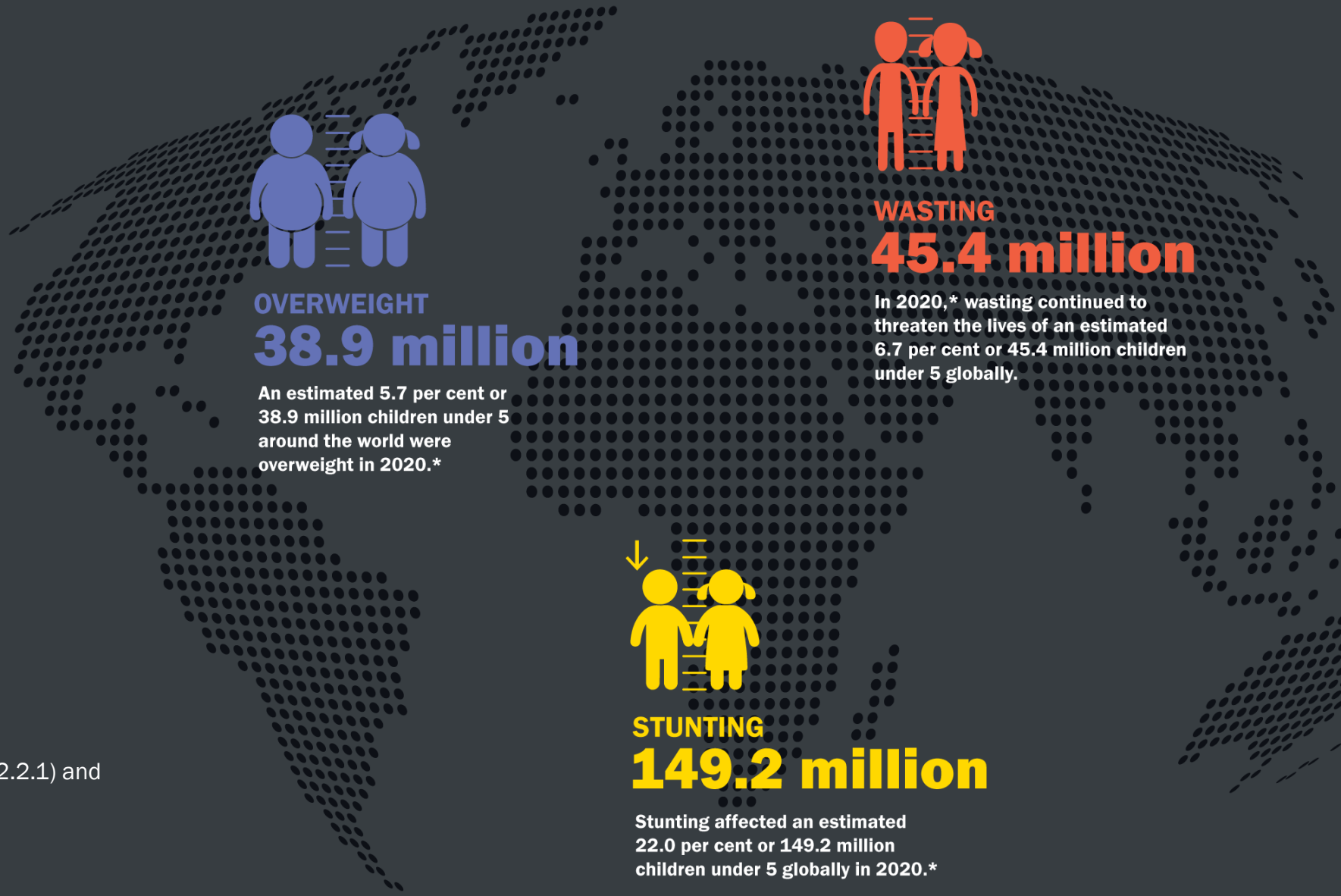
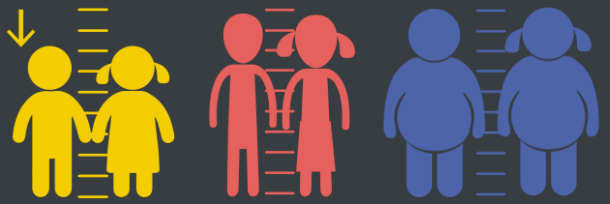
Updated methodology for indicators on stunting (2.2.1) and overweight (2.2.2(a))



Updated methodology for indicators on stunting (2.2.1) and overweight (2.2.2(a))

Overview

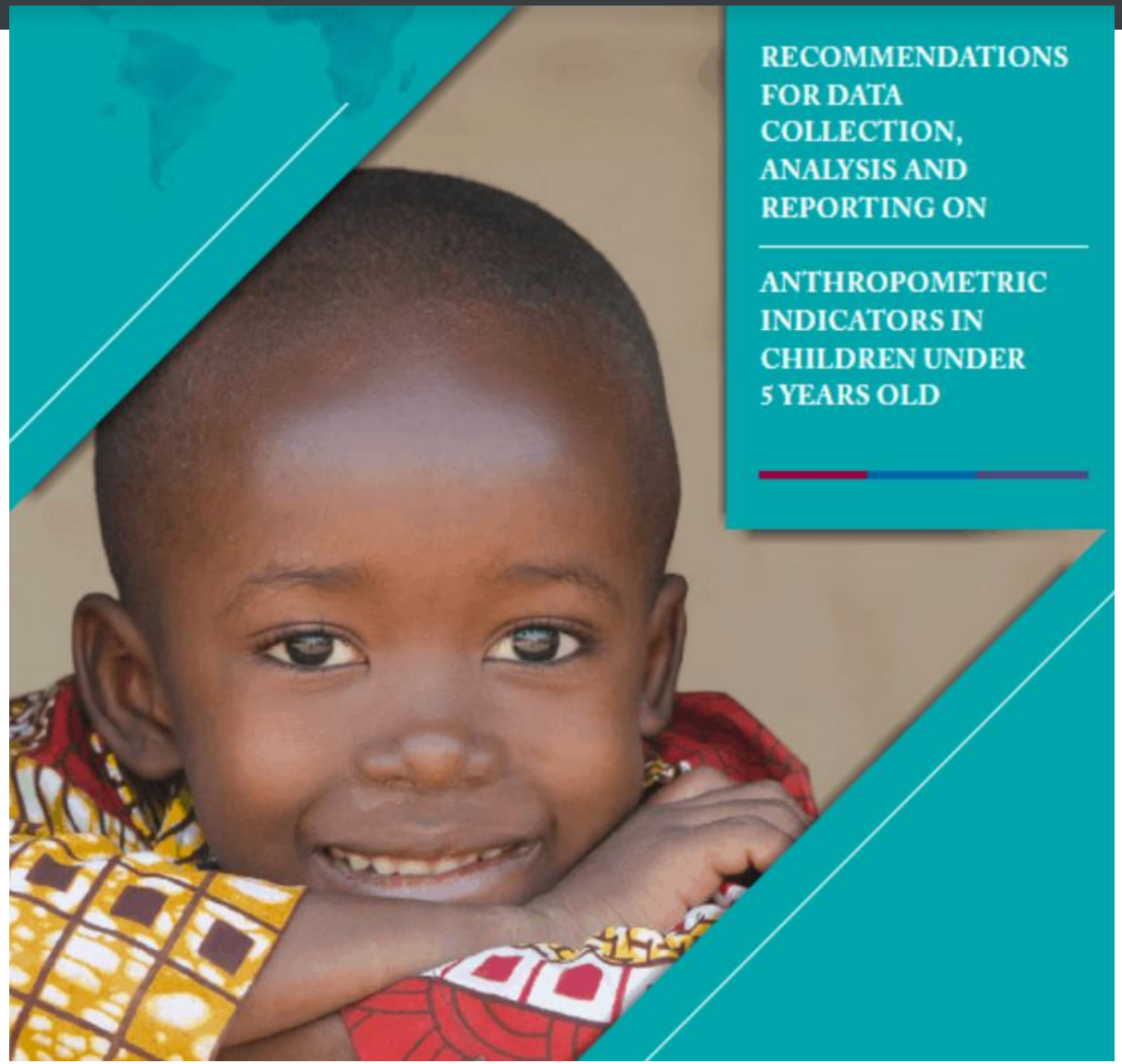


- Systematic Review of primary sources of data (e.g. surveys)
- Rationale for and overview of updated method for indicators on stunting and overweight
- Country consultation summary

SYSTEMATIC REVIEW

1. WHO/UNICEF report on generating malnutrition estimates

- First WHO/UNICEF report outlining recommended methods for data collection, analysis and reporting
- Multiple agencies worked toward consensus on best recommendations given current knowledge
- Outlines key components for training and data collection
- Includes parameters of data quality to assess
- Research needed to refine and establish cut offs for data quality parameters



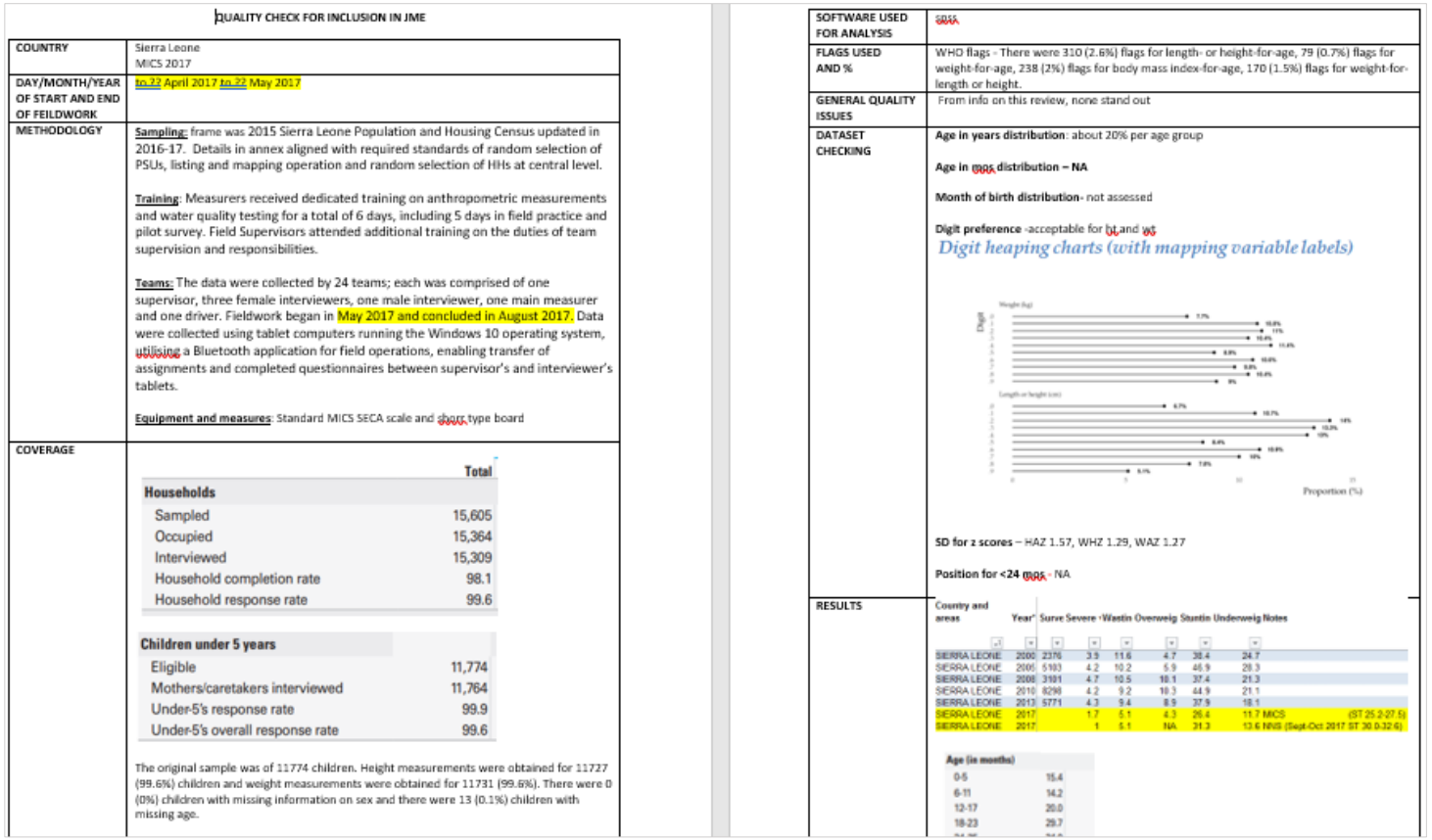
https://data.unicef.org/resources/data-collection-analysis-reporting-on-anthropometric-indicators-in-children-under-5/

