The use of nutrition administrative data to generate population-level child malnutrition estimates

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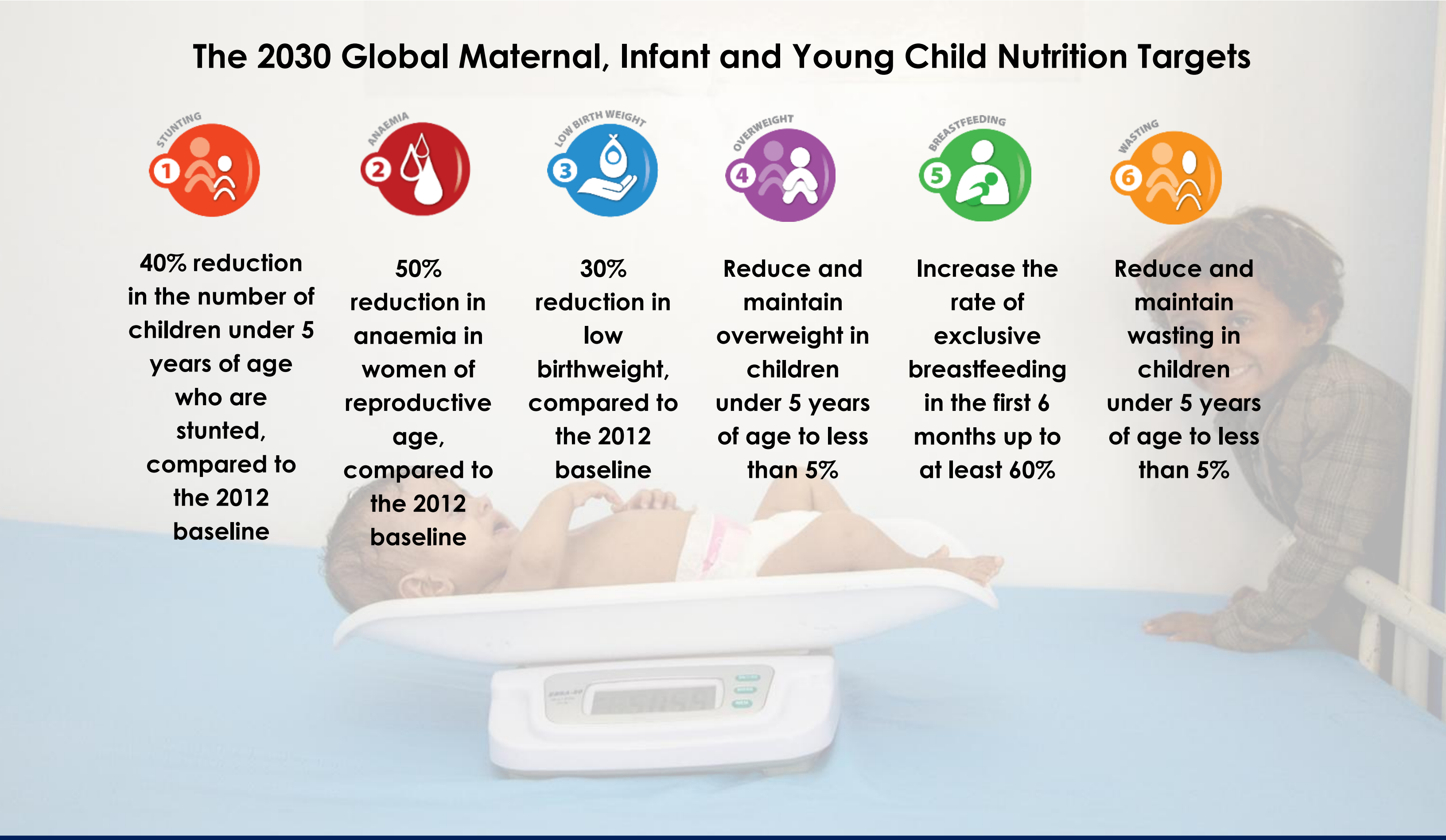
Abbreviations

AFRO	World Health Organization Regional Office for Africa
AMRO/PAHO	World Health Organization Regional Office for the Americas/Pan American Health Organization
Cm	Centimetres
CMAM	Community Management of Acute Malnutrition
DESA	United Nations Department of Economic and Social Affairs
DHIS2	District Health Information Software Version 2
DHS	Demographic and Health Surveys
DoB	Date of Birth
DoV	Date of Visit
DQA	Data Quality Assurance
EMRO	World Health Organization Regional Office for the Eastern Mediterranean
ESARO	United Nations Children's Fund Eastern and Southern Africa Regional Office
EURO	World Health Organization Regional Office for Europe
g	grams
GDCGM	WHO Global Database on Child Growth and Malnutrition
GMP	Growth Monitoring Programme
HAZ	Height-for-age z-score
HMIS	Health Management Information System
ID	Identification
IHSN	International Household Survey Network
JME	UNICEF-WHO-WB Joint Child Malnutrition Estimates
Kg	Kilograms
MIYCN	Maternal, Infant and Young Child Nutrition
MICS	Multiple Indicator Cluster Survey
MOH	Ministry of Health
MOS	Monitoring and Surveillance Unit of the Department of Nutrition and Food Safety
RHIS	Routine Health Information Systems
SDG	Sustainable Development Goal
SEARO	World Health Organization Regional Office for South-East Asia
UN	United Nations
UNGA	United Nations General Assembly
UNPD	United Nations Population Division
UNICEF	United Nations Children's Fund
WB	World Bank
WHA	World Health Assembly
WHO	World Health Organization
WHZ	Weight-for-height z-score
WPP	World Population Prospects
WPRO	World Health Organization Regional Office for the Western Pacific

Chapter 1. Introduction

Nutrition is central to the wellbeing of individuals and communities and a critical pillar for national development. Poor nutrition, especially in the first five years of life, sets a child back from achieving their full potential. With the declaration of the 2030 Agenda for Sustainable Development, Sustainable Development Goal (SDG) Target 2.2 guides governments and nutrition stakeholders to focus critical and increasingly scarce resources on the reduction of stunting, overweight, and wasting among children under 5 years of age. Many countries have established national and subnational priorities including the strengthening of national programmes to monitor the growth of pre-school aged children to identify and address malnutrition (1).

World Health Organization (WHO) Member States were galvanized to improve child nutrition globally by 2025. The Sixty-Fifth World Health Assembly (WHA) provided momentum and a platform to articulate six nutrition targets through the *Comprehensive Implementation Plan on Maternal, Infant and Young Child Nutrition (MIYCN*) (2). The Seventy-Eighth WHA agreed to further extend these targets to 2030 (3) in alignment with the 2030 Agenda for Sustainable Development while acknowledging the progress and shortfalls to reach the global targets. New operational targets and process indicators have been introduced to monitor progress more systematically. Targets that are globally within reach, such as exclusive breastfeeding and childhood overweight, have become more ambitious to motivate countries.



The 2030 Global Maternal, Infant and Young Child Nutrition Targets

1. 40% reduction in the number of children under 5 years of age who are stunted, compared to the 2012 baseline
2. 50% reduction in anaemia in women of reproductive age, compared to the 2012 baseline
3. 30% reduction in low birthweight, compared to the 2012 baseline
4. Reduce and maintain overweight in children under 5 years of age to less than 5%
5. Increase the rate of exclusive breastfeeding in the first 6 months up to at least 60%
6. Reduce and maintain wasting in children under 5 years of age to less than 5%

1.1 An untapped data source: administrative health information systems

The data used to monitor progress towards the global nutrition targets have traditionally come from population-based surveys conducted every three to five years such as the Demographic and Health Surveys (DHS) or the Multiple Indicator Cluster Survey (MICS). While these surveys may yield valid estimates if they are well-implemented and representative, another untapped source of data can generate similarly accurate and reliable national and subnational estimates for childhood stunting, wasting and overweight: **administrative health information systems**, often referred to as Health Management Information Systems (HMIS) or Routine Health Information Systems (RHIS).[1] Nutrition data from administrative health information systems cover important gaps in national monitoring of nutrition indicators, as they are often at the facility, district, or community levels. This data granularity allows for real-time depiction of nutritional status to identify malnutrition hot spots, and provides regular snapshots for analysis, planning, development, execution and course correction of nutrition services and evidence-based programmes.

As part of global monitoring efforts, the United Nations Children's Fund (UNICEF), WHO and the World Bank (WB) Joint Child Malnutrition Estimates (JME) group harmonizes estimates for childhood stunting, wasting, and overweight to present a consistent and coherent overview of their latest levels and trends. Although most data sources included in the JME joint database are household surveys, the group has recently initiated a case-by-case review of data from health information systems. The primary focus is on nationally representative samples and is based on a set of inclusion criteria aiming for comparability with survey-derived estimates. The work is ongoing, and recommendations will be disseminated in due time.

Due to the diversity of data collection methods and reporting from administrative data systems, various efforts are underway to understand the state of nutrition information reported through the national HMIS. For example, a landscape analysis of existing data collection tools and methods conducted by UNICEF Eastern and Southern Africa Regional Office (ESARO) provided recommendations towards the harmonization of reports using District Health Information Software Version 2 (DHIS2) (4). Furthermore, UNICEF, in collaboration with WHO and partners, drafted the core nutrition module in DHIS2 (5) to address a public health data gap in triangulating and integrating systems (6). WHO conducted a mapping exercise to support the identification of gaps in data collection and quality of child nutrition indicators in the HMIS, the results which are incorporated into this technical note.

