomarker technicians need to perform. However, because in general flagged remeasurements should be rare, most of the remeasurement is random.

> *"We need to have in mind we have to trust them." (R6)*

> *"At some point, you know a lot of these things come from deeper issues, like they are not being paid on time, the conditions are tough." (R5)*

> *"One solution is to think about the amount of remeasurement you're doing. You can create an algorithm, if there are not a lot of flags, reduce the random. Or increase the random if lots of flagged. Anthropometry takes time, it's not something consistent with the idea that you can squeeze it into 3 days into a cluster." (R5)*

Among the few examples of gaming described, identical height/length and weight measurements for original and second measurements were most often how gaming was identified. Informants explained that this indicated biomarker technicians may be copying their original measurements rather than remeasuring children.

> *"My suspicion is that we have a mixed bag there that some people do it properly and some people just keep track of the measurements from the first time around and enter the same thing again and don't [remeasure]." (R4)*

An observation from fieldwork in Jordan revealed that sometimes team supervisors have the original Biomarker Questionnaires when conducting remeasurement with the biomarker technician. This can happen when data collection from the households is completed early in the day and remeasurement takes place a few hours later. In this specific observation, the biomarker technician was curious to know how close the remeasurement was to the original measurement and so asked the team supervisor the original measurement after the remeasurement values had been recorded. While all field conditions vary, this does suggest that measures to blind biomarker technicians and supervisors to the initial measurements (on the paper questionnaires) can be strengthened.

3.4.6 Field check tables

Field check tables (FCTs) are used to monitor and evaluate data quality during data collection. Using SyncCloud, the FCTs incorporate all data submitted by supervisors. When older, paper-based FCTs were used, the tables were run periodically as data from the field arrived at the central office. The updated FCT system helps monitor data as they are being captured and identifies patterns that indicate poor data quality, which can be communicated back to the team supervisors and fieldwork monitors for remedial action much more quickly and regularly. There are several FCTs for anthropometry, including two for remeasurement that capture completeness and the percentage of teams with the same height/length and weight values. Two informants explained that all of the biomarker FCTs were reviewed weekly. However, for anthropometry, most of their attention was on the out-of-range (implausible) measurements for each team, with only one informant mentioning remeasurement FCTs. This suggests a need for further strengthening the use of FCTs by implementing agencies to monitor quality. The DHS Program recently created an FCT guidance document outlining the purpose of each table, interpretation guidelines, and the flags used. This document will be shared with implementing agencies prior to the pretest and consulted during fieldwork to assist in greater utilization of FCTs.

> *"When biomarker technicians encounter anything in the field at any time, they talk to me. There is no barrier between us. I told them I'm supportive, not observer." (R14)*

3.5 Remeasurement of Age and Sex of Children

WHO guidelines on anthropometry data collection among children under age 5 recommend collecting date of birth and sex information during remeasurement.[2] However, this information is not currently collected as part of remeasurement in DHS surveys. Informants were asked about their thoughts on capturing age and sex information among children eligible for anthropometry remeasurement for data quality reasons, and they raised several challenges. In terms of age, informants explained that date of birth is obtained from the Household or Woman's Questionnaire, and biomarker technicians are not trained to collect age information.

Some informants suggested that interviewers or team supervisors could collect age information. Other comments included what to do if the caregiver is not the mother or what to do if the ages did not match and which age should be used. With respect to sex, many saw this as being much more feasible and a few raised what to do if the sex information did not match. In the case of both age and sex, many informants felt that there was no reason to collect these data again if they would not be used beyond supervision purposes. They felt that the current field check tables on anthropometry and remeasurement (height/length and weight) are sufficient for monitoring and evaluating data quality.

> *"I'm not sure that there's much value in doing it. For sex, for example, you're equally likely to have a mistake in the remeasurement as you are to have a mistake in the original measurement or in the recording of it. It's just going to add a complication to try and figure out which is correct." (R4)*

> *"You could recollect the date of birth. But there would be quite a lot of headaches about how to use that." (R4)*

4 RECOMMENDATIONS AND NEXT STEPS

The findings from this qualitative study reflect key informants' lessons from the implementation of the standardization exercises and child remeasurements in different settings and complement other research on nutrition data collection in DHS surveys. Our work highlights some of the challenges and on-the-ground solutions for implementing the selected data quality procedures in DHS surveys from a cross section of DHS staff, consultants, implementing agency staff, and fieldworkers. The findings highlight best practices and a few research gaps. Many of the recommendations below are already instituted practices, while others encompass ongoing or future work as part of The DHS Program's commitment to collecting quality anthropometry data in surveys.