Process

In depth review

Standardized format to record information about:

- Sampling
- Training
- Field teams
- Equipment
- Sample coverage
- Data quality checks
- Estimates and trends
- Programme context and information
- Overall assessment and consensus



QUALITY CHECK FOR INCLUSION IN JME

COUNTRY	Sierra Leone MICS 2017
DAY/MONTH/YEAR OF START AND END OF FEILDWORK	to 22 April 2017 to 22 May 2017
METHODOLOGY	Sampling: frame was 2015 Sierra Leone Population and Housing Census updated in 2016-17. Details in annex aligned with required standards of random selection of PSUs, listing and mapping operation and random selection of HHs at central level. Training: Measurers received dedicated training on anthropometric measurements and water quality testing for a total of 6 days, including 5 days in field practice and pilot survey. Field Supervisors attended additional training on the duties of team supervision and responsibilities. Teams: The data were collected by 24 teams; each was comprised of one supervisor, three female interviewers, one male interviewer, one main measurer and one driver. Fieldwork began in May 2017 and concluded in August 2017. Data were collected using tablet computers running the Windows 10 operating system, utilising a Bluetooth application for field operations, enabling transfer of assignments and completed questionnaires between supervisor's and interviewer's tablets. Equipment and measures: Standard MICS SECA scale and short type board
COVERAGE	

	Total
Households	
Sampled	15,605
Occupied	15,364
Interviewed	15,309
Household completion rate	98.1
Household response rate	99.6
Children under 5 years	
Eligible	11,774
Mothers/caretakers interviewed	11,764
Under-5's response rate	99.9
Under-5's overall response rate	99.6

The original sample was of 11774 children. Height measurements were obtained for 11727 (99.6%) children and weight measurements were obtained for 11731 (99.6%). There were 0 (0%) children with missing information on sex and there were 13 (0.1%) children with missing age.

SOFTWARE USED FOR ANALYSIS	spss
FLAGS USED AND %	WHO flags - There were 310 (2.6%) flags for length- or height-for-age, 79 (0.7%) flags for weight-for-age, 238 (2%) flags for body mass index-for-age, 170 (1.5%) flags for weight-for-length or height.
GENERAL QUALITY ISSUES	From info on this review, none stand out
DATASET CHECKING	**Age in years distribution**: about 20% per age group **Age in mos distribution – NA** **Month of birth distribution**- not assessed **Digit preference** -acceptable for ht and wt *Digit heaping charts (with mapping variable labels)*
RESULTS	**SD for z scores** – HAZ 1.57, WHZ 1.29, WAZ 1.27 **Position for <24 mos** - NA

Country and areas	Year	Surve	Severe	Wastin	Overweig	Stuntin	Underweig	Notes
SIERRA LEONE	2000	2376	3.9	11.6	4.7	38.4	24.7	
SIERRA LEONE	2005	5193	4.2	10.2	5.9	46.9	28.3	
SIERRA LEONE	2008	3931	4.7	10.5	10.1	37.4	21.3	
SIERRA LEONE	2010	8298	4.2	9.2	10.3	44.9	21.1	
SIERRA LEONE	2013	5771	4.3	9.4	8.9	37.9	18.1	
SIERRA LEONE	2017		1.7	5.1	4.3	26.4	11.7	MICS (ST 25.2.27.5)
SIERRA LEONE	2017		1	5.1	NA	31.3	13.6	NNS (Sept-Oct 2017 ST 30.0.32.6)

Age (in months)	
0-5	15.4
6-11	14.2
12-17	20.0
18-23	29.7

2. Review sheet and criteria applied
METHODOLOGY

- Sampling - some key points considered
  - Nationally representative
  - Probabilistic with enough details to understand how all stages were implemented

- Equipment - some key points considered
  - Electronic scales
  - Shorr type board

- Training - some key points considered
  - Time allotted for anthropometry techniques training
  - Standardization tests

2. Review sheet and criteria applied
METHODOLOGY

- Field work/teams - some key points considered
  - 2 trained measurers
  - Supervision details
  - Call back protocols

- Questionnaires - some key points considered
  - Determination of date of birth
  - Collection of metadata about clothing, etc
  - HH member definition of survey aligned with questionnaire

2. Review sheet and criteria applied
SURVEY COVERAGE

- Some key points considered
- Age range targeted
  - All U5 or other
- Household response rate
- U5 response rate
  - That all eligible children in selected HHs were listed
  - Response rate using correct denominator
  - Check for each indicator (e.g. HAZ, WHZ)

Table HH.1: Results of household, women's, men's and under-5 interviews

Number of households, women, men, and children under 5 by interview results, and household, women's, men's and under-5's response rates, Nigeria, 2016-17

		Residence		Geopolitical zone					
	Total	Urban	Rural	North Central	North East	North West	South East	South South	South West
Households									
Sampled	37,440	12,240	25,200	6,720	5,760	7,680	4,800	5,760	6,720
Actual Coverage	35,747	11,991	23,756	6,552	4,620	7,586	4,752	5,626	6,611
Occupied	34,289	11,311	22,978	6,318	4,447	7,424	4,593	5,387	6,120
Interviewed	33,901	11,104	22,797	6,244	4,396	7,395	4,524	5,354	5,988
Household response rate	98.9	98.2	99.2	98.8	98.9	99.6	98.5	99.4	97.8
Women									
Eligible	36,176	11,689	24,487	7,462	5,469	9,765	3,753	4,918	4,809
Interviewed	34,376	10,965	23,411	7,013	5,223	9,376	3,645	4,728	4,391
Women's response rate	95.0	93.8	95.6	94.0	95.5	96.0	97.1	96.1	91.3
Women's overall response rate	93.9	92.1	94.9	92.9	94.4	95.6	95.7	95.5	89.3
Men									
Eligible	16,514	5,450	11,064	3,468	2,559	4,356	1,568	2,253	2,310
Interviewed	15,183	4,890	10,293	3,184	2,452	3,935	1,481	2,173	1,958
Men's response rate	91.9	89.7	93.0	91.8	95.8	90.3	94.5	96.4	84.8
Men's overall response rate	90.9	88.1	92.3	90.7	94.7	90.0	93.0	95.9	82.9
Children under 5									
Eligible	28,578	7,612	20,966	5,474	4,855	9,662	2,399	3,187	3,001
Mothers/caretakers interviewed	28,085	7,471	20,614	5,347	4,733	9,519	2,383	3,172	2,931
Under-5's response rate	98.3	98.1	98.3	97.7	97.5	98.5	99.3	99.5	97.7
Under-5's overall response rate	97.2	96.4	97.5	96.5	96.4	98.1	97.8	98.9	95.6

2. Review sheet and criteria applied
ANALYSIS

- Notes other available syntax files or software that are similar (MICS, DHS, ENA)
- Use of WHO growth standards and WHO flags
- Calculate age using DOB/DOI and use of day 15 if no day available
- Report at minimum on prevalence of moderate, severe forms of malnutrition as well as mean and SD for HAZ, WHZ and WAZ

- Recommended approach available when using WHO Anthro analyzer and standard STATA and R syntax from JME

Reanalysis

Indicator Definition

Stunting

- **Height for age <-2 SD**

Severe Wasting

- **Weight-for-height <-3SD**

Wasting

- **Weight-for-height<-2SD**

Overweight

- **Weight-for-height>2+SD**

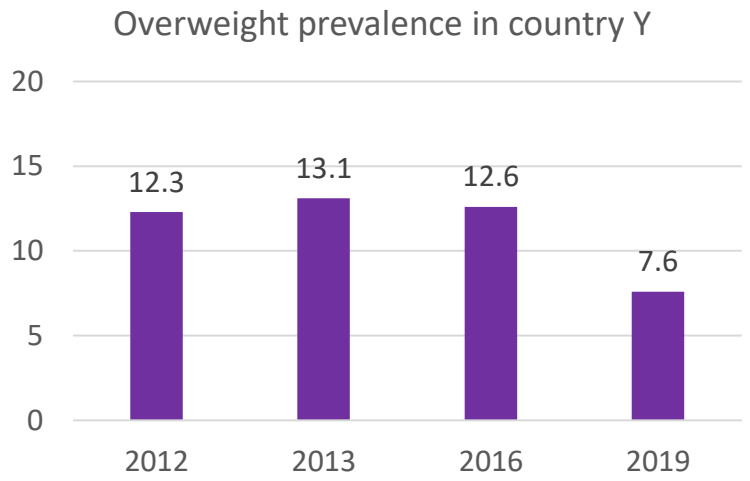
2. Review sheet and criteria applied
DATA QUALITY CHECKS

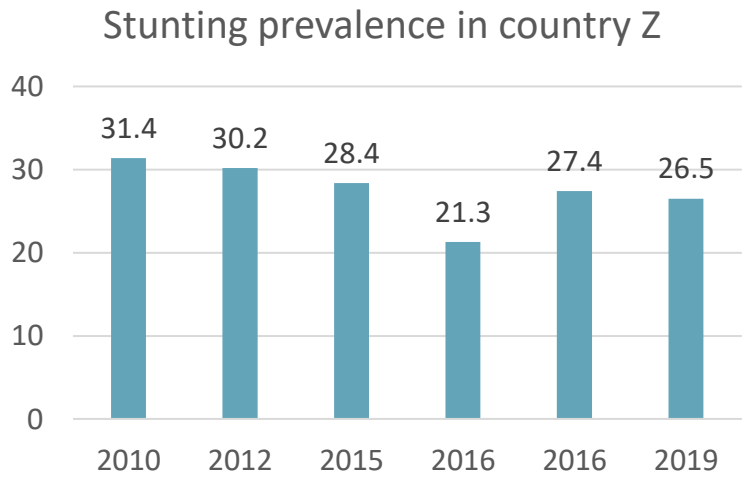
- Key checks
- Age distribution
- Digit preferences
- Implausible values
- Standard deviation

- Do not consider parameters in isolation
- Formal tests or scoring not recommended
- WHO Anthro analyzer can output most and is an easy tool to use

2. Review sheet and criteria applied
ESTIMATES AND TRENDS

- Are trends plausible in time frame for each indicator?
- Is there programmatic evidence for large shifts (e.g. country strategy and actions for overweight reduction