Despite the wealth of data that administrative health information systems can provide, **there is no clear guidance on how to apply these data to generate population-level estimates. This lack of a standard analytical framework is a significant public health data gap.** The availability of an authoritative guidance, therefore, will steer countries with solid methods to collect, analyse, interpret and use national administrative data to strengthen nutrition programmes and monitor progress towards national and global nutrition targets.

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[1] The terms "administrative data" or "routine data" in this document refer to data that national institutions such as the Ministry of Health collect about their operations, including routine information that captures institutional progress in meeting its objectives.

1.2 Purpose, scope and structure

The purpose of this technical note is to provide evidence-based recommendations in the collection, quality assessment and analysis of **individual-level anthropometric data** for pre-school aged children using **administrative health information systems** to derive national and subnational malnutrition estimates for a given period (normally a calendar year). This is a **first but important step** towards the establishment of a standard analytical framework. The audience for this document includes National Statistics Offices or government entities responsible for nutrition monitoring and SDG reporting, and academia involved in research.

National focal points have frequently requested for guidance on the use of routine nutrition data to track progress towards nutrition targets in the absence of, or in between, periodic population-based surveys. While best practices for routine data collection, analyses and interpretation align with those for household surveys (7), consideration for the different nature of administrative data is required. This technical note is based on lessons learned from several case study countries where routine data are collected. While further research and evidence are needed, this document aims to enhance knowledge around routine data collection, analyses and uses with the goal of improving data quality, thereby contributing to advances in guidance to cover crucial gaps in scenarios where household survey data on child anthropometry is insufficient for regular updates or inexistent.

Not all routine data systems provide unbiased time-bound status of malnutrition in target populations. An example of bias is when there is a pre-selection of children prior to enrolment, as in programmes where children are screened for malnutrition and referred to treatment programmes. The scope of this technical note will be limited to:

i) data systems associated with *child growth monitoring* which target the entire population at the community, district or national levels.
ii) estimates at the *national or subnational level* given the target population sample representativeness is established based on pre-set criterion.

The analyses and uses of aggregate data, commonly gathered from administrative data systems, although important for programme monitoring and evaluation, is out of the scope of this document. **The analytical framework described here requires individual-level data to generate population-level estimates.**

Finally, this technical note is structured to follow the data journey from collection to dissemination of results: methodology (**Chapter 2**), data collection (**Chapter 3**), data analysis (**Chapter 4**), interpretation of results (**Chapter 5**); and dissemination of nutrition data from administrative HMIS to contribute to global reporting (**Chapter 6**).

Chapter 2. Background

This technical note is based on key lessons learned from a series of field applications and desk-reviews to identify key challenges and opportunities for improving the uses of routine data to generate population-based estimates.

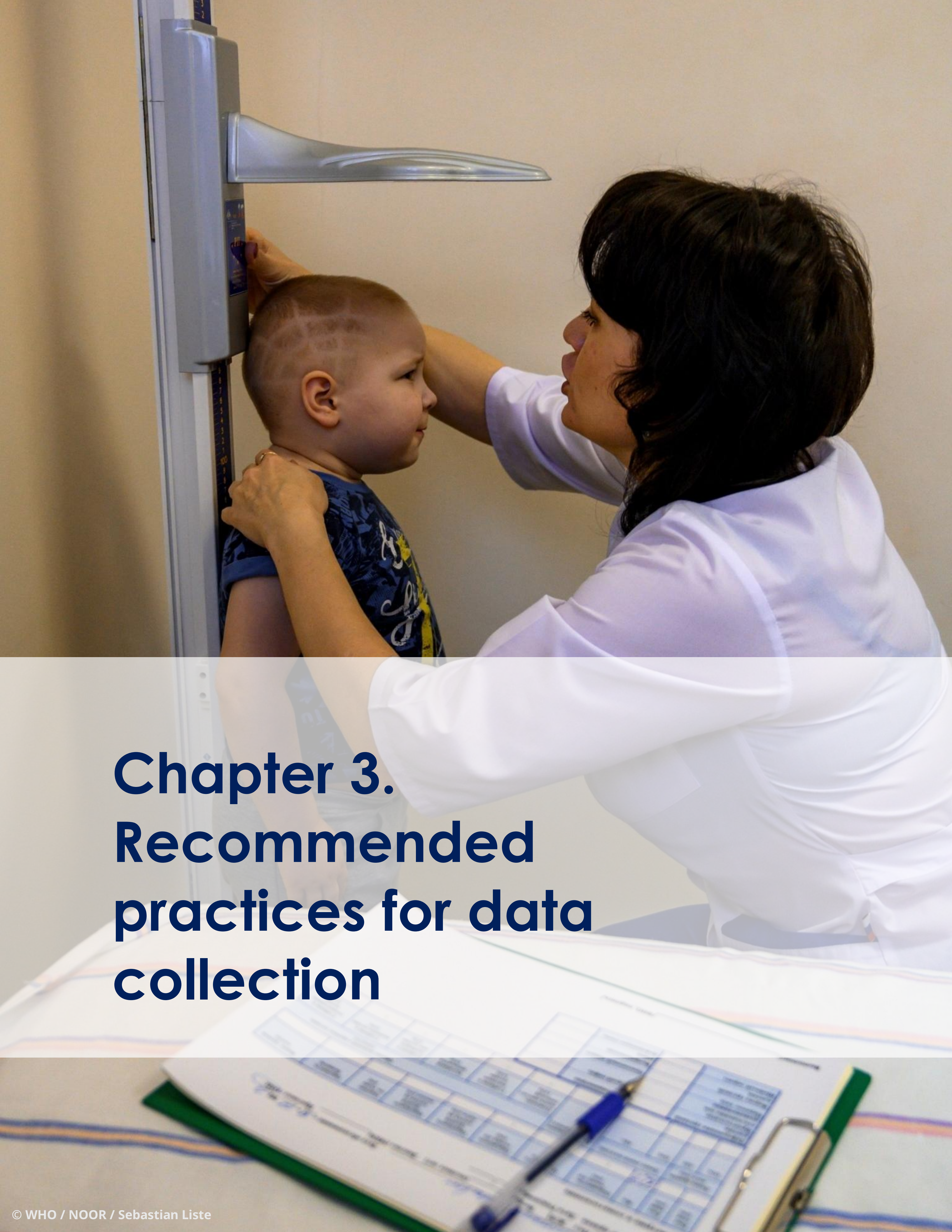
In 2018, WHO and the Ministry of Health (MOH) of the Republic of Seychelles conducted a comprehensive review of nutrition indicators with a two-fold aim: to develop recommendations to strengthen the national HMIS, and to pilot a methodology to analyse routine data for monitoring and reporting towards the global nutrition targets (8). The review identified a shortage of skills in the data reporting unit to curate, analyse and interpret data. The final report provided a roadmap to address these gaps and documented pitfalls in the national information system that impacted data quality and impeded the efficient use of data collected from children under 5 years of age. WHO partnered with the country team to develop the methodology illustrated in this technical note, organized capacity-building workshops, and provided step-by-step guidance with tools that supported the improvement of their data systems. Lessons learned from this case study were vital to understand the nature of administrative data and common practices in the routine data system. This exercise also demonstrated the need for digital data entry and analysis tools and more robust data validation.

In 2022, WHO launched a landscape review of child malnutrition data in administrative systems with wide geographical scope.[2] The initiative included a literature review of the state of child nutrition surveillance through the routine health information system over the past decade (2012-2022) and a multi-country mapping of anthropometric indicators in the HMIS. The desk review and key informant interviews with WHO regional nutrition advisers uncovered regional and country limitations in the data journey, i.e. the collection, collation, analysis, interpretation and dissemination of data. The concluding report has informed this technical note through the gaps identified and potential solutions to improve population-level coverage data (**Annex 1**). Moreover, three countries from the landscape review provided routine health information system microdata which enabled the assessment and testing of data quality based on adjusted criteria, further honing the assessment and analysis approaches for administrative data. A validation exercise grounded in the pilot methodology in Seychelles explored different analysis techniques and their impact on final prevalence estimates.

Data quality assessment was also explored for child growth monitoring. Data quality criteria aligned with the global recommendations for quality assessment of anthropometric measures (7) were proposed as a means of evaluating whether the data adhered to minimum requirements. The criteria were selected based on:

i) the specific intent for reporting child malnutrition estimates or trends;
ii) the information deemed important to reveal biases that should be adjusted when deriving estimates or trends.

[2] Argentina, Bangladesh, Bahrain, Bhutan, Botswana, Chile, Colombia, Croatia, Denmark, Eswatini, Ethiopia, Finland, Germany, Guatemala, Hungary, Iceland, India, Indonesia, Israel, Italy, Kuwait, Lao People's Democratic Republic, Lesotho, Lithuania, Maldives, Mauritius, Mexico, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Seychelles, Sri Lanka, Thailand, Tonga, Uganda, The United Kingdom of Great Britain and Northern Ireland, Vanuatu, Vietnam, Yemen, Zambia.



Chapter 3. Recommended practices for data collection

3.1 Selection of the data collection programme

The data collection programme heavily influences the characteristics of the data. Policymakers should review all available programmes and platforms that target children under age five before selecting the one most befitting for the specific context. Depending on the national nutrition plans, policymakers may choose to focus on a specific target population. It is important to consider the occurrence of multiple data collection points for a target population in each setting. For example, the population of children 0 to 23 months old may routinely interact with several national service delivery points such as immunization centres, educational hubs and daycare networks which compile their health and nutrition information. It may be more efficient to leverage already existing platforms to integrate the anthropometric data collection mechanism rather than establishing a completely new monitoring programme.