- Continue to implement standardization and remeasurement procedures in DHS surveys as an important data quality feature.
- Continue to share the DHS anthropometry brief with implementing agencies. It provides an overview of data quality procedures in DHS surveys including human resources, budgets, and space requirements for standardization.
- Reach a consensus (internally) on acceptable approaches for taking the expert anthropometrists' (reference) measurements when conducting standardization exercises.
- Consider a time cap for standardization exercises so that they do not exceed 2–3 hours per standardization group (that is, 10 children). Children can become fatigued and agitated if standardization exercises take too long, and respecting the time of caregivers and their children is paramount.
- Ensure that trainees receive additional practice with children (under age 2 and over age 2) before restandardization and communicate this requirement to implementing agencies early so that arrangements for inviting children can be made.
- Continue to collaborate with implementing agencies in the selection of trainees for data collection. Consider developing a rubric for the selection of trainees that can include, for example, information on their strengths and recommendations for whether they should be measurers or assistants. The rubric can also be used to inform last-minute changes in data collection teams.
- Establish/formalize systems to ensure communication between implementing agencies and DHS staff about replacement of biomarker technicians and inclusion of information on the replacements' refresher training and standardization results.
- Continue to explore ways to blind fieldworkers to previous measurements during fieldwork to increase the likelihood of an independent second measurement. In addition, evaluate the percentage of identical first and second measurements in surveys to help establish acceptable thresholds.

- Continue to support enhancements to survey training to increase buy-in for remeasurement such as an explanation of the importance of remeasurement during interviewer training, supervisor training, and CAPI training as well as the importance of inclusion of remeasurement in field practice.
- Continue to document remeasurement field procedures in different contexts (for example, surveys with multiple biomarkers) and how the field check tables on remeasurement are interpreted and used.
- Conduct an evaluation of the impact of standardization and remeasurement on anthropometry data quality by comparing anthropometric data quality metrics between recent surveys and older surveys that did not implement these procedures.

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APPENDIX I

Phase 1. In-depth Interview Guide: Evaluation of DHS Anthropometry Data Quality Procedures

Hello, I have gotten in touch with you because we are writing a report to understand successes and challenges in implementing several anthropometry data quality measures in DHS surveys.

The report will be published and shared both internally within The DHS Program and externally to a wider audience. In order to do this successfully, it is important to understand the perspectives of people that have implemented standardization and/or remeasurement for anthropometry, so thank you for agreeing to talk with us today to share your experiences. During our discussion today, we will be focusing on:

- Standardization
- Remeasurement

Your participation in this interview is completely voluntary. If you want to stop at any time or don't feel comfortable answering a question, please let me know. Taking part in this interview is your agreement to participate.

This discussion will be recorded, and the recordings will be kept securely and only accessed by the research team. We would also like to collect demographic information about the experts we have interviewed.

The information you provide will not be attributed to you individually but your name will appear in the appendix of the report. Do I have your permission to record the discussion and include your name in the appendix of the report? Our discussion today will take approximately ____

[Enter time prior to beginning interview. Estimate 30 minutes per topic.]

[Do you have any questions before we start?]

[Answer any questions.]

Please feel free to respond to questions that you are not an expert in if you have something to share. You also are free to skip questions that you do not have an opinion on. Let's begin.

[START RECORDER]

I. Demographic Information

First, some demographic information before we jump in.

1. What is your title and role in your institution?

   Probes:

   - Are you an ICF consultant for The DHS Program?
   - Does your institution implement DHS surveys? Other surveys (specify)?

- Where are you geographically located?

2. How many years of work experience do you have in survey work if any?

3. Please describe your experience in the collection of anthropometry.

   Probe:

   - How many years of work experience do you have in the collection of anthropometric data?

4. What's your highest level of education completed?

II. Standardization

I'd like to start and talk about anthropometry standardization with children.

1. Can you describe what hands-on practice trainees receive on children before standardization if any?

   Probes:

   - Ask what works well during practice and why.
   - Ask about age range for children for practice.
   - Ask what if any challenges are experienced.
   - Ask about strategies used to overcome the challenges.

2. Can you describe what you find typically works well when recruiting children for standardization exercises as part of the survey training?