Disaggregations

Renalysis also adds disaggregations missing in the report

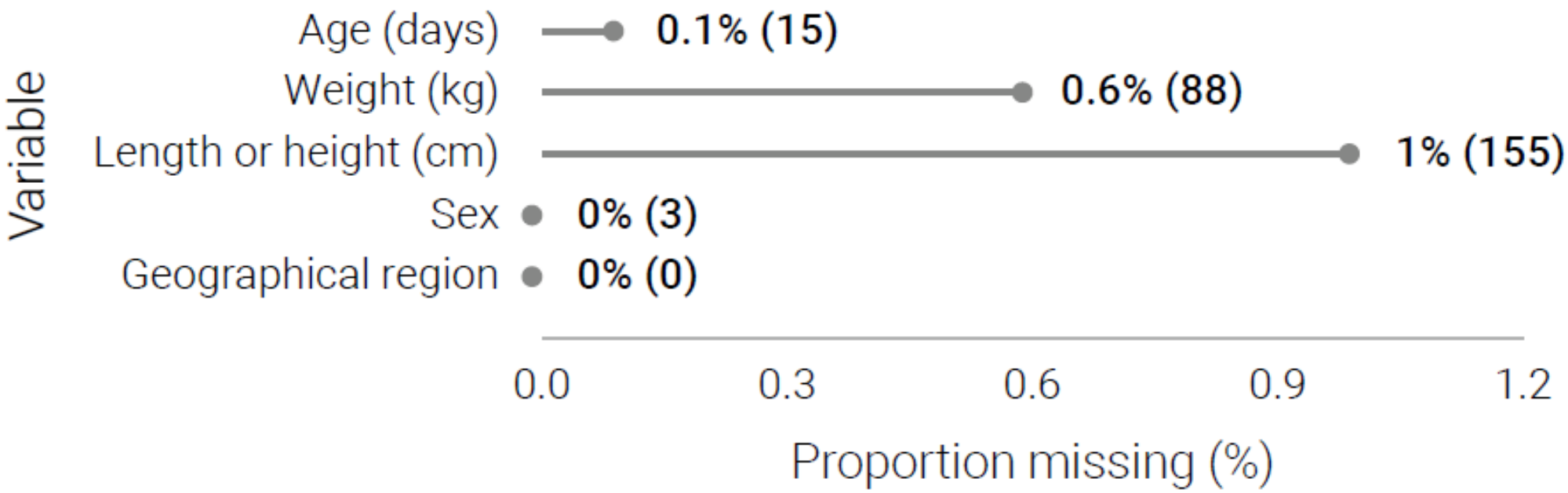
Disaggregation produced by reanalysis macros

- Sex of child (male, female)
- Type of residence (urban, rural)
- Wealth Quintile (Q1, Q2, Q3, Q4, Q5)
- Wealth Quintile Grouping (bottom 80%, top 80%, bottom 60%, top 60%, bottom 40%, top 40%)
- Mother's Education (none, primary, none and primary, secondary, higher, secondary and higher)
- Age in months (6 month groups, 12 month groups, 24 months and under)
- Subnational region
- Sex and age in months

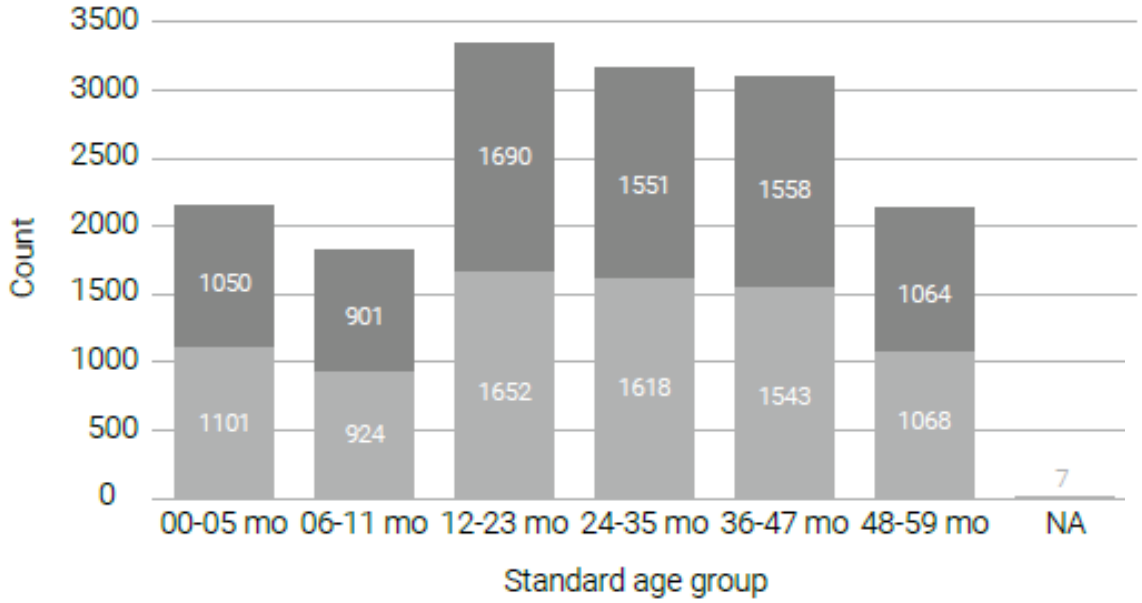
DATA QUALITY

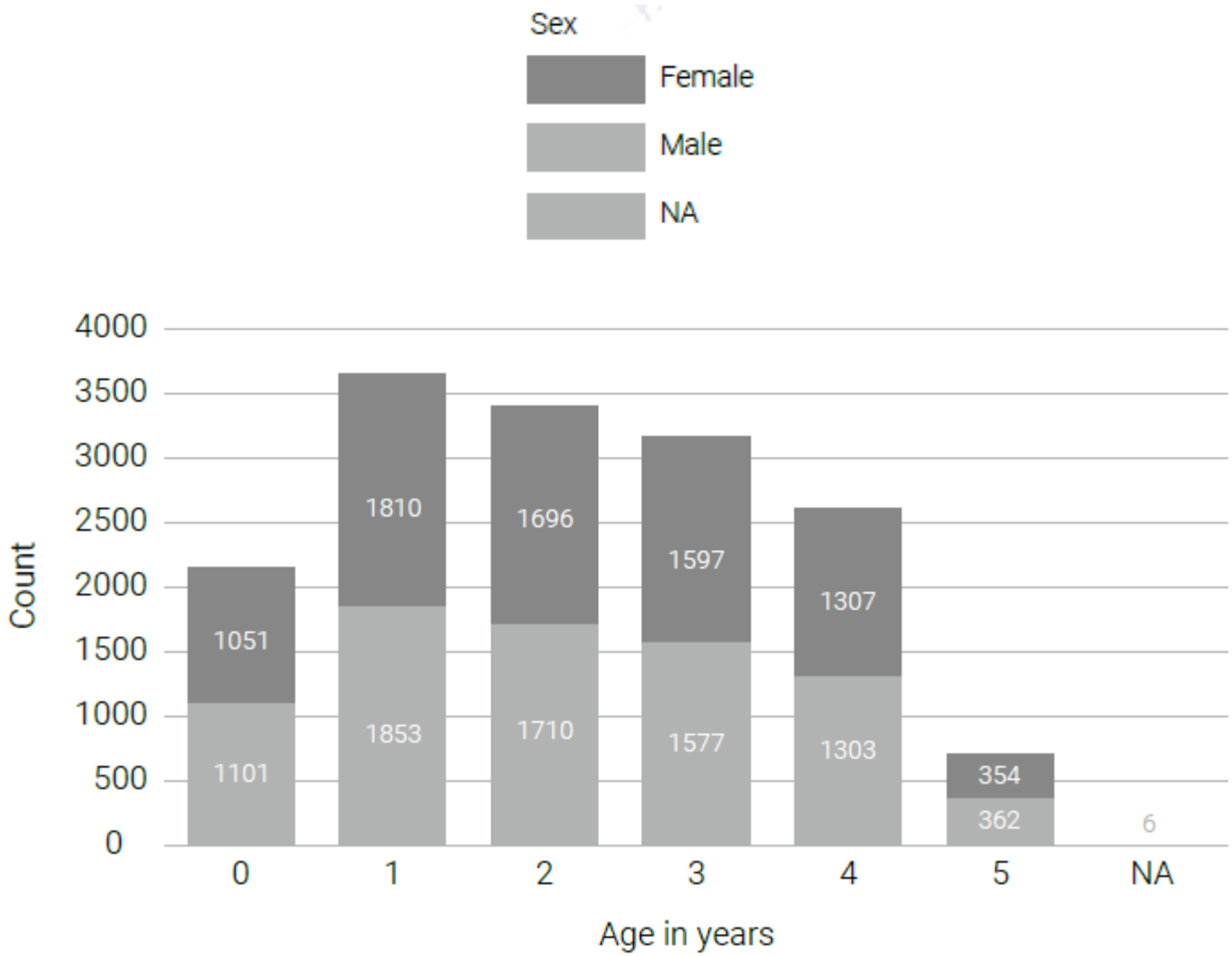
Report of the recommendations to evaluate data quality &
Quick guide of the WHO Anthro Survey Analyser

DATA QUALITY – Missing values



DATA QUALITY – Age distribution by age group or age in complete years and sex of the child