There are six recommended criteria when selecting the most suitable data collection programme to derive child malnutrition estimates (**Table 1**). A programme suitability review template has been developed in this technical note to help countries assess the required minimum criteria (**Annex 2**). The template includes a section on administrative data documentation that captures key aspects of the data collection process. Member States in the development or refinement stages of their nutrition data systems are encouraged to refer to this template.

An additional criterion to consider when selecting the most suitable programme is the amount of data that is already collected through the platform. Longer questionnaires can result in lower quality data. **Chapter 3.3** describes the minimum data elements required to generate population-level child malnutrition estimates.

Table 1. Key selection criteria to identify a data collection programme for child anthropometric measures

Criteria	Best Practice
Service delivery for all children	The selected data collection programme should deliver services to all children regardless of health status. The enrolled children must not have been referred or previously screened through other mechanisms to prevent bias.
Age range	Data collection programmes should primarily focus on children within the age range of 0 to 59 months.
Target population representativeness	The programme should ensure sufficient geographic and demographic coverage to generate estimates for the target population.
Anthropometric equipment	Standardized equipment must be consistently available and regularly calibrated across all designated health facilities (7).
Training	Staff involved in data collection should undergo standardized training in the collection of anthropometric measures aligned with WHO recommendations (9).
Supervision	Regular supervision for measurement and data validation should be in place for the programme.

3.1.1 Service delivery for all children

When selecting the most appropriate data collection programme to generate accurate and reliable child malnutrition estimates for national or subnational reporting, **WHO recommends the collection of anthropometric measurements from programmes where services are delivered to all children regardless of their health status.** Programmes that rely on referrals or prior screening can lead to biased estimates as the children interacting with those services would have been previously selected based on some criteria.

3.1.2 Age range

While the data collection programme should ideally target children 0 to 59 months of age, this may not always be feasible given the established age groupings of an existing programme or the difficulties in setting up a routine programme that specifically covers this age range. To overcome these challenges, **WHO recommends the regular administration of population-based surveys to generate estimates that encompass the entire 0 to 59 months age bracket, thereby complementing the data gathered through the administrative system.** Frequent comparative reviews triangulating the administrative data with the population-based survey data with consideration to the data collection period (e.g., season) will improve the interpretation of these estimates.

3.1.3 Target population representativeness

To ensure population representativeness, the data collection programme should span the entire country or target area geographically (in the case of subnational estimates). **WHO recommends the regular assessment of the profile of children interacting with the programme to assure that the sample is representative in terms of socio-demographic factors** such as region, place of residence (urban or rural), age, and sex in comparison to national demographic projections and references.

3.1.4 Anthropometric equipment

The installation of anthropometric equipment at the facility level will increase the quality and timeliness of administrative records while reducing staff time and effort associated with moving the measurement tools. The *2021 Anthropometry Procedures Manual* developed by the US Centers for Disease Control and Prevention (10) provides key guidance on the types of anthropometric equipment and how to care for, calibrate and maintain them.

When portable anthropometric equipment is necessary for data collection, the *Recommendations for data collection, analysis and reporting on anthropometric indicators in children under 5 years old* (7) provides guidance on the selection, calibration, maintenance and use of the equipment. **To measure the length/height of children aged 0 to 4 years, WHO recommends that length/height-boards have a minimum measuring range of 0-135 cm with a 0.1 cm minimum gradation, and**

an accuracy and precision of ± 0.2 cm. For weight, **WHO recommends having weight scales with a measuring range of 0 to no less than 150 kgs with a 100 g minimum gradation and an accuracy better than ± 0.15%/± 100 g** (7). To reduce recording error, it is also recommended that equipment have digital readouts (7).

3.1.5 Training

WHO has designed a *Training Course on Child Growth Assessment* (9) for healthcare providers who take measurements of children for growth assessment and supervisors who monitor these activities. **WHO recommends that the course be incorporated into staff on-boarding training**, **complemented by regular refresher courses, to ensure that staff have the most up-to-date knowledge and skills to produce high quality anthropometric measurements.**

3.1.6 Supervision

Regular supervision of and feedback to facility staff taking the measurements of children will support their professional development in conducting anthropometric assessments. Measurement standardization exercises support the measurer's ability to obtain accurate and precise measurements (11). Those who do not pass the acceptable threshold levels can be guided for further training.

3.2 Aggregated tabulations versus individual-level records

Aggregated summary statistics and individual-level records are both necessary and serve different purposes. It is important to differentiate between aggregated tabulations obtained from short-term snapshots versus individual data analyses collected over a prolonged period. Most health management information systems including DHIS2 report aggregated summary statistics at the facility, community or district levels and do not necessarily store the individual-level records which yielded those totals. Individual-level records/microdata allow for a close evaluation of the quality of the anthropometric measures (height, weight) and granular assessment of the sample coverage (e.g., by age-group, sex, facility). Wherever possible, appropriate adjustments for aggregate estimates can be applied. In turn, aggregate tabulations without individual-level assessments usually provide a glimpse of nutritional status for programmatic purposes, for instance, planning based on incidence rather than prevalence.

To derive population-level child malnutrition estimates, a full evaluation of the data collected through administrative data systems is strongly recommended to prevent biases related to data quality (e.g., poor quality data in a particular region with limited infrastructure or distinct socio-economic status), representativeness, and unbalanced sample distribution across age or sex groups. Moreover, sample denominators are not always clear when aggregated tabulations are generated. Some data quality checks regarding the completeness, timeliness, consistency, and external validation as recommended in the WHO Data Quality Assurance (DQA) toolkit (12) may be advantageous but cannot replace the specificities of the data quality checks when individual anthropometry is available. **For these reasons, this technical note recommends collecting and storing the individual-level records alongside the aggregated totals.**

3.3 Minimum data elements

For the collection of data, WHO recommends a typical electronic health data collection system with standardized forms. WHO and partners have developed the SCORE for Health Data Technical Package (13) to assist Member States in strengthening country data systems and capacities to monitor progress towards the health-related SDGs and national health priorities including the national nutrition targets.

Trained health workers using the right equipment is foundational for accurate growth assessment. **Measurements that are taken for child anthropometric estimates should follow standard procedures with the recommended precision.** Several training materials published by WHO support the capacity-building of health workers. Loss of accuracy, however, can occur beyond the moment a measurement is taken, such as when the child health visit form is filled out. For example, staff taking the measurements should be aware of the importance of recording to at least one decimal place for length/height (cm) and weight (kg), but ideally, to three decimal places to preserve adequate data quality. **Table 2** lists the minimum data elements required to calculate a child's height-for-age z-score (HAZ) and weight-for-height z-score (WHZ) to generate population-level child malnutrition estimates.

Table 2. Minimum data elements required to generate population-level child malnutrition estimates

Variable	Description
Unique Child ID	This variable indicates if a particular child has interacted with the programme multiple times during the reporting period (i.e. the child has multiple measurements). It supports the data validation process and prevents data entry errors such as incorrect name or birth date.
Age	Ideal: Date of Birth (DoB) and Date of Visit (DoV). If DoB and/or DoV are not recorded, the recommendation is to calculate and report the age in days or in exact months.
	Acceptable: Age calculated in completed months
Sex of child	Male or Female
Weight	In kilograms (kg), **with at least one decimal place**, ideally with 3 decimals (g)
Length or height	In centimetres (cm), with at **least one decimal place**

3.4 Additional data elements

Additional data elements are invaluable for improving analysis and granularity of results. For example, the measurement position may be worthwhile to note in a context where a child may have developmental differences. **If a child's position is not recorded, it is assumed that s/he is lying down if less than 24 months of age and standing upright if older than 24 months of age (these are the recommended measurement positions).** Contextual variables further improve sample representativeness and the interpretation of results. While data from health facilities automatically indicate location, other geographic indicators such as region and department may provide more refined data for programmatic action and the generation of subnational estimates. Recommended contextual data elements are shown in **Table 3**.

Table 3. Additional recommended contextual data elements

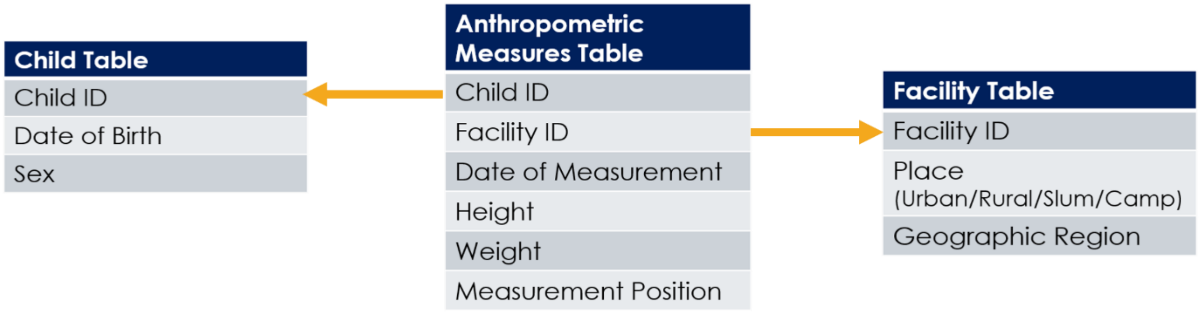
Variable	Description
Measurement position	This variable indicates if the child's length/height was measured standing upright or lying down, thereby supporting data quality assessment and improvement in the calculation of z-scores. **The recommendation is to measure all children below 24 months of age lying down. If the measurement position is not recorded, the recommendation is to assume that the child is lying down if less than 24 months of age and standing upright if older.**
Unique facility identification (ID)	This variable facilitates regular reviews of the data sample (e.g., how a facility fares against the national reference) and enables the recognition of specific facilities with data quality issues and subsequent corrective action.
Place of facility	Urban/Rural/Slum/Camp
Geographic region	Subnational region where data was collected

3.5 Database structure

To ensure consistency in the data used for further analyses, **this technical note proposes a relational database structure with three main components (Figure 1):**

i) A **child-centric reference** table containing the Child ID, Date of Birth, Sex and other critical information related to the child;
ii) An **anthropometric measurement table** containing the anthropometric estimates (Height, Weight, Measurement position, etc.) alongside the Date of Measurement linked by Child ID and Facility ID;
iii) A **facility-centric reference table** containing the Facility ID, Place of facility, Geographic region and any additional information related to the facility.