   Probes:

   - Ask why for each item discussed.
   - Ask about getting the correct age composition.
   - Ask about any support from the implementing agency or others.
   - Ask about any time, financial, and staff/human resource needs.

3. In your experience, describe what you find to be the biggest challenges when recruiting children for standardization exercises as part of the survey training.

   Probes:

   - Ask why for each item discussed.
   - Ask about getting the correct age composition.
   - Ask about any support from the implementing agency or others.
   - Ask about any time, financial, and staff/human resource needs.

4. For the challenges you mentioned, what sorts of things could reduce these challenges in the future?

5. In your experience, can you describe the general process of anthropometry standardization with children?

   Probes:

   - Ask about where the standardization takes place.
   - Ask what works well and why.
   - Ask what if any challenges are experienced.
   - Ask about strategies used to overcome the challenges.

6. In your experience, during standardization who usually serves as the gold standard measurer?

   Probes:

   - Ask where the gold standard takes measurements from, i.e., do they measure the kids in a separate room, or use the stations in the room set up for standardization?
   - Ask about how the gold standard takes the measurements, for example measuring the child twice (i.e., repeating the measurement) or measuring each child once and going back for a second round.
   - Ask whether they have ever experienced a standardization with more than one gold standard and explain how that was handled.

7. When there is a large group of trainees to standardize, can you describe how you organize the standardization?

   Probes:

   - Ask what works well and why.
   - Ask what if any challenges are experienced.
   - Ask about strategies used to overcome the challenges.

8. Sometimes, children and caregivers may want to leave before the standardization has been completed. In your experience, can you describe strategies you have used to retain children for the full duration of the standardization?

   Probes:

   - Ask about what happens when children or caregivers do not stay for the duration of the standardization.
   - Ask about any contingencies for when children and their caregivers drop out, e.g., recruiting backup children.

9. After the standardization is completed, can you describe how feedback is given to trainees?

   Probes:

   - Ask about what type of feedback is provided.
   - Ask about what the feedback is based on, for example, based on the observations of trainees during the standardization exercise, based on the results of the standardization, etc.

10. Can you describe your experience using the height standardization tool or any other tool you have used?

    Probes:

    - Ask about any challenges using the standardization tool.
    - Ask about how the tool is used to provide feedback to trainees and what methods are commonly used, e.g., presentation, one-on-one discussions.

11. Can you describe what happens to trainees that fail the standardization?

    Probes:

    - Ask about if restandardization happens and how.
    - Ask about what sort of training happens before restandardization.
    - Ask about what happens to trainees that fail the restandardization, e.g., do they still go out as measurers during data collection?

12. What is the process and criteria used to select which trainees go out as measurers during survey data collection?

13. Sometimes during data collection, technicians in the field may need to be replaced with backups. In your experience, can you describe how this process happens?

    Probes:

    - Ask about how backups are standardized.
    - Ask about when the backups are standardized, during the pretest or main training or at another time.

Next, I would like to talk to you about anthropometry remeasurement procedures in DHS surveys.

1. What is your experience with anthropometry remeasurement procedures?

2. In your opinion, how do you think remeasurement influences the measurements being taken by the fieldworkers?

    Probe:

    - Ask for examples of how remeasurement influences data quality.

3. Can you describe how the CAPI program for remeasurement works?

    Probes:

    - Ask who does each step and how well it's working.
    - Ask whether the CAPI program is easy to use and understand.
    - Ask if anything could be improved with the program or process.

4. Can you explain how the remeasurement process works in the field?

    Probes:

- Ask what works well and why.
- Ask what if any challenges are experienced.
- Ask about strategies used to overcome the challenges.
- Ask about the revisits to the households and perceptions on how that process is working or not working.
- Ask about how the respondents are responding to the visits, e.g., what communications are shared and if there are messages and/or methods that are particularly helpful.

5. In your experience, have you seen any impact on the pace of data collection in each cluster because of remeasurement?

   Probes:

   - Ask whether it takes the teams the same amount of time, or less time, or more time to close the cluster because of remeasurement.
   - Ask whether biomarker technicians are ever left behind in the cluster to complete remeasurement while the rest of the team moves to the next cluster.
   - Ask about if the pace of data collection changes when anthropometry is in a subsample, for example in half the households in a cluster.
   - Ask about what strategies are/can be used to improve the efficiency of the remeasurement procedures, e.g., in field movements or the CAPI program.