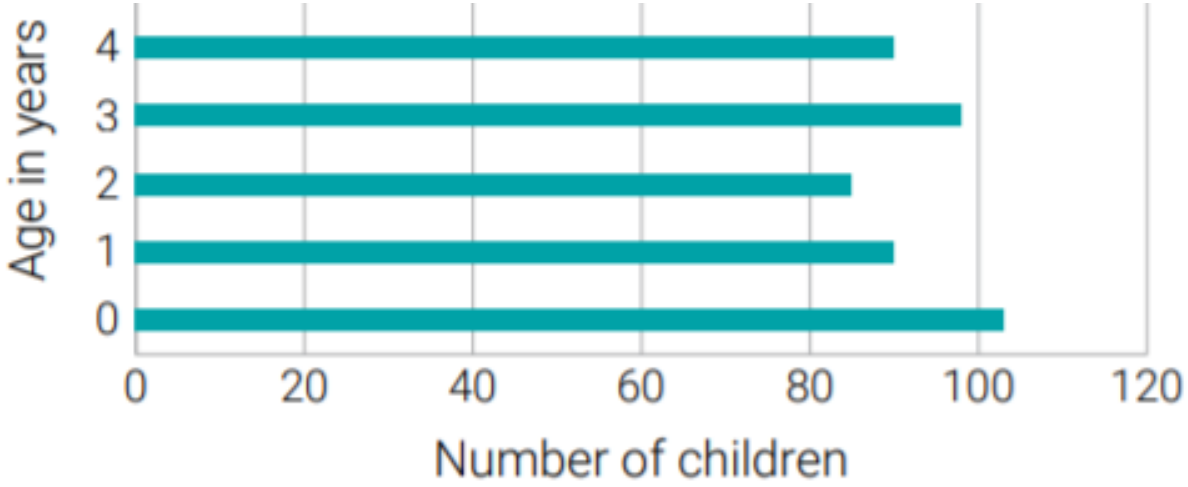
DATA QUALITY – Measurement position

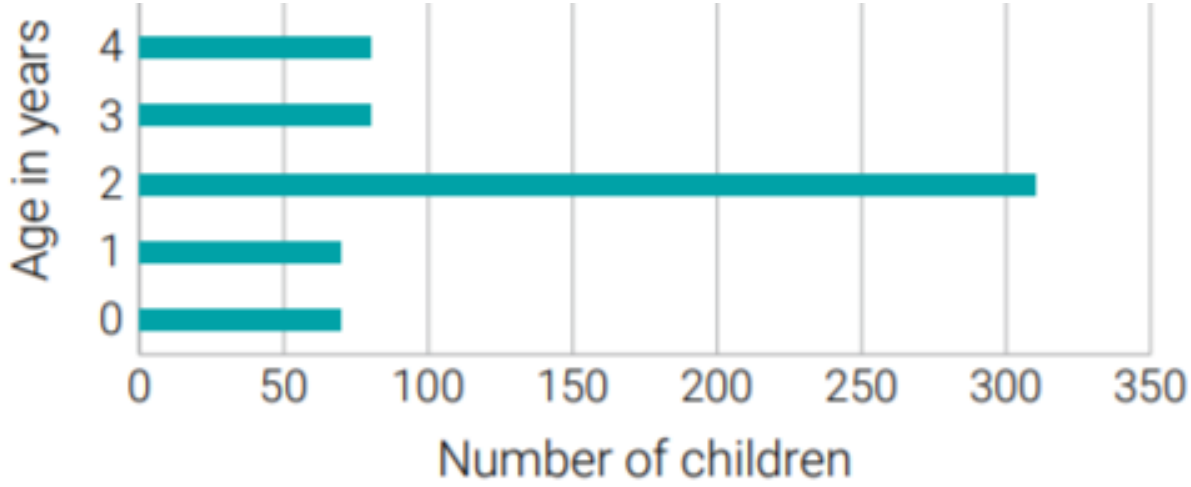
Number of cases and proportion of the mismatch between the length/height measuring position and the recommended position, by age group

AGE GROUP	EXPECTED POSITION	TOTAL	OBSERVED MISMATCH*	% MISMATCH*
00-11 mo	lying	3504	515	14.7%
00-08 mo	lying	2780	405	14.6%
12-23 mo	lying	2980	515	17.3%
24-35 mo	standing	2797	1861	66.5%
36-47 mo	standing	2753	1009	36.7%
48-59 mo	standing	1871	548	29.3%
Total		13905	4448	32.0%

DATA QUALITY – Age distribution

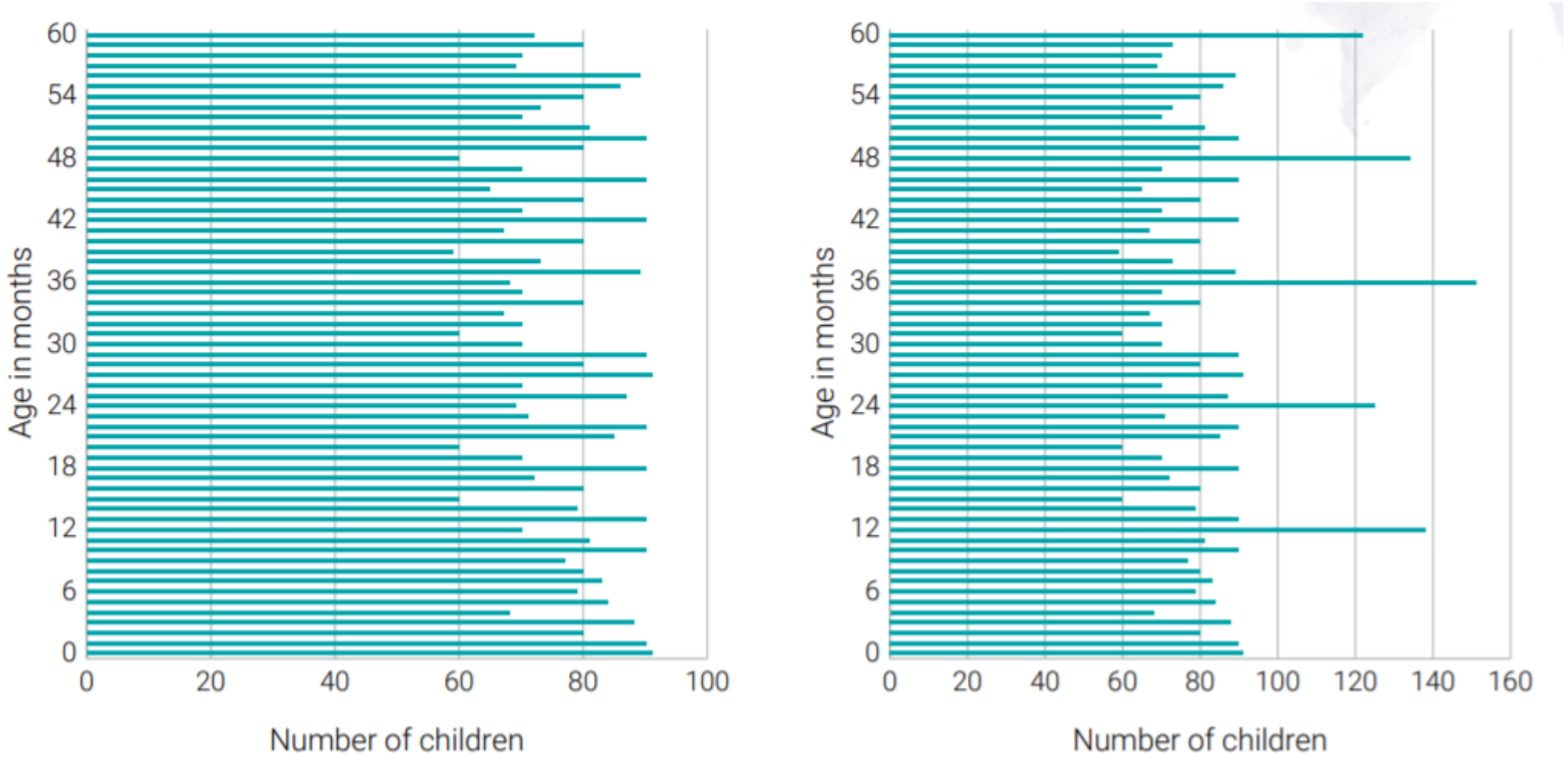
Possible age distribution patterns in years





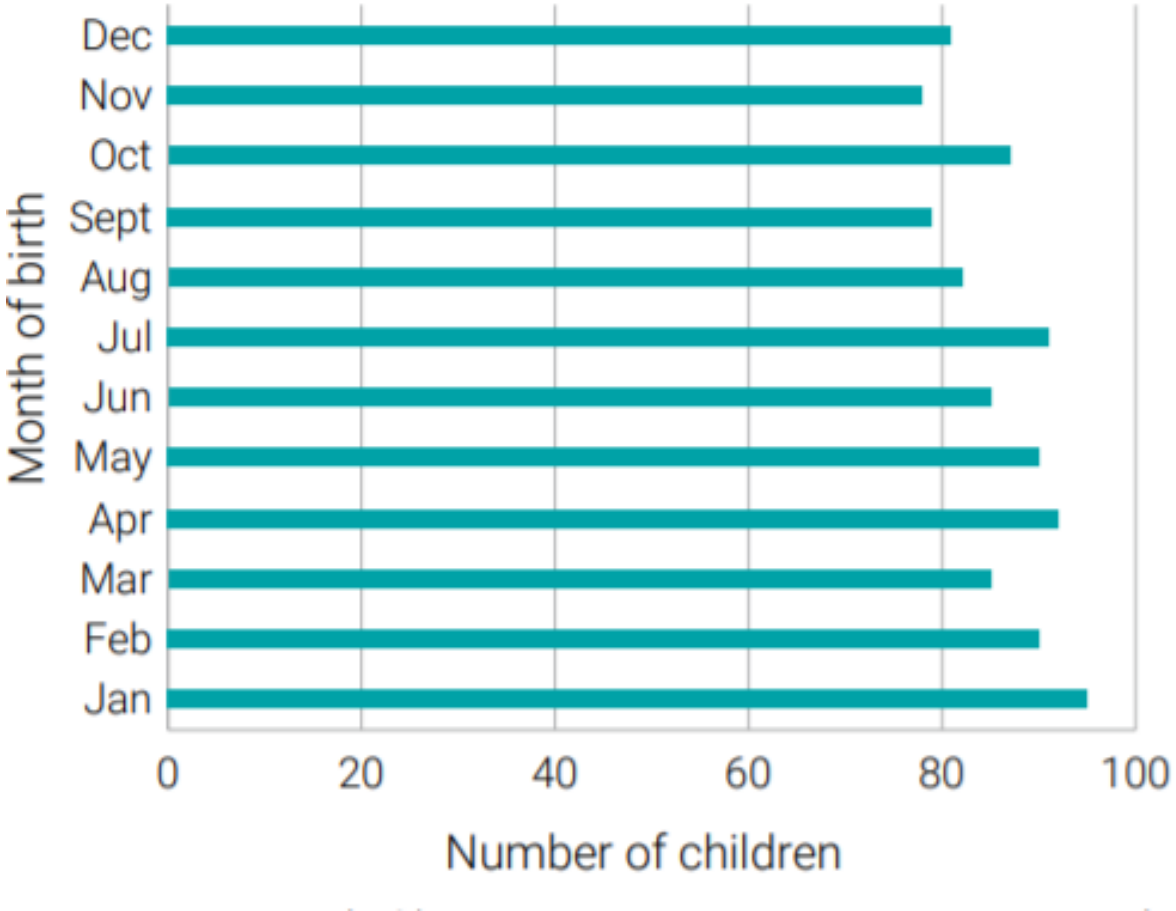
DATA QUALITY – Age distribution

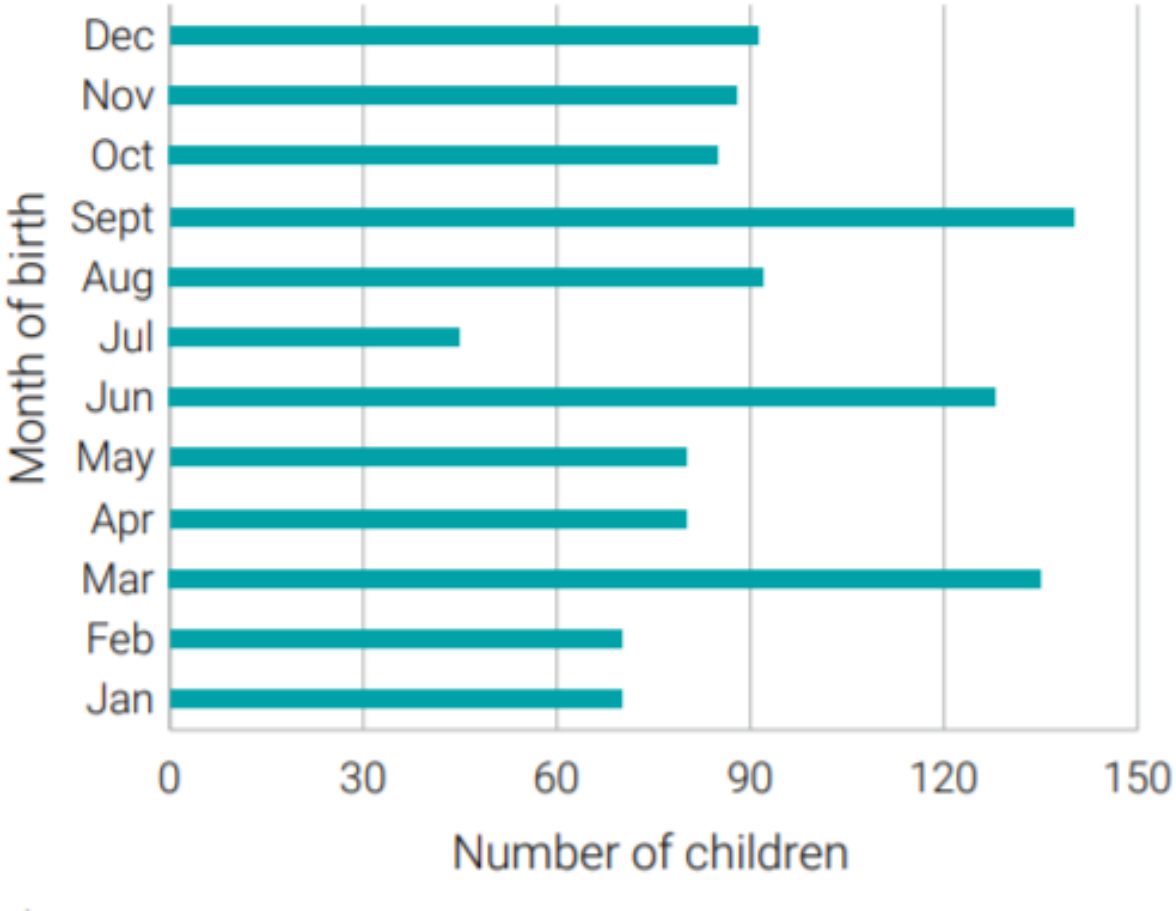
Possible age distribution patterns in months