Figure 1. Recommended structure for data collection and management



3.6 Data validation

To achieve high quality results, programme managers must ensure that they adhere to best practices with regards to integrating robust data validation criteria. This minimizes the likelihood of invalid data being included in the database (e.g. measurement and/or reporting errors). Examples of data validations include:

i) Ensuring all dates adhere to valid dates in the calendar so that implausible dates are excluded;
ii) Ensuring that the Date of Visit is not before Date of Birth;
iii) Using input mask/format to ensure that dates are entered correctly (e.g. DD-MM-YYYY);
iv) Using dropdown menus for categorical data (e.g. place, geographic region) instead of free text;
v) Integrating flagging systems into the data entry form to detect typos or implausible measurement values.

3.7 Reporting period

Member States often employ monthly reporting periods which are further aggregated into annual reporting. Not only is this advantageous for programme monitoring and evaluation, but it also reduces the time gap from data collection to data use to drive action. However, annual estimates are the norm for global reporting on national or subnational statistics. **The reporting period of the data from administrative systems should ideally encompass the full calendar year (1 January to 31 December)**.

Chapter 4. Recommended practices for data analysis

4.1 Checking for dataset inconsistencies

The first step in preparing the data for analyses is to review the dataset for inconsistencies. Even in cases where a relational database structure is used, inconsistencies may be introduced if the data is not merged correctly. **Table 4** contains examples of two such inconsistencies.

Table 4. Examples of inconsistencies in data

Record Number	Child ID	Sex	Date of Birth (DD-MM-YYYY)
1	001	F	10/09/2000
2	001	F	10/09/2000
3	001	F	**09/10/2000**
4	002	**M**	17/01/2002
5	002	**F**	17/01/2002

Example 1
There are three records for Child ID 001. In records 1 and 2, the date of birth is 10 September 2000 while in record 3, the date of birth is 9 October 2000. This inconsistency arises from the merger of records that used a data collection system which has failed to apply a fixed date format for the Date of Birth, thus allowing for the use of local date settings.

Example 2
There are two records for Child ID 002. In record 4, the child is Male and in record 5, the child is Female. This inconsistency may arise when a relational database is not implemented, and child-specific data (e.g. Date of Birth, Sex) are not automatically merged through the Child ID when it is recorded during the visit. In this case, an in-depth investigation is warranted after child records are merged to identify potential sources of error, including re-checking the ID number, Sex, and Date of Birth, as they could also be mistakenly assigned to twin children.

Once an inconsistency is found, the following remedial steps are recommended:

i) Confirm the correct value by reviewing other data related to the same record within the national health information system.
ii) If the correct value is confirmed, address the change in the source reference table and rerun the data export process to ensure that all future exports do not contain that inconsistency.
iii) If the correct value cannot be confirmed, drop all records pertaining to that ID from the dataset that will be used for analysis.

In the Sample Report, the use of the metric ***Proportion of Children Excluded from Analysis due to Data Inconsistency (P_{exc})*** is recommended, calculated as follows:

$$P_{exc} = \frac{\text{Total Number of Children Excluded from Analysis due to Data Inconsistency}}{\text{Total Number of Children in the Sample}}$$

The metric is based on the number of children in the sample and not the number of observations. If there are additional data about the child (e.g. name, parent ID), they can also be used to check for inconsistencies; for example, children born on the same day with the same name, same sex, in the same facility but with different ID numbers.

4.2 Addressing invalid data

The next step is to review the data for invalidity. This review is not focused on biologically implausible estimates which will be covered in **Chapter 5.2**. Invalidity of data primarily refers to two elements: Date of Birth (DoB) and Date of Visit (DoV). Examples of invalid dates and the reasons for their invalidity are summarized in **Table 5**.

Table 5. Examples of invalid dates

Example	Record Number	Date	Reason for Invalidity
1	Day in the date is larger than maximum permitted for the month	32 January 2023	January has a maximum of 31 days
2	29 February but not in a leap year	29 February 2023	2023 is not a leap year. The maximum number of days for February in this year is 28
3	DoV is before DoB	DoB: 28 February 2023 DoV: 31 January 2023	The date of visit cannot be before the date of birth

To address invalid dates, WHO recommends:

i) To change invalid days to 15 where the invalidity can be corrected by changing the day in the date (Examples 1 and 2);

ii) To exclude cases from indicators derived from HAZ in the case where the DoV is before DoB (Example 3). The child will still be included for indicators derived from WHZ.

In the Sample Report, the use of the metric ***Proportion of Observations with Invalid Dates (P_{inv})*** is recommended, calculated as follows:

$$P_{inv} = \frac{\text{Total Number of Observation with Invalid Dates}}{\text{Total Number of Observations in the Sample}}$$

The metric is based on number of observations in the sample and not the number of children.

4.3 Calculating age in months

When dates (DoB and DoV) cannot be exported or in cases where age in months is automatically calculated, **WHO recommends the following formula when calculating age in months:**

$$Age\ in\ Months = \frac{Date\ of\ Measurement - Date\ of\ Birth}{30.4375}$$

Note: 30.4375 is the average number of days in a month throughout the year considering the occurrence of a leap year (366 days) every four years.

The use of age in exact months as opposed to completed months or rounded months is a best practice and avoids misclassification, **especially in school-age children where growth velocity is highest**. **Table 6** provides an example of the differences between exact, rounded and completed months along a child's second month of age.

Table 6. Differences between exact month, rounded month and completed month

Exact Month	Rounded Month	Completed Month
2.0	2.0	2.0
2.1	2.0	2.0
2.2	2.0	2.0
2.3	2.0	2.0
2.4	2.0	2.0
2.5	3.0	2.0
2.6	3.0	2.0
2.7	3.0	2.0
2.8	3.0	2.0
2.9	3.0	2.0

Table 7 illustrates the impact that the different recording methods for age in months can have on HAZ. A male child aged exactly 2.8 months measuring 55.0 cm in length can have three different height-for-age assessments depending on the age calculation. If we use exact month – the most accurate assessment – the child will be reported as moderately stunted (-2.83 HAZ). If we were to use rounded months, the child would be reported as severely stunted (-3.09 HAZ). If completed months were used, the child would not be classified as stunted (-1.67 HAZ).

Table 7. Impact of different age calculations in months on height-for-age z-score

Variable	Exact Month	Rounded Month	Completed Month
Age in months	2.8	3.0	2.0
Sex	Male	Male	Male
Measurement position	Lying down	Lying down	Lying down
Height/length (cm)	55.0	55.0	55.0
Height-for-age z-score (HAZ)	-2.83	-3.09	-1.67
Assessment	Moderately Stunted	Severely Stunted	Not Stunted

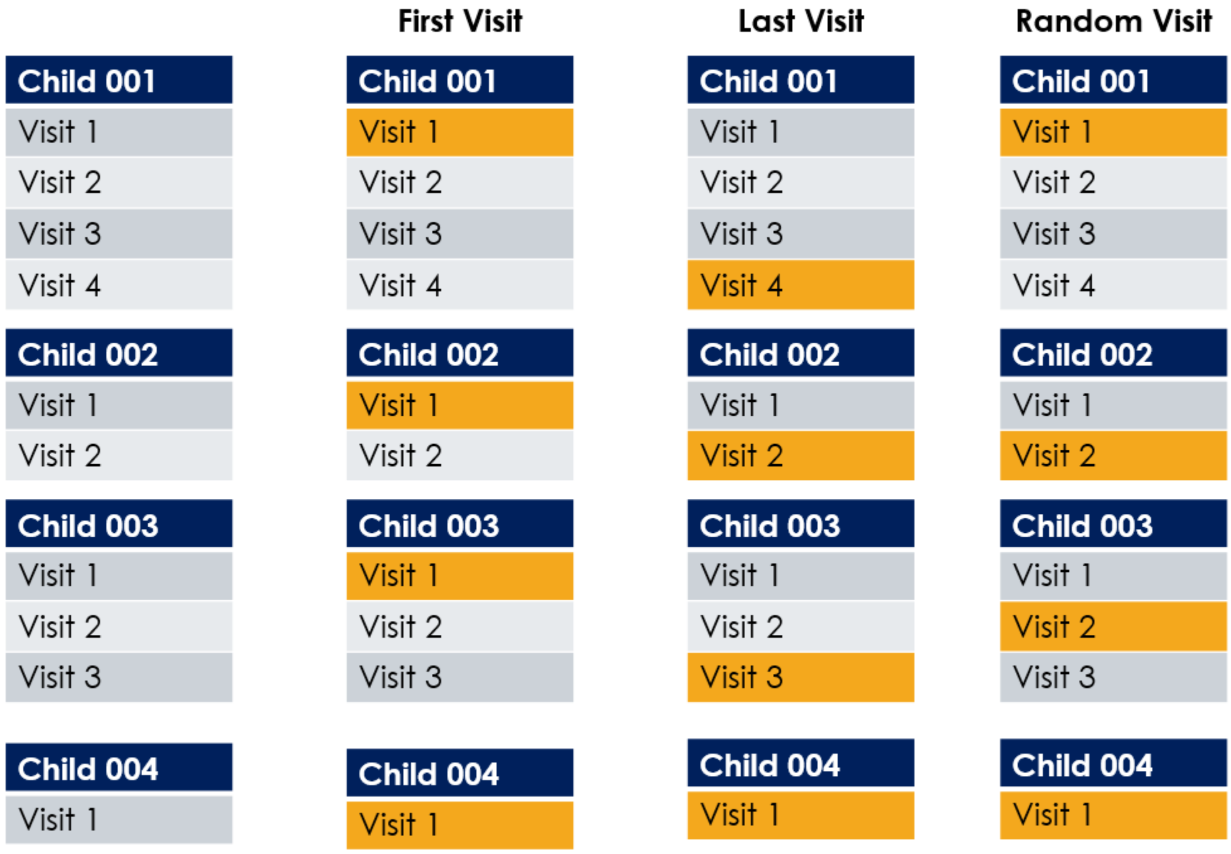
4.4 Selecting one measurement per child

Datasets from administrative data can contain multiple records (visits) for each child as s/he may interact with the programme more than once over the course of the calendar year. If the programme is linked to routine immunization, for example, younger children would have more records than older ones as they follow the national immunization schedule.