6. In your experience, have you seen or do you know whether there is any gaming of the remeasurement procedures? For example, copying the first measurements from CAPI to the revisit forms instead of remeasuring children.

   Probes:

   - Ask can you describe what you saw/know about any gaming of the remeasurement procedures.
   - Ask can you describe what you saw/know about data fabrication.

7. In your experience or opinion, what sort of procedures could be implemented to limit data fabrication and increase the chances that an independent second measurement is taken?

8. What are your thoughts on including remeasurement for age and sex of the children among children who are eligible for anthropometry remeasurement?

   Probes:

   - Ask whether this can be performed by the biomarker technicians, interviewers, or both.
   - Ask about the pros and cons of recollecting children's age and sex regarding:
     - Ease of collection
     - Pace of data collection in each cluster

III. Closing Questions

1. Do you have anything else you would like to add that we have not already talked about?
2. Do you have any questions for me?

Thank you for your time. I really appreciate you talking with me today.

[END RECORDING]

Phase 2. In-depth Interview Guide: Evaluation of DHS Anthropometry Data Quality Procedures (phase 1)

Implementing Agency Staff

Hello, I am talking to you today because we are writing a report to understand the implementation of anthropometry remeasurement, the severe acute wasting referral, and the liquid and food lists in DHS surveys.

The report will be published, and the learnings will be used to inform future DHS procedures. In order to do this successfully, it is important to understand the perspectives of people that have experience with implementation. So thank you for agreeing to talk with us today to share your experiences.

Your participation in this interview is completely voluntary. If you want to stop at any time or don't feel comfortable answering a question, please let me know. Taking part in this interview is your agreement to participate.

This discussion will be recorded, and the recordings will be kept securely and only accessed by the report team. Do I have your permission to record the discussion?

The information you provide will not be attributed to you individually but there will be an acknowledgement section in the appendix. Would you like your name to appear in the appendix of the report? Our discussion today will take approximately 1 hour.

[Do you have any questions before we start?]

[Answer any questions.]

Let's begin.

[START RECORDER]

I. Demographic Information

First, some demographic information before we jump in.

1. What is your title and role in your institution?

   Probe:

   - Does your institution implement DHS surveys? Other surveys (specify)?

2. How many years of work experience do you have in survey work if any?

3. What's your highest level of education completed?

II. Anthropometry

I'd like to start and talk about anthropometry data collection.

1. From your experience, what works well and what are the challenges with collecting anthropometry data in the survey?

   Probes:

   - Ask what works well and why.
   - Ask about strategies used to overcome the challenges.

2. Remeasurement of children is a data quality procedure included in DHS surveys. What is your experience with the anthropometry remeasurement procedures?

3. Can you describe the training that technicians receive on remeasurement?

   Probes:

   - Ask what works well and why.
   - Ask about any challenges and potential solutions to the challenges.
   - Ask about any clarifying questions or confusions being asked by the trainees.
   - Ask whether remeasurement is part of the field practice.

4. Can you describe how the remeasurement procedures are working? I'm interested to know what works well and if there are any challenges.

   Probes:

   - Ask what works well and why.
   - Ask if they have any solutions to the challenges.

5. Can you describe how the CAPI program for remeasurement is working?

   Probes:

   - Ask who does each step and how well it's working.
   - Ask about any challenges with the program and potential solutions to the challenges.
   - Ask whether the CAPI program is easy to use and understand.
   - Ask if anything could be improved with the program or process.

6. Can you describe how the process for taking the remeasurements in the households is working?

   Probes:

   - Ask who does each step and how well it's working.
   - Ask about any challenges and potential solutions to the challenges.
   - Ask what technicians communicate to the households when returning for revisits. Are there are any messages that are particularly helpful?
   - Ask about how the respondents are responding to the visits, e.g., what questions do they ask.

7. In your experience, have you seen any impact on the pace of data collection in each cluster because of remeasurement?

   Probes:

   - Ask how remeasurement impacts closing the cluster.
   - Ask whether biomarker technicians are ever left behind in the cluster to complete remeasurement while the rest of the team moves to the next cluster.
   - Ask about what strategies have been used to improve the efficiency of the remeasurement procedures, e.g., in field movements or the CAPI program.

8. How, if at all, do you think having remeasurement procedures included in the survey influences technicians' performance?

9. In your experience, how are the remeasurement field check tables being used during fieldwork monitoring?

10. In your experience, do you know/suspect whether there is any data fabrication occurring for remeasurement? For example, copying the first measurements from CAPI to the revisit forms instead of remeasuring children.