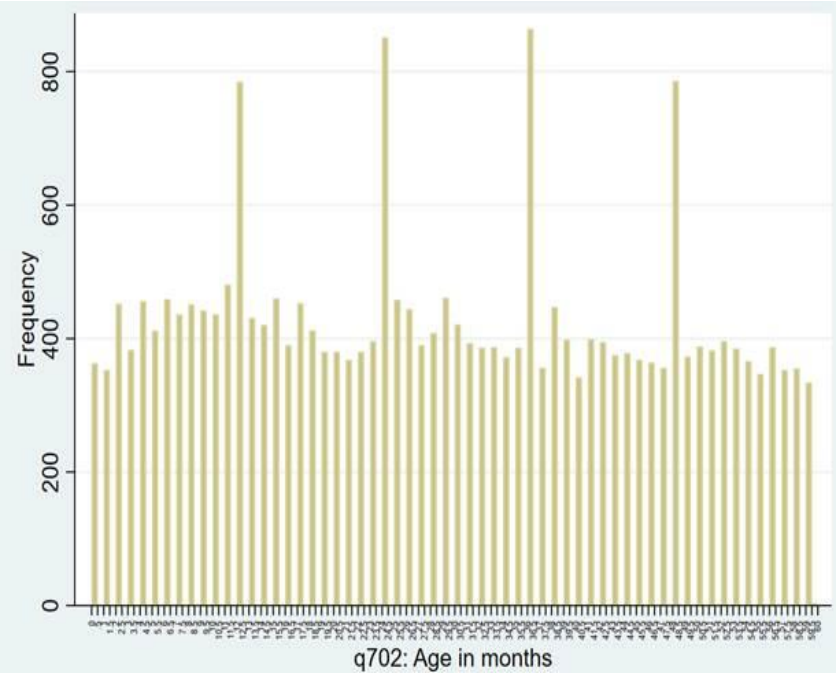
DATA QUALITY – Age distribution

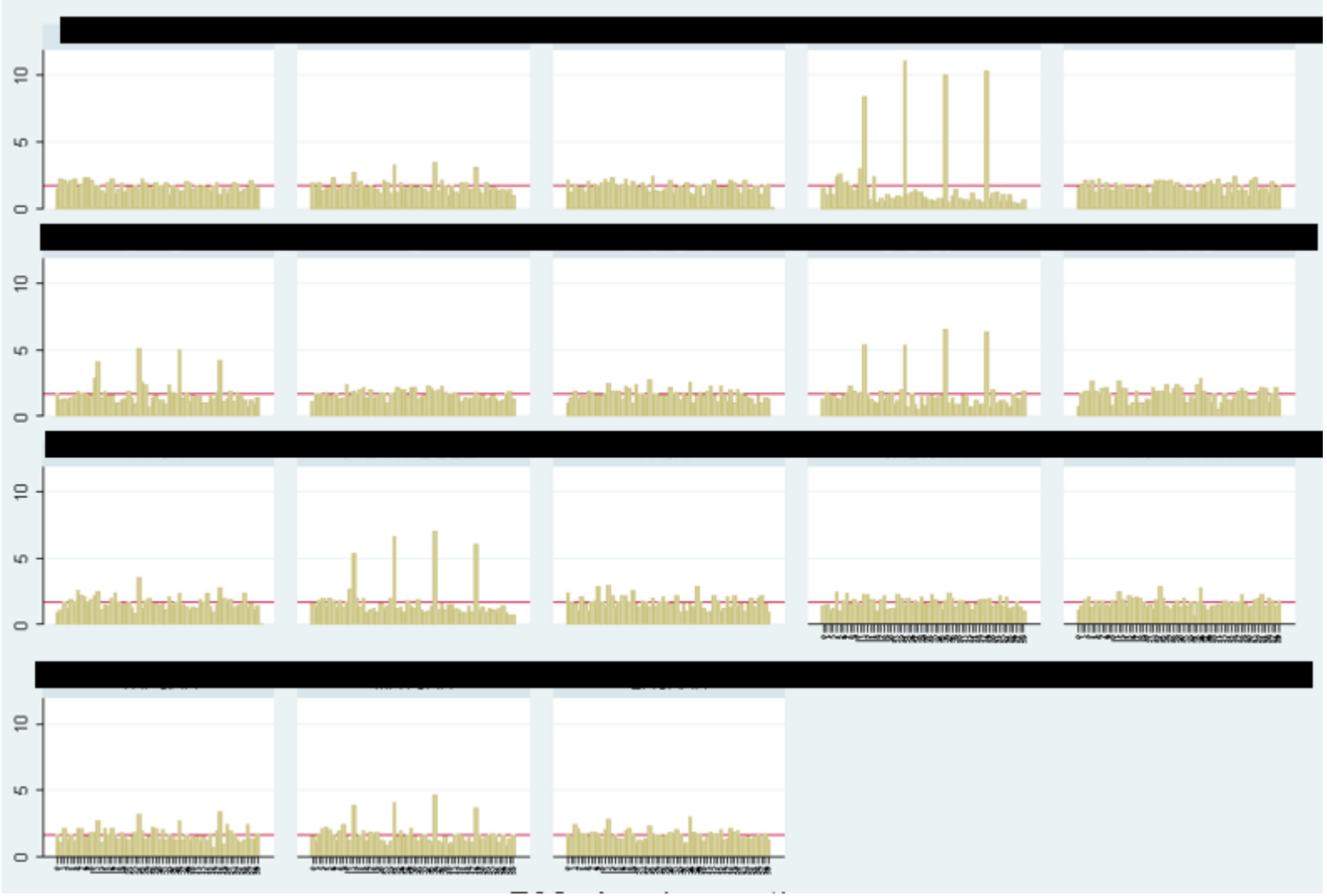
Possible distribution patterns of the month of birth