For annual global reporting of child malnutrition indicators, the final dataset for analysis should not include multiple visits per child (i.e. double counting) to avoid biases of any type when inferring about the nutritional status of the general population. There are several approaches to address double counting. However, in this technical note, WHO focuses on an approach that restricts the final dataset to one visit per child. To achieve this, there are three common options (**Figure 2)**:

i) selecting the first visit
ii) selecting the last visit
iii) selecting a random visit.

Figure 2. Example of first visit, last visit and random visit



In this example, there are four children with different numbers of visits. Child 001 visited four times, Child 002 visited two times, Child 003 visited three times and Child 004 visited once. When selecting the **first visit**, it is important to list the visits in ascending order by date of visit, and not by record number. This ensures the selection of the child's first true interaction with the programme during the reporting period (i.e. calendar year). A similar logic is applied when selecting the **last visit**. In this case, the first visit on the list in descending order by date of visit is selected. This will capture the child's last interaction with the programme in the reporting period. For **random visit**, statistical software such as R and Stata and spreadsheet software such as Excel can assign a random number for each visit using pseudorandom number generators (14). Visits can be sorted in either ascending or descending order and the first visit based on the random number sorting should be selected. Note that in the case where a child has interacted only once with the programme, there is no difference between first, last and random visit.

WHO has investigated the impact on prevalence estimates when using each of the above approaches based on real datasets from case study countries and additional bootstrapping exercises (unpublished research). The differences were minor, most likely because all age groups well represented. This was, by no means, an exhaustive analysis and one might see greater differences across the three approaches depending on the sample age group distribution. **In general, random selection is the safest to avoid introducing any systematic biases.**

4.5 Weighting the sample

If the sample has lower coverage than the reference population, sample weights should be applied to improve the representativeness of the estimates generated from the dataset. It is important to select the right reference population, and the right subgroups used to assess representativeness. More details on this can be found in **Chapter 5.1**.

When calculating sample weights, WHO recommends the following formula:

$$Sample\ Weight = \frac{Total\ Count\ of\ Children\ in\ the\ Sample}{Subgroup\ Total\ in\ Sample} \times \frac{Subgroup\ Total\ in\ the\ Reference\ Population}{Total\ in\ the\ Reference\ Population}$$

For subgroups, 1-year age groups are strongly recommended. Countries are also encouraged to use region or the combination of age-sex as alternatives. For the reference population, **WHO recommends the United Nations Population Division (UNPD) World Population Prospects (WPP)** (15) for any age and sex comparisons and the **Medium Projection scenario** when projections are needed. Countries are also encouraged to use their own national estimates and projections as alternatives. **Table 8** provides a scenario where 1-year age subgroups are used for weighting.

Table 8. Sample and reference populations using 1-year age subgroups

Subgroup	0 to 11 months	12 to 23 months	24 to 35 months	36 to 47 months	48 to 59 months	Total
Count in sample	500	600	600	500	400	2600
Proportion of sample (%)	19.2	23.1	23.1	19.2	15.4	100
Count in reference population	700	900	800	700	700	3800
Proportion of reference population (%)	18.4	23.7	21.1	18.4	18.4	100

In this case, children aged 48 to 59 months represent 15.4% of the sample but 18.4% of the reference population. To account for this discrepancy, the following sample weight is calculated:

$$Sample\ Weight = \frac{2600}{400} \times \frac{700}{3800}$$

This will result in a sample weight of 1.1974 for children in that age group. The product of the sample weight (1.1974) times the count in the sample in the 48 to 59 months subgroup (400) is 478.9474 which is 18.4% of the total sample (2600). In the same way, the proportion of the reference population mirrors the proportion in the sample. These weights are normalized so the weighted sum of observations equals the unweighted sum of observations.

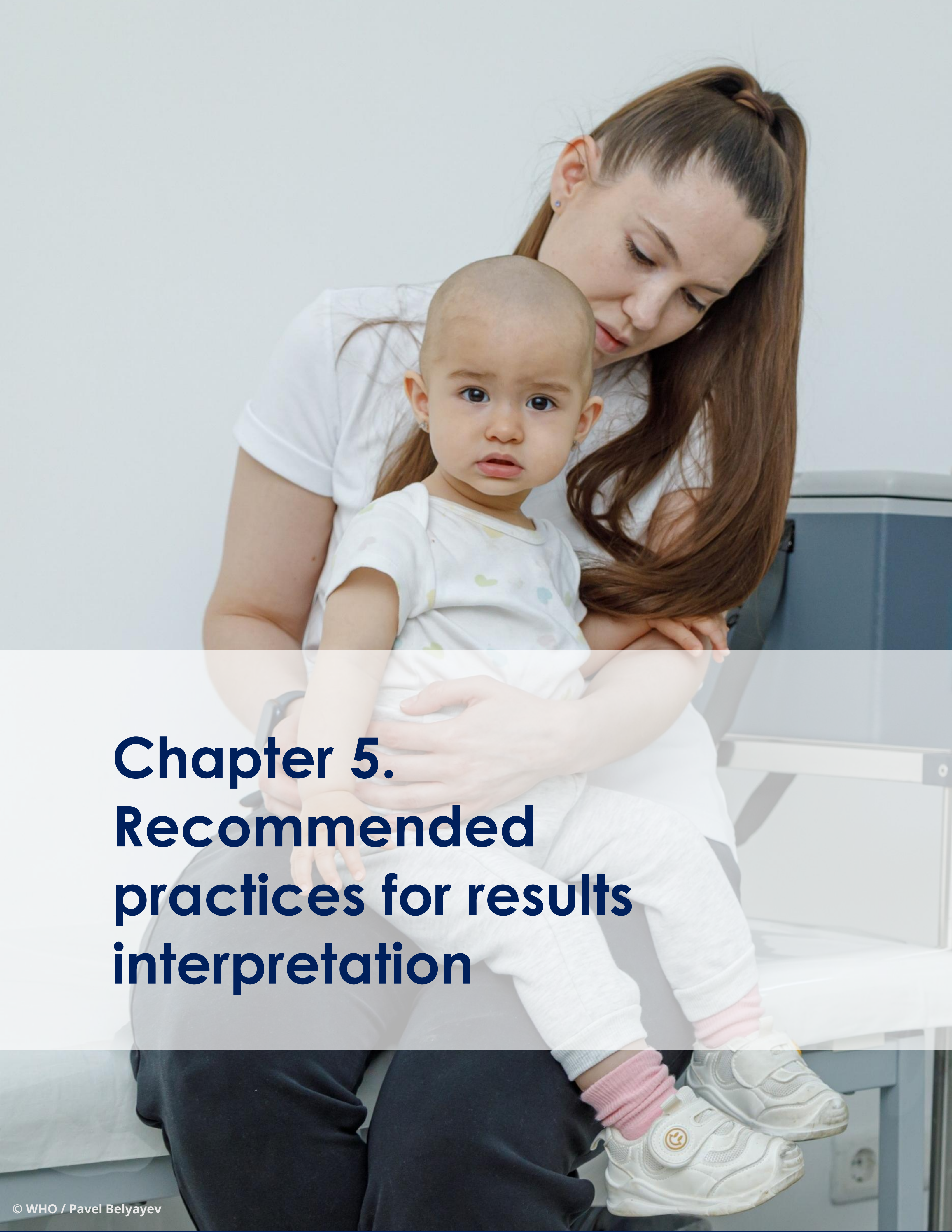
4.6 The WHO Anthro Survey Analyser

The WHO Anthro Survey Analyser[3] was developed by WHO to facilitate the analysis of individual-level child anthropometric data and reporting of related indicators. This online tool analyses both HAZ and WHZ indicators and provides the following outputs:

i) The input dataset with set of z-scores;
ii) A file with prevalence estimates by stratification variables following the format in the WHO Global Database on Child Growth and Malnutrition (GDCGM);[4]
iii) A report template on data quality assessments;
iv) A summary report with a template to be filled in with information and ready-to-use graphics and tables depicting analysis results.