    Probes:

    - Ask how you know or suspect this.
    - Ask can you describe what you know or suspect about any data fabrication for remeasurement.

11. In your experience or opinion, what sort of procedures could be implemented to limit data fabrication and increase the chances that an independent second measurement is taken?

Team Supervisors

Hello, I am talking to you today because we are writing a report to understand the implementation of anthropometry remeasurement, the severe acute wasting referral, and the liquid and food lists in DHS surveys.

The report will be published, and the learnings will be used to inform future DHS procedures. In order to do this successfully, it is important to understand the perspectives of people that have experience with implementation. So thank you for agreeing to talk with us today to share your experiences.

Your participation in this interview is completely voluntary. If you want to stop at any time or don't feel comfortable answering a question, please let me know. Taking part in this interview is your agreement to participate.

This discussion will be recorded, and the recordings will be kept securely and only accessed by the report team. Do I have your permission to record the discussion?

The information you provide will not be attributed to you individually but there will be an acknowledgement section in the appendix. Would you like your name to appear in the appendix of the report? Our discussion today will take approximately 1 hour.

[Do you have any questions before we start?]

[Answer any questions.]

Let's begin.

[START RECORDER]

I. Demographic Information

First, some demographic information before we jump in.

1. What is your title and role in the survey?
2. How many years of work experience do you have in survey work if any?
3. What's your highest level of education completed?

II. Anthropometry

I'd like to start and talk about anthropometry data collection.

1. From your experience, what works well and what are the challenges with collecting anthropometry data in the survey?

   Probes:

   - Ask what works well and why.
   - Ask about strategies used to overcome the challenges.

2. Remeasurement of children is a data quality procedure included in DHS surveys. What is your experience with the anthropometry remeasurement procedures?
3. Can you describe how the CAPI program for remeasurement is working?

   Probes:

   - Ask who does each step and how well it's working.
   - Ask about any challenges with the program.
   - Ask whether the CAPI program is easy to use and understand.
   - Ask if anything could be improved with the program or process.

4. Can you describe how the remeasurement procedures are working? I'm interested to know what works well and if there are any challenges.

Probes:

- Ask what works well and why.
- Ask if they have any solutions to the challenges.

5. Can you describe how the CAPI program for remeasurement is working?

   Probes:

   - Ask who does each step and how well it's working.
   - Ask about any challenges with the program and potential solutions to the challenges.
   - Ask whether the CAPI program is easy to use and understand.
   - Ask if anything could be improved with the program or process.

6. Can you describe how the process for taking the remeasurements in the households is working?

   Probes:

   - Ask who does each step and how well it's working.
   - Ask about any challenges and potential solutions to the challenges.
   - Ask what technicians communicate to the households when returning for revisits. Are there are any messages that are particularly helpful?
   - Ask about how the respondents are responding to the visits, e.g., what questions do they ask.

7. In your experience, have you seen any impact on the pace of data collection in each cluster because of remeasurement?

   Probes:

   - Ask how remeasurement impacts closing the cluster.
   - Ask whether biomarker technicians are ever left behind in the cluster to complete remeasurement while the rest of the team moves to the next cluster.
   - Ask about what strategies have been used to improve the efficiency of the remeasurement procedures, e.g., in field movements or the CAPI program.

Fieldworkers

Hello, I am talking to you today because we are writing a report to understand the implementation of [anthropometry remeasurement and the severe acute wasting referral] / [the liquid and food lists] in DHS surveys.

The report will be published, and the learnings will be used to inform future DHS procedures. In order to do this successfully, it is important to understand the perspectives of people that have experience with implementation. So thank you for agreeing to talk with us today to share your experiences.

Your participation in this interview is completely voluntary. If you want to stop at any time or don't feel comfortable answering a question, please let me know. Taking part in this interview is your agreement to participate.

This discussion will be recorded, and the recordings will be kept securely and only accessed by the report team. Do I have your permission to record the discussion?

The information you provide will not be attributed to you individually but there will be an acknowledgement section in the appendix. Would you like your name to appear in the appendix of the report? Our discussion today will take approximately 30 minutes.

[Do you have any questions before we start?]

[Answer any questions.]

Let's begin.

[START RECORDER]

I. Demographic Information [ALL]

First, some demographic information before we jump in.