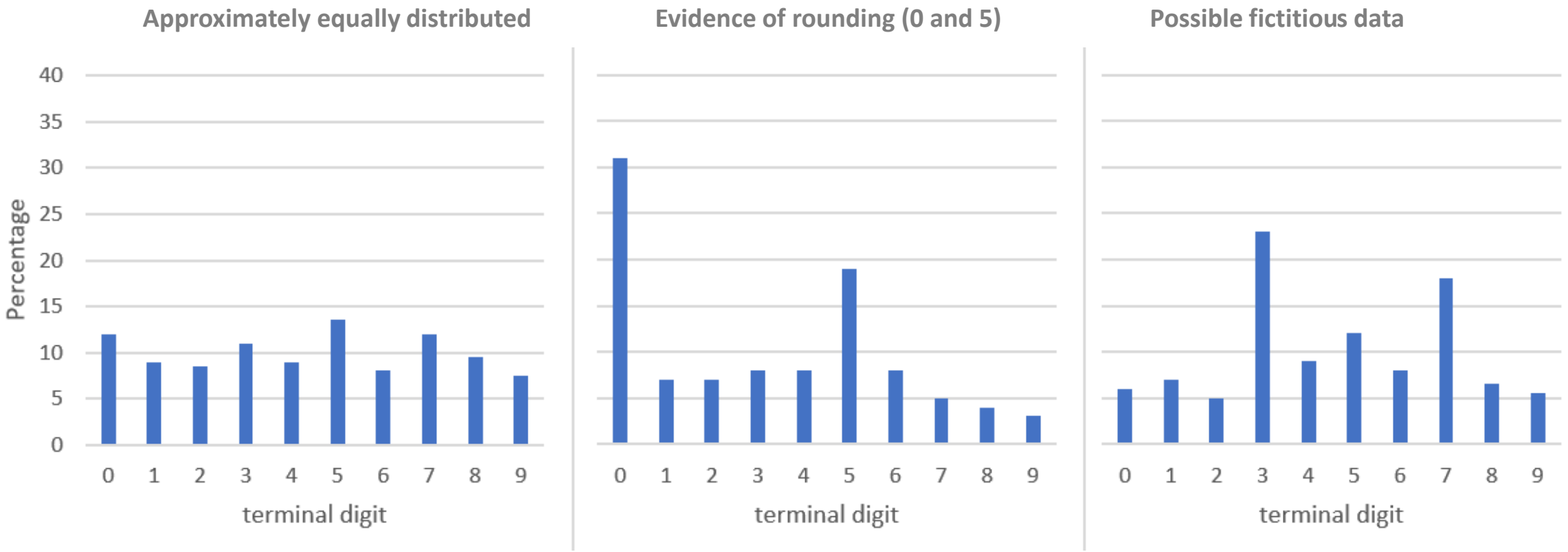


DATA QUALITY – Age distribution



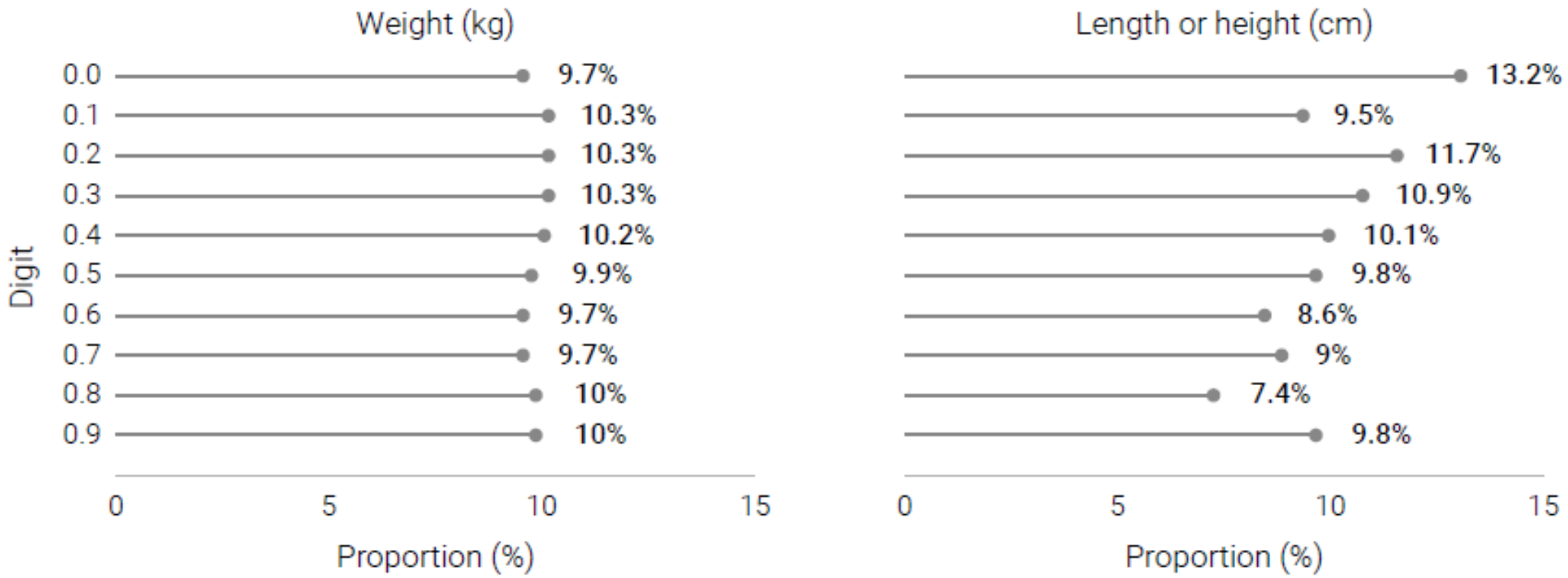


DATA QUALITY – Digit preference

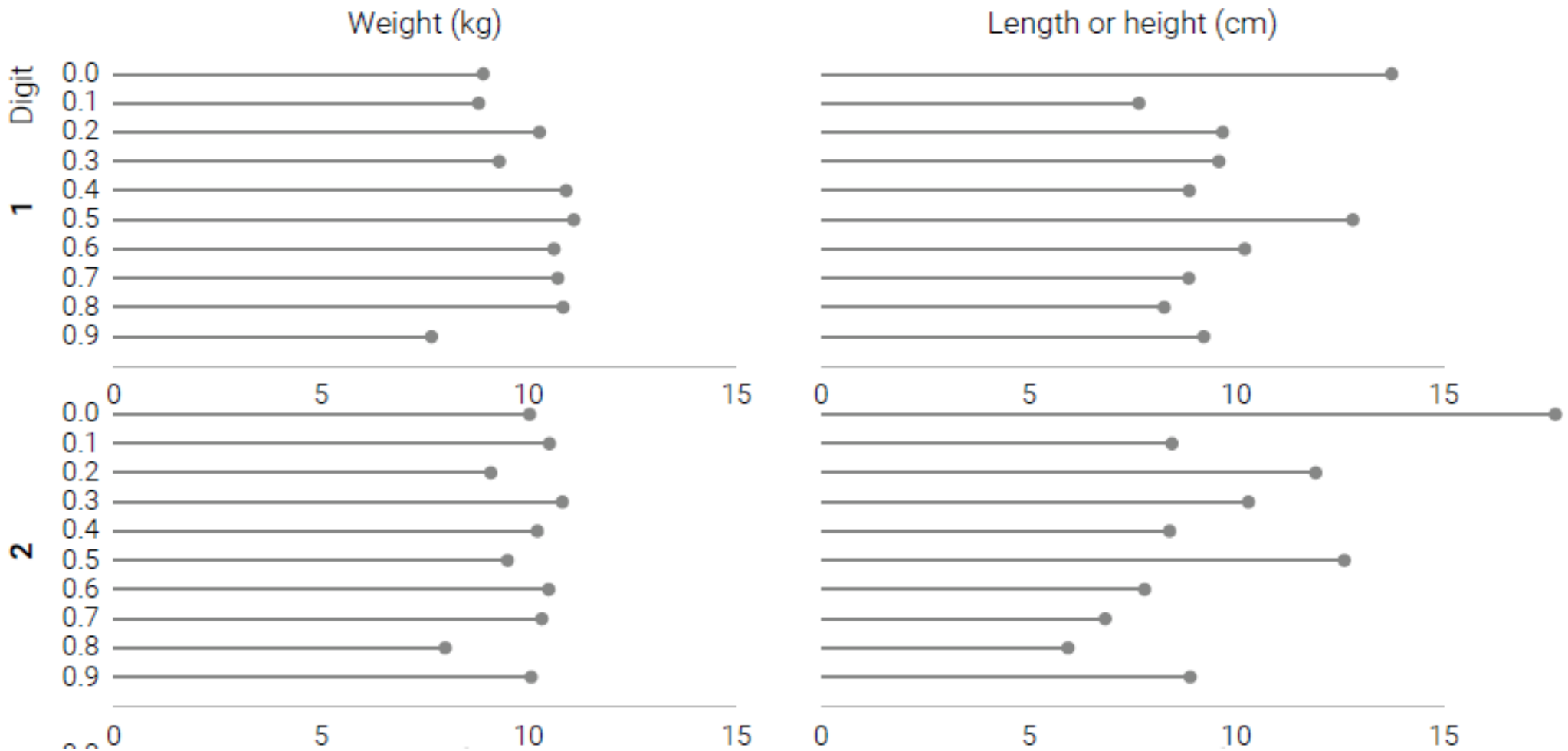


Larger issue for estimates if heaping is on weight than height

DATA QUALITY – Digit preference

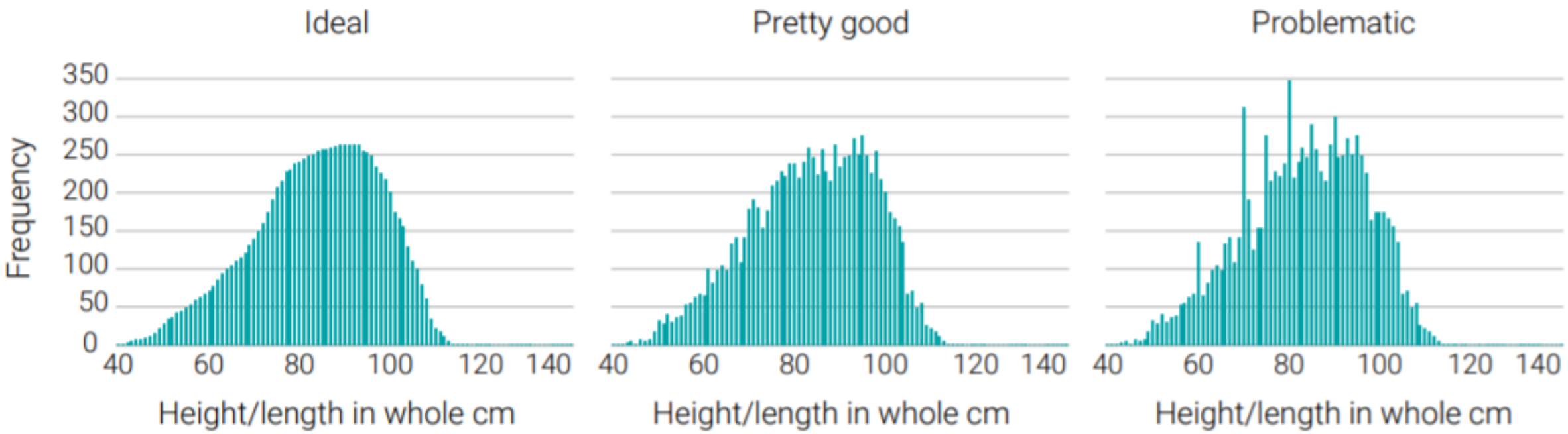


DATA QUALITY – Digit preference



DATA QUALITY – Digit preference in height/length

Possible distribution patterns of integers of height/length in cm

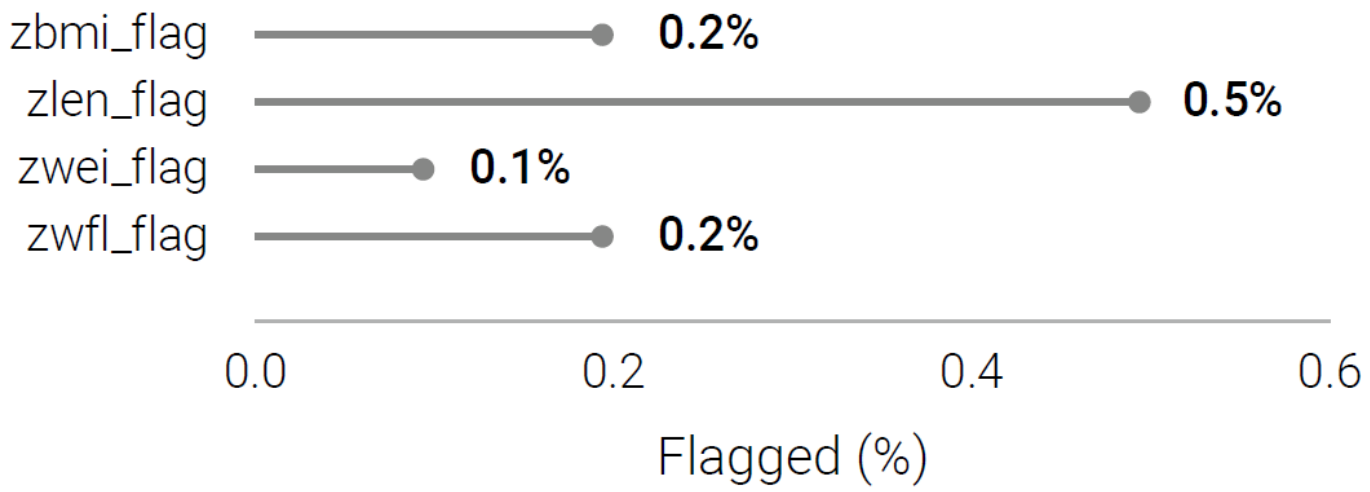


DATA QUALITY – Digit preference in weight

Possible distribution patterns of integers of weights in kg

DATA QUALITY – Implausible z-score values

- What – Report on the % of cases outside of WHO flags for each HAZ, WHZ and WAZ - unweighted
- Why – above 1% indicative of potential data quality issues in measurements or age determination
- Present – The percentages for each index as well as by team and other disaggregations



DATA QUALITY – Standard Deviations (SD)

- What – Report the SD for each HAZ, WHZ and WAZ - unweighted

- Why – large SDs may be a sign of data quality problems and/or population heterogeneity unclear what causes SD's size and more work needed to determine appropriate interpretation. Have outlined that:
  - ✓ Ranges set in 1995 need revision (1.1 to 1.3 for HAZ, 1.0 to 1.2 for WAZ and 0.85 to 1.1 for WHZ)
  - ✓ SDs typically wider for HAZ than WHZ or WAZ
  - ✓ For HAZ SD typically widest in youngest (0-5 mo) and increases through to age <5 years
  - ✓ Should be no substantial difference between boys and girls

- Present – unweighted SD value for HAZ, WHZ, WAZ as well as by team or other disaggregations