In some cases, after selecting one random visit per child, samples from administrative systems may be too large (more than 1 million observations) for the efficient use of the online version of the tool (depending on internet connection speed and other parameters). **In such cases, WHO recommends the use of the offline version of the Anthro Survey Analyser**.[3]

[3] Available at https://www.who.int/tools/child-growth-standards/software
[4] Available at https://platform.who.int/nutrition/malnutrition-database



Chapter 5. Recommended practices for results interpretation

5.1 Assessing population coverage

Administrative systems are not always built for the purpose of covering the general population. As mentioned before, this technical note focuses on providing guidance to the uses of data that are collected through administrative systems for the generation of population-level child malnutrition estimates. In this sense, **population coverage is an important metric in understanding differences between the final sample used for analysis and the reference population. It is defined as:**

$$Population\ Coverage = \frac{Total\ Number\ of\ Distinct/Unique\ Children\ in\ the\ Sample}{Total\ Number\ of\ Children\ in\ the\ Reference\ Population}$$

The population coverage can be calculated for subgroups in the sample by comparing them with the same subgroup in the reference population. **When assessing population coverage, it is important to select the appropriate subgroups (strata) and the appropriate reference population.**

For child malnutrition estimates, it is important to consider the fact that levels of malnutrition, depending on the context, may vary along the timeline from birth to 5 years of age. Thus, **WHO recommends 1-year age groups to closely examine population coverage.** Other recommended subgroups are geographic divisions such as provinces or regions depending on the target population estimates. For the reference population, **WHO recommends the United Nations Population Division (UNPD) World Population Prospects (WPP)** (15) for any age and sex comparisons and the **Medium Projection scenario** for projections.

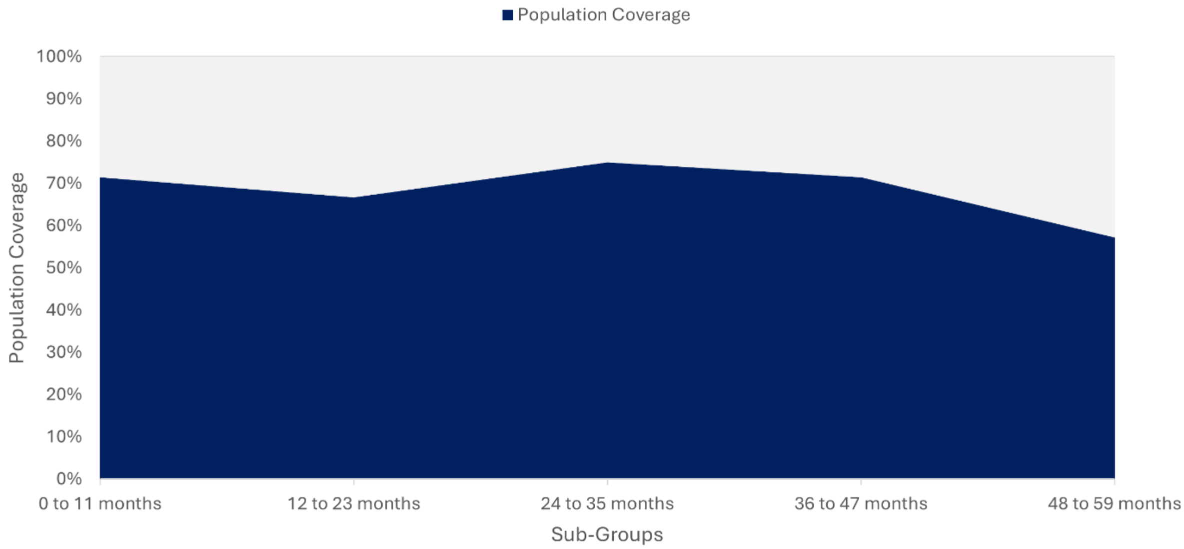
Note that there is currently no recommended population coverage threshold to determine whether a sample requires adjustments (e.g. sampling weights) for the estimates to be representative of the nutritional status of the target population. Neither is there any recommended system to account for expected versus observed distributions across population subgroups.

Table 9 presents a scenario where the population coverage is calculated for the total sample as well as for the subgroups. This is further visualized in **Figure 3.**

Table 9. Assessing population coverage (Scenario 1)

Subgroup	0 to 11 months	12 to 23 months	24 to 35 months	36 to 47 months	48 to 59 months	Total
Count in sample	500	600	600	500	400	2600
Count in reference population	700	900	800	700	700	3800
Population coverage (%)	71.4	66.7	75.0	71.4	57.1	68.4

Figure 3. Assessing population coverage (Scenario 1)



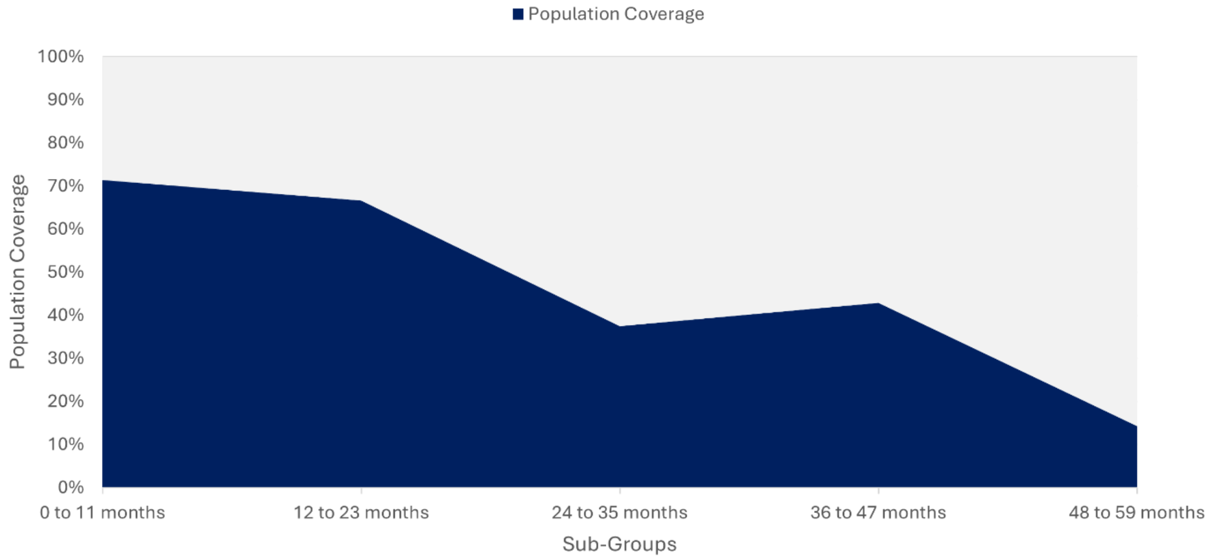
In this scenario, the overall sample covers 68.4% of the population. Where samples are considered not to be representative of the target population, a potential solution is to apply sample weights (see **Chapter 4.5**). In addition, a review of how to boost coverage in this programme or a review of other target programmes may be needed if the coverage is not ideal. Guidance on the review of platforms is outlined in **Chapter 3.1**.

Table 10 and **Figure 4** illustrate a second scenario where coverage drops significantly after the 12 to 23 months subgroup while the reference population shows sustained numbers across age groups. In some contexts, the use of the sample to represent the entire 0 to 59 months age interval could lead to biased estimates. For instance, in a country where child overweight is higher in the first two years, the simple aggregation of the sample to generate the entire interval estimate would lead to overestimation of child overweight. In **Chapter 4.5**, WHO proposes sample weights that could adjust for this imbalance across age-groups, albeit with the risk of affecting the precision of estimates. On the other hand, when the programme targets a subset of the population, for example, a smaller age interval, the age groups that are not a target might present considerably smaller sample sizes. In such cases, the approach could be to truncate to the target age interval.

Table 10. Assessing population coverage (Scenario 2)

Subgroup	0 to 11 months	12 to 23 months	24 to 35 months	36 to 47 months	48 to 59 months	Total
Count in sample	500	600	300	300	100	1800
Count in reference population	700	900	800	700	700	3800
Population coverage (%)	71.4	66.7	37.5	42.9	14.3	47.4

Figure 4. Assessing population coverage (Scenario 2)