1. What is your title and role in the survey?
2. How many years of work experience do you have in survey work if any?
3. What's your highest level of education completed?

II. Anthropometry [BIOMARKER TECHNICANS ONLY]

I'd like to start and talk about anthropometry data collection.

1. From your experience, what works well and what are the challenges with collecting anthropometry data in the survey?

   Probes:

   - Ask what works well and why.
   - Ask about strategies used to overcome the challenges.

2. Remeasurement of children is a data quality procedure included in DHS surveys. What is your experience with the anthropometry remeasurement procedures?

3. Can you describe how the process for taking the remeasurements in the households is working?

   Probes:

   - Ask who does each step and how well it's working.
   - Ask about any challenges and potential solutions to the challenges.
   - Ask what technicians communicate to the households when returning for revisits. Are there are any messages that are particularly helpful?
   - Ask about how the respondents are responding to the visits, e.g., what questions do they ask.

Phase 2. Observation Form: Remeasurement

Date	
Observation ID	
Country	
Cluster ID	
Household ID	
Technician IDs	
Supervisor IDs	

Observe and take notes on the following for **remeasurement**:

For each of the following describe what is observed and record notes		Notes
1.	When is the CAPI program run for remeasurement?	
2.	Who completes the top section of the Remeasurement Questionnaire?	
3.	What are the communications between supervisor and technicians about remeasurement?	
4.	Is the remeasurement visit planned for the same day (when the program is run)? Who plans when the remeasurement visit will happen?	
5.	Time approximately how long it takes to return to the household once the technician has been handed the Remeasurement Questionnaire.	Start: End:
6.	What are the logistics for the technician to return to the household (describe for each)?	
	a. How is travel organized?	
	b. Is the remeasurement visit the main purpose of the trip? Do other team members wait for remeasurement to be completed?	
	c. Are technicians dropped off on the way to other households in the same cluster?	
	d. Are technicians dropped off on the way to other households in the next cluster?	

7.	Does the technician travel alone or with anyone to the household? Specify who.	
8.	Time approximately how long the technician is in the household for remeasurement.	Start: End:
9.	What does the technician communicate to the household when returning for the remeasurement visit?	
10.	Do household members seem skeptical or curious about the remeasurement visit? Describe.	
11.	What are household concerns and how does the technician respond?	
12.	After remeasurements are taken, is anything communicated to the household? Describe.	
13.	What is the process to get the Remeasurement Questionnaire entered into CAPI (describe for each)?	
	a. Where does this happen? Near the household or other location? If other location, what are transportation logistics to get there?	
	b. Who enters the Remeasurement Questionnaire?	
	c. Are the Remeasurement Questionnaires entered immediately into CAPI?	
	d. Are the initial measurements visible in CAPI?	
	e. Approximately how long does it take from the technician leaving the household to get the form entered into CAPI?	

Any other observations

APPENDIX II

Key Informants

List of key informants	Affiliation
Peter Aka	DHS Program
Suzanne Arrington	DHS Program
Yodit Bekele	DHS Program
Jean de Dieu Bizimana	DHS Program
Eleanor Brindle	DHS Program
Trevor Croft	DHS Program
Chinyere Okoro	South to South Consultant
Anjushree Pradhan	DHS Program
Keith Purvis	DHS Program
Amadou Sow	DHS Program
Michel Toukam	South to South Consultant
Hanna Useem	DHS Program
Eman Bny Mfarej	Head of Statistical Analysis and Studies Division, Jordan Department of Statistics
Amani Judeh	Jordan Department of Statistics
Walaa al-Hadidi	Jordan Department of Statistics
Rania Abu Dhaim	Jordan Department of Statistics
Alia al-Eamayrat	JPFHS Biomarker Technician
Nisreen al-Haju	JPFHS Team Supervisor
Sura al-Darawish	JPFHS Team Supervisor
Ola Abu Rumaan	JPFHS Biomarker Technician
Hind Ambishi	JPFHS Team Supervisor
Kefayah Earab	JPFHS Biomarker Technician
Ayat Dhiab	JPFHS Biomarker Technician
Amani al-Humarishat	JPFHS Team Supervisor
Nuha Najarat	JPFHS Biomarker Technician
Hayat Aleasi	JPFHS Team Supervisor
Ahdab Hanatilat	JPFHS Biomarker Technician
Sausan Al-Hafiz	JPFHS Team Supervisor
Hadeel al-Shiear	JPFHS Biomarker Technician