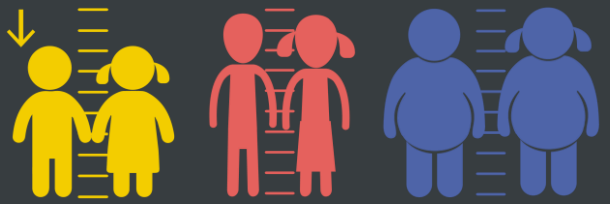
Next steps

- Continue working with the countries to have access to the final reports and databases of the new surveys;
- Continue to improve the review template and criteria used;
- Build capacities in countries by providing training on the tools developed (WHO Anthro Survey Analyzer, etc.);
- Work with partners to:
  - undertake research and develop ranges/limits for data quality determination parameters
  - set additional parameters to determine this quality

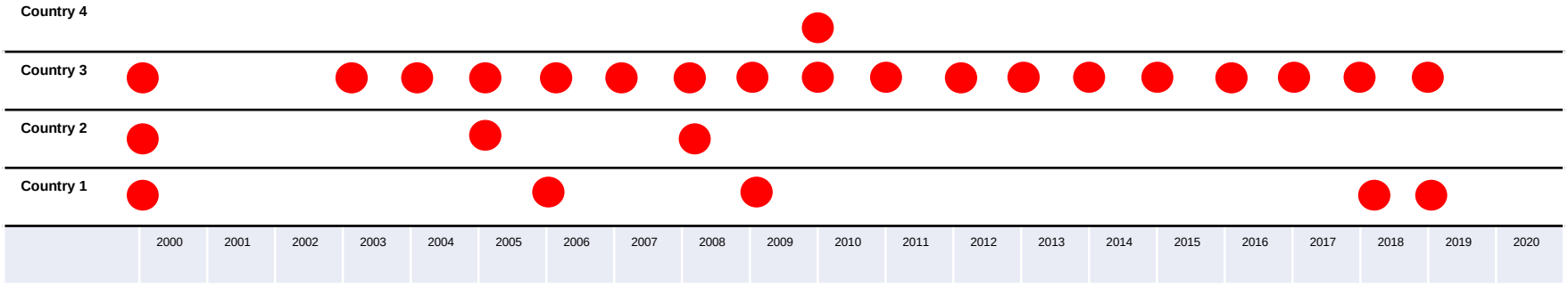
UPDATED METHOD

For stunting and overweight

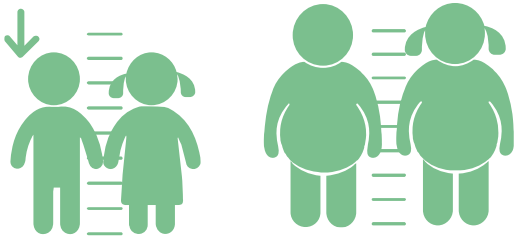
Rationale for country-level model



- To produce a set of estimates that are comparable across place, time, and data source type (i.e., cross-context equivalent)
- To support and harmonize country tracking of progress towards SDGs by filling data gaps with timely estimates
- To overcome statistical limitations of the previous method, and account for measures of inaccuracy around country prevalence estimates



Start with stunting and overweight country model (2000-2020) for release in 2021



Wasting and severe wasting country model post 2021 (influenced by seasonality)

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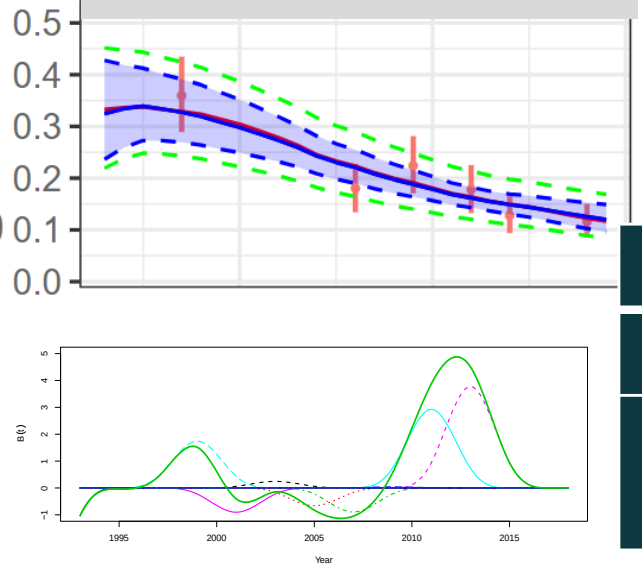
New Method

- Mixed effect model with random effects for countries
- Fixed effects are covariates and region effects
- Country-level trends from 2000-2020
- Produces confidence intervals
- Uncertainty levels were thoroughly tested
- B-splines: more flexible to fit data points

Stunting prevalence Kyrgyzstan



Cross Validation Results

Marker	N	Bias	RMSE
Stunting	93	0.004	0.0411
Over-weight	89	-0.003	0.0166

The complete statistical model took the form:

$$Y_{ij} = Z_{ij}\beta + f(t_{ij}) + g_i(t_{ij}) + \epsilon_{ij}$$

Y_{ij} is the logit transformed outcome for country *i* time-point *j*

t_{ij} is the year (i.e., 2005)

Z_{ij} are covariates

Stunting	SDI, (Health Access)
Overweight	SDI

$f(t_{ij})$ represents the global/region time effect

$g_i(t_{ij})$ represents the country specific time effect

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New method – sample results

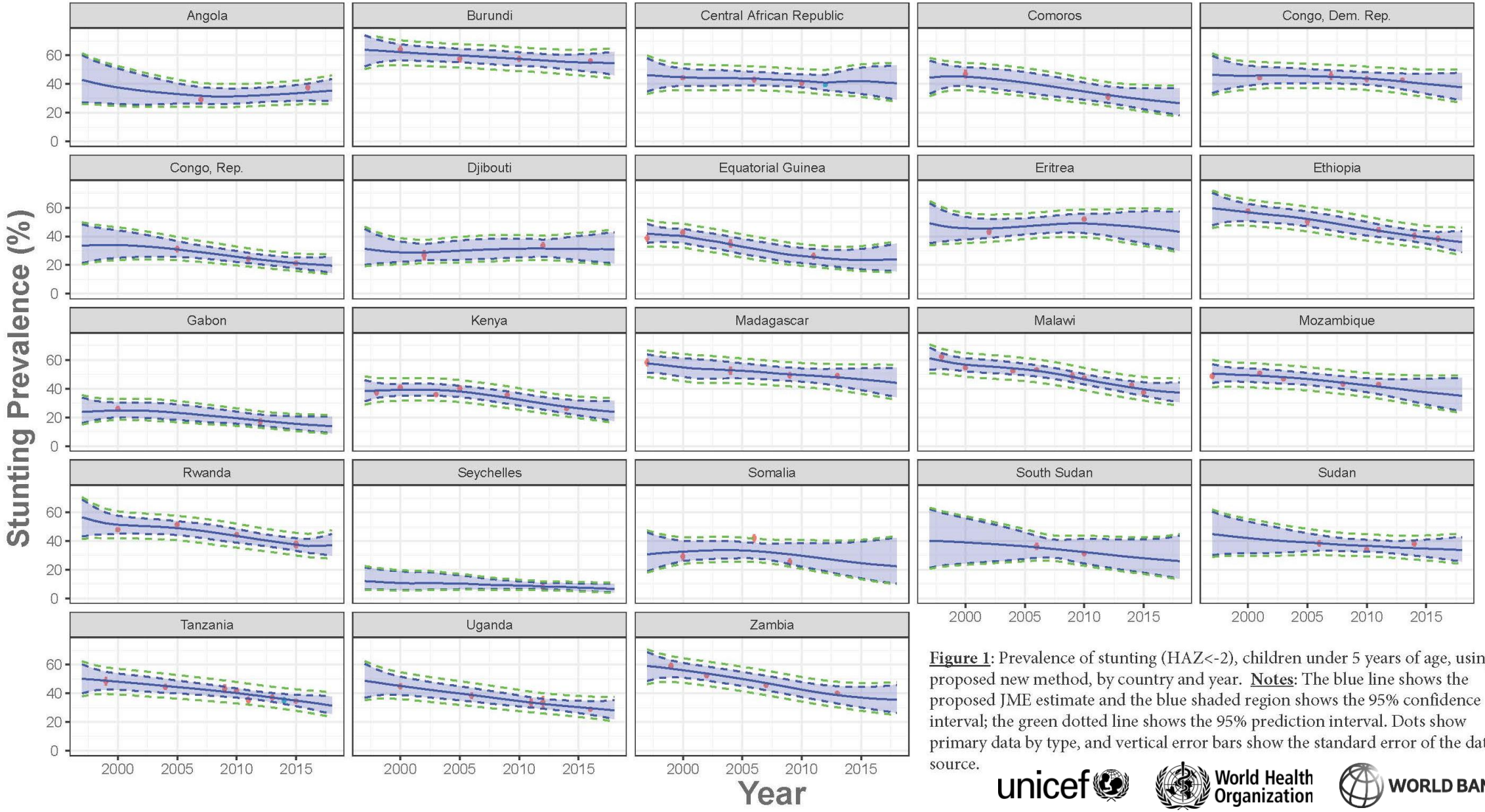

Figure 1: Prevalence of stunting (HAZ<-2), children under 5 years of age, using proposed new method, by country and year. **Notes**: The blue line shows the proposed JME estimate and the blue shaded region shows the 95% confidence interval; the green dotted line shows the 95% prediction interval. Dots show primary data by type, and vertical error bars show the standard error of the data source.

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Stages of updated method development

2015-2017

Developed with Africa region

- World Bank's Knowledge for Change Trust Fund grant to develop and test country-models for stunting and overweight for African countries
- Feedback from small group of model experts
- 2 workshops held in East and Southern Africa – overall positive feedback
- Methods in peer-review publication
- Served as the basis for current models

2019

Global Model & Consultation

- Improvements to Africa model, applied to all regions, including use of covariates
- Global technical consultation in December 2020
- Recommendations to refine the model (e.g. separate analysis for each region), and for undertaking country consultations (e.g. webinars and scenario examples)

2020

Final Model with Latest Data

Model further refined by applying:

- separate analysis for each region
- survey-specific standard errors
- methods to account for surveys missing age groups
- various covariates tested
- updated dataset
- For country consultation

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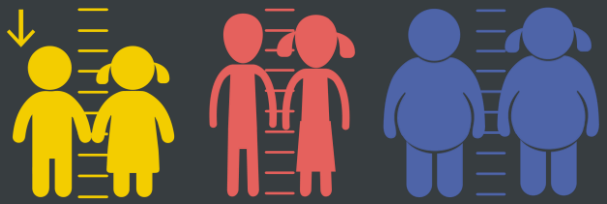
COUNTRY CONSULTATION

Summary

Summary of JME 2020 Consultation

(Nov 2020–March 2021)



An email was sent out to the SDG focal points of

202

Countries inviting them to the consultation

56

countries suggested another contact *(i.e.. a focal point related to the subject)*