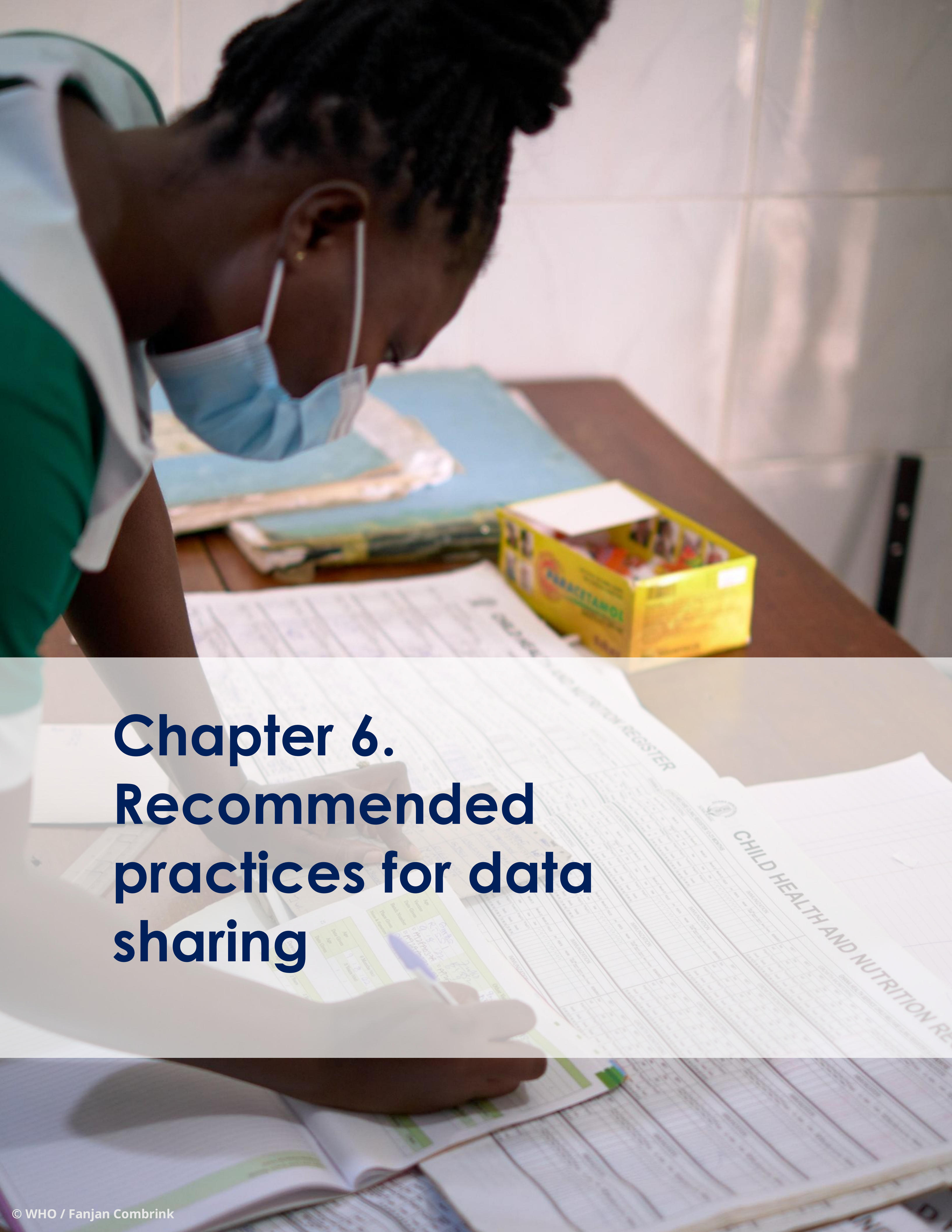


This technical note proposes that sensitivity analyses are done to compare estimates with and without adjustments where coverage is inadequate, acknowledging that more research is needed to identify thresholds that can be applied for global reporting.

5.2 Assessing data quality of anthropometric measures

Depending on the nature of the programme selected, it would be unlikely that the sample would behave in the same way as the data collected from household surveys. For example, if data are collected through the routine immunization programme, there will be peaks in age periods around the target visit dates that roughly follow the national immunization schedule. In such cases, age heaping assessment would not be too relevant unlike data quality checks recommended for survey data. In turn, **data quality reviews based on missing data, digit preference, and implausible z-scores are useful in all cases as they help to identify issues in data collection**. WHO and UNICEF have developed relevant guidance on the collection and analysis of anthropometric data to support the calculation and interpretation of these data quality metrics (7).

The Data Quality Report from the WHO Anthro Survey Analyser[3] contains all the necessary data quality graphics.



Chapter 6. Recommended practices for data sharing

6.1 Aggregated tabulations

The definition of stunting, wasting and overweight used for global reporting are outlined in **Table 11**. Stunting is calculated based on the WHO Child Growth Standards height-for-age index. Wasting and overweight are calculated based on the WHO Child Growth Standards weight-for-height index.

Table 11. Indicator definitions for stunting, wasting and overweight

Indicator	Definition
Stunting	Prevalence of stunting (height-for-age < —2 standard deviation from the median of the WHO Child Growth Standards) among children under 5 years of age
Wasting	Prevalence of wasting (weight-for-height < —2 standard deviation from the median of the WHO Child Growth Standards) among children under 5 years of age
Overweight	Prevalence of overweight (weight-for-height > +2 standard deviation from the median of the Child Growth Standards) among children under 5 years of age

We strongly recommend the sharing of individual-level microdata when available. The rationale for this is outlined in **Chapter 3.2**. When individual-level microdata cannot be shared with WHO or partners, it is recommended that **estimates be generated and shared for the disaggregates as shown in Table 12 in addition to the Total.** Additional useful disaggregates include place of residence (for example, Urban, Rural, Slums or Camp), Geographic Region, Mother's Education (e.g. No Education, Primary Education, Secondary Education, Tertiary Education) and Household Wealth Quintile.

Table 12. Recommended disaggregates for global reporting

Background Characteristics	Sex	Age	Age and Sex
Disaggregates	Male	0 to 5 months	Male 0 to 5 months
	Female	6 to 11 months	Male 6 to 11 months
		12 to 23 months	Male 12 to 23 months
		24 to 35 months	Male 24 to 35 months
		36 to 47 months	Male 36 to 47 months
		48 to 59 months	Male 48 to 59 months
			Female 0 to 5 months
			Female 6 to 11 months
			Female 12 to 23 months
			Female 24 to 35 months
			Female 36 to 47 months
			Female 48 to 59 months

The WHO Anthro Survey Analyser produces these prevalence tabulations with the abovementioned disaggregates. **It is recommended that the prevalence estimates file be shared with WHO or partners alongside the Data Quality Report and the Summary Report.** A reporting template to share with the tabulations can be found in **Annex 2**. WHO is available to support countries with their analyses through workshops.

6.2 Reporting on the coverage and the sample

Whether sharing aggregated tabulations or individual-level microdata, **WHO recommends the sharing of the following additional information:**

i) A completed Programme suitability review template (**Annex 2**)
ii) An additional sample analysis report describing:
   a. Any observation filters used (i.e. all measurements, first measurement, last measurement, random measurement or any other approach);
   b. Population coverage with details on the reference population used;
   c. Details if the dataset was truncated or the analysis was weighted;
   d. Proportion of children excluded due to data inconsistency (see **Chapter 4.1**);
   e. Proportion of observations with invalid dates (see **Chapter 4.2**).

6.3 Anonymizing identification numbers

When sharing individual-level records, **WHO recommends anonymization of all personally identifiable information** such as names, national IDs, addresses and telephone numbers. This anonymization should fully ensure that individual privacy is protected, and a person cannot be identified beyond what is necessary to generate national statistics. The International Household Survey Network (IHSN) has developed a useful resource on anonymization practices (16).

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Annexes


REPUBLIC OF KENYA
MINISTRY OF HEALTH
BABY FRIENDLY COMMUNITY INITIATIVE (BFCI) TOOLS FOR USE IN AREAS IMPLEMENTING THE NUTRITION IMPROVEMENTS THROUGH CASH AND HEALTH EDUCATION PROJECT (INCHE PROJECT)
BFCI FORM 1A:
INDIVIDUAL INFANT AND YOUNG CHILD FEEDING & GROWTH MONITORING RECORD
MOH 281

Annex 1. Summary of challenges reported in child nutrition surveillance in RHISs and possible solutions

Nutrition surveillance stage	Challenges	Solutions
Collection	No data collection secondary to conflict	Collection of routine data should be suspended in emergency situations and survey approaches utilised
	May not be population-based, lack of coverage	Sampling should either adopt a census or sentinel surveillance approach
	Selection bias	Sampling should either adopt a census or sentinel surveillance approach; clear instructions in training manuals and courses on avoiding selection bias
	Busy/crowded environment with marked time constraints	Review of structure and organization of well-baby clinic
	Limited or imprecise equipment	Give equipment recommendations and provide named suppliers; provide funds for equipment
	Limited measurement/recording of length/height	Creation of Quality and Outcomes Framework (QOF), a pay for performance scheme covering a range of clinical and organisation areas in primary care including surveillance
	Limited recording of/alignment with GNMF indicators	Creation of Quality and Outcomes Framework (QOF), a pay for performance scheme covering a range of clinical and organisation areas in primary care including surveillance
	Incomplete/inaccurate recording of data elements required for calculating nutritional status	Cover poor practices in training manual and course; integrate semi-annual audits to find out if surveillance is being provided in line with standards
	Suboptimal training of health workers	Provision of semi-annual training courses
	Demotivated health workers	Qualitative study to understand perceptions and experiences of health workers
	No/limited time of health workers to collect data (clinic understaffing)	Qualitative study to understand perceptions and experiences of health workers
	Data collected by more than one Ministry leading to lack of coordination/centralization	Identify and liaise with MOH to agree on key coordinating unit
Collation	Rounding values/typos	Cover poor practices in training manual and course
	Inconsistent use of charts in the WHO Child Growth Standards	Liaise with MOH to ensure that charts in the WHO Child Growth Standards are used

Nutrition surveillance stage	Challenges	Solutions
	Inaccurate plotting	Cover poor practices in training manual and course
	May not include total number of children who came to clinic/denominator of prevalence	Cover poor practices in training manual and course
	Data transmission delays	Cover optimising data flow in training manual and course
	Lack of double entry from paper forms to digital platforms	Cover poor practices in training manual and course; switch to paperless recording forms
	Suboptimal training in using electronic RHIS software (e.g. DHIS2)	Cover poor practices in training manual and course
Analysis & interpretation	Suboptimal data validation/checking	Cover poor practices in training manual and course
	Lack of training in the uses of the existing guidance on interpreting measurements	Provision of training manual and semi-annual course
	Uncertainty regarding thresholds and/or ranges for indicators of data quality	Provision of training manual and semi-annual course
	Accounting for repeated observations on the same child throughout the year not always considered	Selection of a single month where nutrition data is transmitted to MOH; if multiple waves of nutrition data are collected on the same children and transmitted to MOH, MOH must present data stratified by time
Dissemination	Challenges to accessing data from DHIS2 platform	Liaise with MOH to ensure that DHIS2 is shared with UN agencies