111

countries responded to the consultation

28

countries shared new sources

22

countries raised queries

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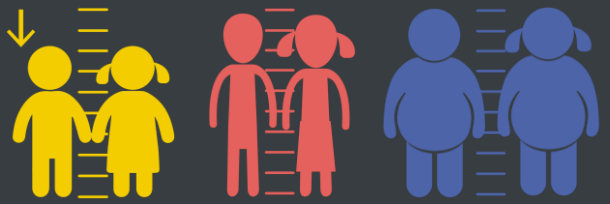
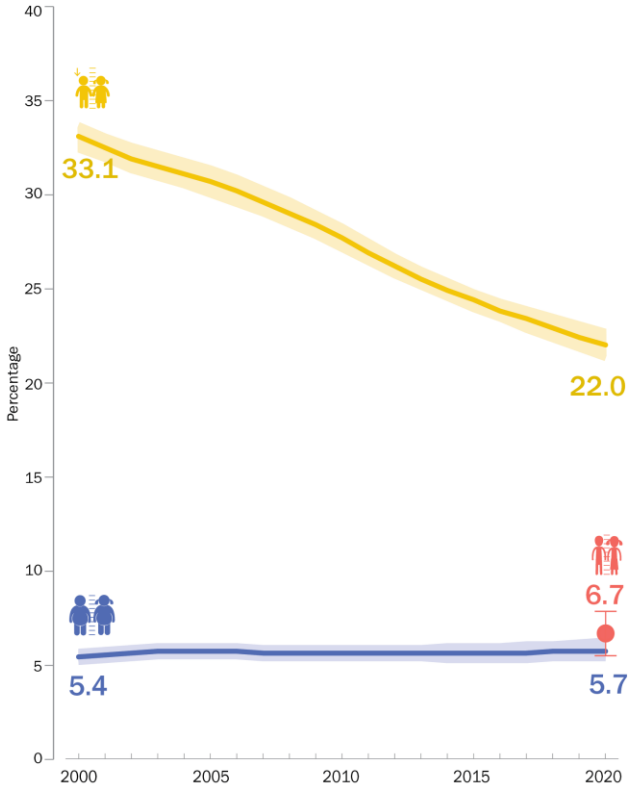
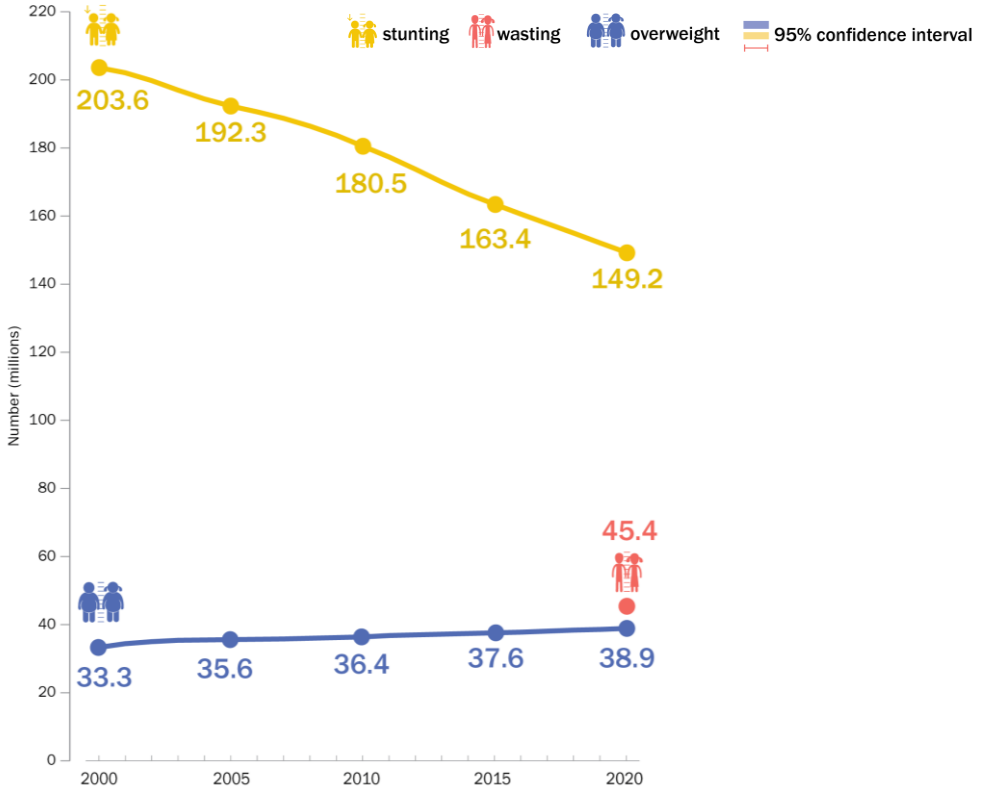
Prevalence and Number (millions) affected



Our regional and global estimates were released on 4 May 2021



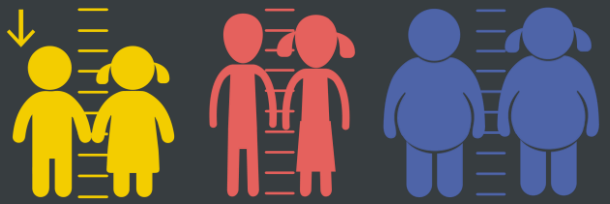
Percentage of children under 5 affected by stunting, wasting and overweight, global, 2000–2020*



Number (millions) of children under 5 affected by stunting, wasting and overweight, global, 2000–2020*

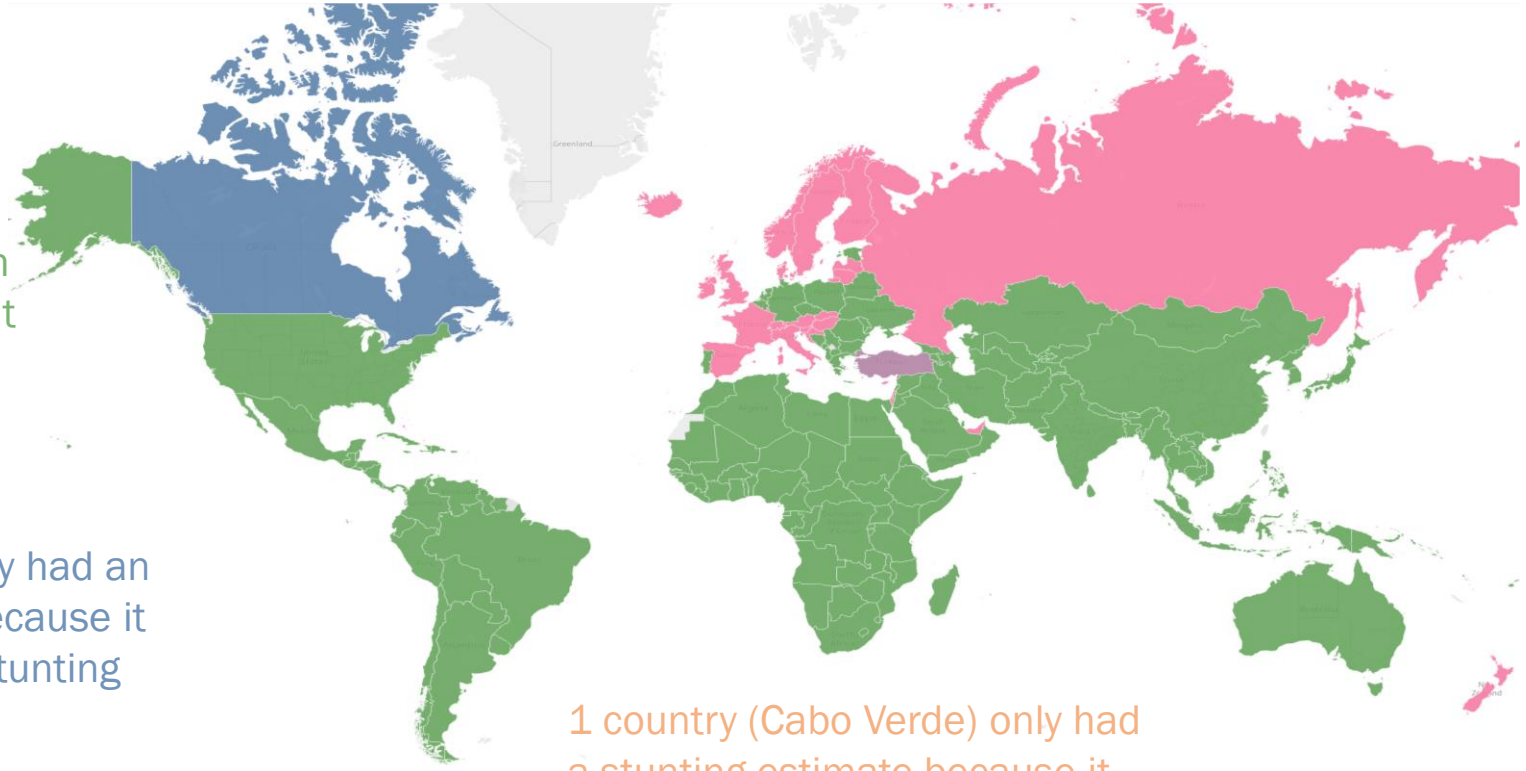
Source: UNICEF, WHO, World Bank Group Joint Child Malnutrition Estimates, 2021 edition. *The collection of household survey data on child height and weight were limited in 2020 due to the physical distancing measures resulting from COVID-19; only four national surveys with at least some field work in 2020 are included in the JME database. The JME estimates are therefore based almost entirely on data collected before 2020 and do not take into account the impact of the COVID-19 pandemic.

Country estimates released



We were able to disseminate estimates for 156 countries.

154 countries had both stunting and overweight estimates



1 country (Canada) only had an overweight estimate because it had no input data for stunting

1 country (Cabo Verde) only had a stunting estimate because it had no input data for overweight

45 countries had no input data. Their estimates are not disseminated publicly but are used in the generation of regional and global aggregates

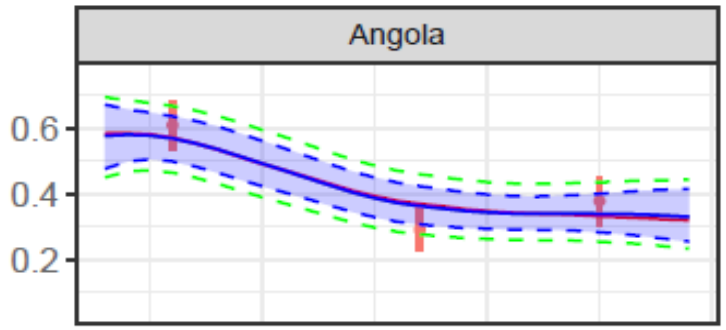
1 country with an unresolved issue. Its estimate is not disseminated publicly but it is still used in the generation of regional and global aggregates

Country Consultations – Country datasheets

Input Data

Year	Sample size	Wasting	Stunting	Overweight	Source
1996	1,534	7.7	61.1	1.7	Instituto Nacional de Estatistica, UNICEF;Inquerito de indicadores multiplos (MICS) 1996. Instituto Nacional de Estatistica - Gabinete de Monitorizaçao das Condiçoes de Vida da Populaçao. Luanda, Angola, 1999 (and additional analysis).
2007	10,224	8.2	29.2		Ministerio da Saude.;Relatorio do inquerito sobre a nutriçao em Angola 2007. Luanda, Republica de Angola: Ministerio da Saude, Direcçao nacional de Saude Publica, 2008.
2015	7,468	4.9	37.6	3.4	Instituto Nacional de Estatística (INE), Ministério da Saúde (MINSA), Ministério do Planeamento e do Desenvolvimento Territorial (MINPLAN) and ICF International.;Inquérito de Indicadores Múltiplos e de Saúde em Angola 2015-2016. Luanda, Angola e Rockville, Maryland, EUA: INE, MINSA, MINPLAN e ICF International (and additional analysis)

Plot of input data and estimates



Sources not included

Other data sources

Year	Sample size	Wasting	Stunting	Overweight	Source	Status of the data quality assessment
2001					MICS	Angola-secured territory - Decided NOT INCLUSION due to lack of national representativeness.

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