Annex 2. Programme suitability review template

COUNTRY		
Information Required	**Description**	**Additional Observations/Comments**
Overview		
Name of Data Source		
Responsible Institution		
Focal Point *Include contact information*		
Representativeness		
Target Population *Define using age-groups, e.g. all children aged 0-59 months*		
Population Coverage *Expressed as a percentage, comparing the sample with the reference population*		
Reference Population used to Calculate Population Coverage *For example, UN DESA World Population Prospects, National Census*		
Anthropometric Equipment *Data should be based on measurements recorded and not self-reporting*		
Equipment used to measure height *Include the manufacturer, model number, measurement range, minimum gradation, accuracy and precision*		
Equipment used to measure weight *Include the manufacturer, model number, measurement range, minimum gradation, accuracy and precision*		
Calibration *Include the process and the frequency*		
Training and Supervision		
Training		
Supervision		

Annex 3. Summary table of recommendations

Chapter	Recommendation
Chapter 3. Recommended practices for data collection	
3.1 Selection of the data collection programme	There are six recommended criteria when selecting the most suitable data collection programme to derive child malnutrition estimates. ***Table 1***. *Key selection criteria to identify a data collection programme for child anthropometric measures*
3.1.1 Service delivery for all children	WHO recommends the collection of anthropometric measurements from programmes where services are delivered to all children regardless of their health status.
3.1.2 Age range	WHO recommends the regular administration of population-based surveys to generate estimates that encompass the entire 0 to 59 months age bracket, thereby complementing the data gathered through the administrative system.
3.1.3 Target population representativeness	WHO recommends the regular assessment of the profile of children interacting with the programme to assure that the sample is representative in terms of socio-demographic factors.
3.1.4 Anthropometric equipment	To measure the length/height of children aged 0 to 4 years, WHO recommends that length/height-boards have a minimum measuring range of 0-135 cm with a 0.1 cm minimum gradation, and an accuracy and precision of ± 0.2 cm. For weight, WHO recommends having weight scales with a measuring range of 0 to no less than 150 kgs with a 100 g minimum gradation and an accuracy better than ± 0.15% / ± 100 g.
3.1.5 Training	WHO recommends that the course be incorporated into staff on-boarding training, complemented by regular refresher courses, to ensure that staff have the most up-to-date knowledge and skills to produce high quality anthropometric measurements.
3.1.6 Supervision	Regular supervision of and feedback to facility staff taking the measurements of children will support their professional development in conducting anthropometric assessments.
3.2 Aggregated tabulations versus individual-level records	▪ To derive population-level child malnutrition estimates, a full evaluation of the data collected through administrative data systems is strongly recommended to prevent biases related to data quality. ▪ This technical note recommends collecting and storing the individual-level records alongside the aggregated totals.
3.3 Minimum data elements	▪ For the collection of data, WHO recommends a typical electronic health data collection system with standardized forms. ▪ Measurements that are taken for child anthropometric estimates should follow standard procedures with the recommended precision. ***Table 2***. *Minimum data elements required to generate population-level child malnutrition estimates*
3.4 Additional data elements	The recommendation is to measure all children below 24 months of age lying down. If the measurement position is not recorded, the recommendation is to assume that the child is lying down if less than 24 months of age and standing upright if older. ***Table 3***. *Additional recommended contextual data elements*

Chapter	Recommendation
3.5 Database structure	This technical note proposes a relational database structure with three main components: i) A child-centric reference table containing the Child ID, Date of Birth, Sex and other critical information related to the child. ii) An anthropometric measurement table containing the anthropometric estimates (Height, Weight, Measurement position, etc.) alongside the Date of Measurement linked by Child ID and Facility ID. iii) A facility-centric reference table containing the Facility ID, Place of facility, Geographic region and any additional information related to the facility. ***Figure 1.*** *Recommended structure for data collection and management*
3.6 Data validation	To achieve high quality results, programme managers must ensure that they adhere to best practices with regards to integrating robust data validation criteria.
3.7 Reporting period	The reporting period of the data from administrative systems should ideally encompass the full calendar year (1 January to 31 December).
Chapter 4. Recommended practices for data analysis	
4.1 Checking for dataset inconsistencies	If an inconsistency is found in the dataset, the following remedial steps are recommended: i) Confirm the correct value by reviewing other data related to the same record within the national health information system. ii) If the correct value is confirmed, address the change in the source reference table and rerun the data export process to ensure that all future exports do not contain that inconsistency. iii) If the correct value cannot be confirmed, drop all records pertaining to that ID from the dataset that will be used for analysis.
	In the Sample Report, the use of the metric ***Proportion of Children Excluded from Analysis due to Data Inconsistency (P_{exc})*** is recommended, calculated as follows: $$P_{exc} = \frac{\text{Total Number of Children Excluded from Analysis due to Data Inconsistency}}{\text{Total Number of Children in the Sample}}$$
4.2 Addressing invalid data	To address invalid dates, WHO recommends: i) To change invalid days to 15 where the invalidity can be corrected by changing the day in the date. ii) To exclude cases from indicators derived from HAZ in the case where the DoV is before DoB. The child will still be included for indicators derived from WHZ.
	In the Sample Report, the use of the metric ***Proportion of Observations with Invalid Dates (P_{inv})*** is recommended, calculated as follows: $$P_{inv} = \frac{\text{Total Number of Observation with Invalid Dates}}{\text{Total Number of Observations in the Sample}}$$
4.3 Calculating age in months	When dates (DoB and DoV) cannot be exported or in cases where age in months is automatically calculated, WHO recommends the following formula when calculating age in months: $$Age\ in\ Months = \frac{Date\ of\ Measurement - Date\ of\ Birth}{30.4375}$$
	The use of age in exact months as opposed to completed months or rounded months is a best practice and avoids misclassification, especially in school-age children where growth velocity is highest.

Chapter	Recommendation
4.4 Selecting one measurement per child	WHO focuses on an approach that restricts the final dataset to one visit per child. To achieve this, there are three common options: i) Selecting the first visit; ii) Selecting the last visit; iii) Selecting a random visit. In general, random selection is the safest to avoid introducing any systematic biases.
4.5 Weighting the sample	When calculating sample weights, WHO recommends the following formula: $Sample\ Weight = \frac{Total\ Count\ of\ Children\ in\ the\ Sample}{Subgroup\ Total\ in\ Sample} \times \frac{Subgroup\ Total\ in\ the\ Reference\ Population}{Total\ in\ the\ Reference\ Population}$
	For subgroups, 1-year age groups are strongly recommended. Countries are encouraged to use region or the combination of age-sex as alternatives. For the reference population, WHO recommends the United Nations Population Division (UNPD) World Population Prospects (WPP) for any age and sex comparisons and the Medium Projection scenario when projections are needed. Countries are encouraged to use their own national estimates and projections as alternatives.
4.6 The WHO Anthro Survey Analyser	▪ The WHO Anthro Survey Analyser was developed to facilitate the analysis of individual-level child anthropometric data and reporting of related indicators. ▪ Samples from administrative systems may be too large (more than 1 million observations) for the efficient use of the online version of the tool (depending on internet connection speed and other parameters). In such cases, WHO recommends the use of the offline version of the Anthro Survey Analyser.
Chapter 5. Recommended practices for results interpretation	
5.1 Assessing population coverage	Population coverage is an important metric in understanding differences between the final sample used for analysis and the reference population. It is defined as: $Population\ Coverage = \frac{Total\ Number\ of\ Distinct/Unique\ Children\ in\ the\ Sample}{Total\ Number\ of\ Children\ in\ the\ Reference\ Population}$
	▪ When assessing population coverage, it is important to select the appropriate subgroups (strata) and the appropriate reference population. ▪ WHO recommends 1-year age groups to closely examine population coverage. Other recommended subgroups are geographic divisions such as provinces or regions depending on the target population estimates. For the reference population, WHO recommends the United Nations Population Division (UNPD) World Population Prospects (WPP) for any age and sex comparisons and the Medium Projection scenario for projections.
5.2 Assessing data quality of anthropometric measures	Data quality reviews based on missing data, digit preference, and implausible z-scores are useful in all cases as they help to identify issues in data collection. WHO and UNICEF have developed relevant guidance on the collection and analysis of anthropometric data to support the calculation and interpretation of these data quality metrics.
Chapter 6. Recommended practices for data sharing	
6.1 Aggregated tabulations	We strongly recommend the sharing of individual-level microdata when available. When individual-level microdata cannot be shared with WHO or partners, it is recommended that estimates be generated and shared for the disaggregates in addition to the total. Additional useful disaggregates include Place (Urban, Rural,

Chapter	Recommendation
	Slums, Camp), Geographic Region, Mother's Education (No Education, Primary Education, Secondary Education, Tertiary Education) and Household Wealth Quintile. ***Table 12:*** Recommended disaggregates for global reporting It is recommended that the prevalence estimates file be shared with WHO or partners alongside the Data Quality Report and the Summary Report.
6.2 Reporting on the coverage and the sample	Whether sharing aggregated tabulations or individual-level microdata, WHO recommends the sharing of the following additional information: i) A completed Programme suitability review ii) An additional sample analysis report describing: a. Any observation filters used (i.e. all measurements, first measurement, last measurement, random measurement or any other approach) b. Population coverage with details on the reference population used c. Details if the dataset was truncated or the analysis was weighted d. Proportion of children excluded due to data inconsistency e. Proportion of observations with invalid dates
6.3 Anonymizing identification numbers	When sharing individual-level records, WHO recommends the anonymization of all personally identifiable information such as names, national IDs, addresses and telephone numbers to ensure that individual privacy is protected and a person cannot be identified beyond what is necessary to generate national statistics.

Suggested Citation: Technical Note: The use of nutrition administrative data to generate population-level child malnutrition estimates. Geneva: World Health Organization; 2025.

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