World Health Organization

WHO Anthro Survey Analyser

Quick guide

Caution note on data privacy:

The user should upload de-identified data to be analysed with the WHO Anthro Survey Analyser; ownership resides with the principal investigator (PI) or researcher. In order to protect the data, https will be used for the data transfer and the data will not be saved once the session has been closed. However, as it will be temporarily stored in a cloud server, a disclaimer and terms of use has to be accepted for the use of the application.

Disclaimer:

The WHO Anthro Survey Analyser runs in its own protected environment and its access is SSL encrypted; uploaded data is not saved once you close the session. However, the data will be temporarily stored in the cloud hosting the application and thus users are advised to ensure data is de-identifiable.

All reasonable precautions have been taken by WHO to verify the calculations performed by this application. However, the application is being distributed without warranty of any kind, either express or implied. The responsibility for the use and interpretation of the application's output lies with the user. In no event shall the World Health Organization be liable for damages arising from its use.

Note on usage of the online tool

This online tool sits in the shinyapp.io platform, where the WHO Department of Nutrition for Health and Development opened an account, which is payable based on the number of hours used per month (fixed). As such, users should be mindful to not leave the application open without using it. To avoid unnecessary time spent, the application is set to close after 15 minutes of idleness. After its closure, the user has to re-upload the file and re-map their variables for the analyses.

The link to the WHO Anthro Survey Analyser

https://whonutrition.shinyapps.io/anthro

Latest update: 31/10/2018

Acknowledgements:

The WHO Anthro Survey Analyser was built up from the WHO R macro developed by Elaine Borghi, from the Growth Monitoring and Assessment Unit (GRS), Department of Nutrition for Health and Development, WHO, Geneva. Monika Blössner and Elaine Borghi worked on the conceptualization, design and content of the application, under the supervision of Mercedes de Onis (GRS). The tool extends the concepts featured in the Nutrition Survey module of the Anthro Software. Epidemos LTD (Jonathan Polonsky as focal point) improved the R macro efficiency and developed the first prototype of the online application based on R and the Shiny R package; and Dirk Schumacher included additional data entry validation checks and implemented user-friendless enhancements.

We are grateful for the work on the testing phase by the Paola Alejandra Castillo Rojas (WHO intern), Monica Crissel Flores-Urrutia and Elisa Dominguez (WHO staff), and Chitra Maharani Saraswati (consultant). We also thank the International Center for Equity in Health, who worked closely with WHO on the application of standard methodology for complex survey sample analyses with financial support from the World Bank. We are also grateful to our colleague Richard Kumapley from UNICEF for his help with testing the WHO Anthro Survey Analyser results against those obtained with UNICEF's Stata macro developed following the same methodology.

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THE WHO ANTHRO SURVEY ANALYSER

The Anthro Survey Analyser is an online tool developed by the Department of Nutrition for Health and Development of the World Health Organization (WHO) which allows users to perform comprehensive analysis of anthropometric survey data for children under 5 years of age based on weight and height. The analyses are based on the WHO Child Growth Standards.[1] This version of the tool provides results for four of the anthropometric indexes: height-for-age, weight-for-age, weight-for-height, and body-mass-index-for-age.

This online tool is designed to build country capacity on data analysis and reporting on child malnutrition outcomes. It aims to enhance good practice in survey data collection, survey analysis, and reporting results.

Users should read this manual before entering their data as it contains a number of directions on data preparation which would assure analysis accuracy.

What are its differences from the Anthro Software?

The tool incorporates standard methodology as in the WHO Anthro Software[2] - Nutrition Survey module to calculate z-scores, prevalence estimates, and z-score summary statistics.

In terms of output, there are some additions:

- Outputs are provided in an "**expanded format**" with the following measures included:
    - The WHO Anthro Software included results disaggregated by age, sex, type of residence and sub-regions/districts, if available. The WHO Anthro Survey Analyser adds to those stratifications according to wealth quintiles, mother's education, and any other country-specific relevant factor.
    - Calculations of confidence intervals and standard errors around the estimates take into account complex sample designs methodology[3] whenever necessary.
    - The Anthro Software provides child malnutrition estimates for the most common cut-offs (e.g. stunting, which uses the indicator height-for-age below -2SD; or wasting, using the indicator weight-for-height below -2SD, and others). The tool provides cut-offs for all four indexes at -3SD, -2SD, -1SD, +1SD, +2SD, and +3SD.
    - For each index, weighted and unweighted sample sizes are provided.

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[1] WHO Multicentre Growth Reference Study Group. WHO child growth standards. Length, height for-age, weight-for-age, weight-for-length and body mass index-for age. Methods and development. Geneva: World Health Organization; 2006. Available at http://www.who.int/childgrowth/standards/Technical_report.pdf (Accessed 07 December 2017).

[2] World Health Organization. WHO Anthro (version 3.2.2, January 2011). Available at http://www.who.int/childgrowth/software (Accessed 07 December 2017).

[3] R package Survey. Available at https://cran.r-project.org/web/packages/survey/survey.pdf. By Thomas Lumley. 2015. (Accessed 07 February 2018).

- In addition to the online graphics and tables that can be easily downloaded, the tool provides a summary report template which includes main findings and key outputs for data quality assessment based on existing best practices for reporting.

What are the outputs of the Anthro Survey Analyser?

- A **Z-score** file based on the WHO Child Growth Standards: individual data, including calculated z-scores, and its corresponding flags based on the WHO flagging system for identifying implausible values.
- A **prevalence** file based on the WHO recommended standard analysis: includes prevalence estimates with corresponding standard errors and confidence intervals; and z-score summary statistics (mean and standard deviation) with all cut-offs describing the full index distribution (-3, -2, -1, +1, +2, +3). All results are provided at overall and disaggregated levels for all available stratification variables (age, sex, type of residence, geographical regions, wealth quintiles, mother education and one additional factor the user is interested in for which the data are available).
- **A survey report template** in Word format. This template lays out the minimum required details to follow the existing guidelines for good practice in reporting.[4] The main findings are also included in the form of graphics and tables which depicts prevalence estimates and z-score distributions. These measures are further stratified by different group variables for the five main indicators—namely stunting, wasting, severe wasting, overweight, and underweight—as well as data quality assessment statistics and displays. This template aims to provide useful inputs of key findings and data quality assessment for a full survey report.
- **Graphics and figures:** all graphics included in the application are in grayscale to allow for black and white printing. They can be downloaded whenever they are displayed.

Who will benefit from using the Anthro Survey Analyser?

The Anthro Survey Analyser is intended to be a useful tool for individuals in National Statistics Offices, data collection specialised agencies or programs, research centres, and any other institutions responsible for the analysis of anthropometric child indicators. It can be especially useful for users who do not have access to standard statistical software to analyse surveys.

[4] Forthcoming : Working Group (WG) on Anthropometry Data Quality, for the WHO/UNICEF Technical Expert Advisory Group on Nutrition Monitoring (TEAM). Recommendations for improving the quality of anthropometric data collection, analysis and reporting. 2018.

STEPS TO ANALYZE SURVEYS

This tool is based on R code and utilises the shiny package.[5] As such, there are some basic rules that will ensure its efficient use. Moreover, the standard analyses of anthropometric survey data require many of the input variables to be defined according to a specific format. The steps described in the following sections will facilitate effective use of the tool.

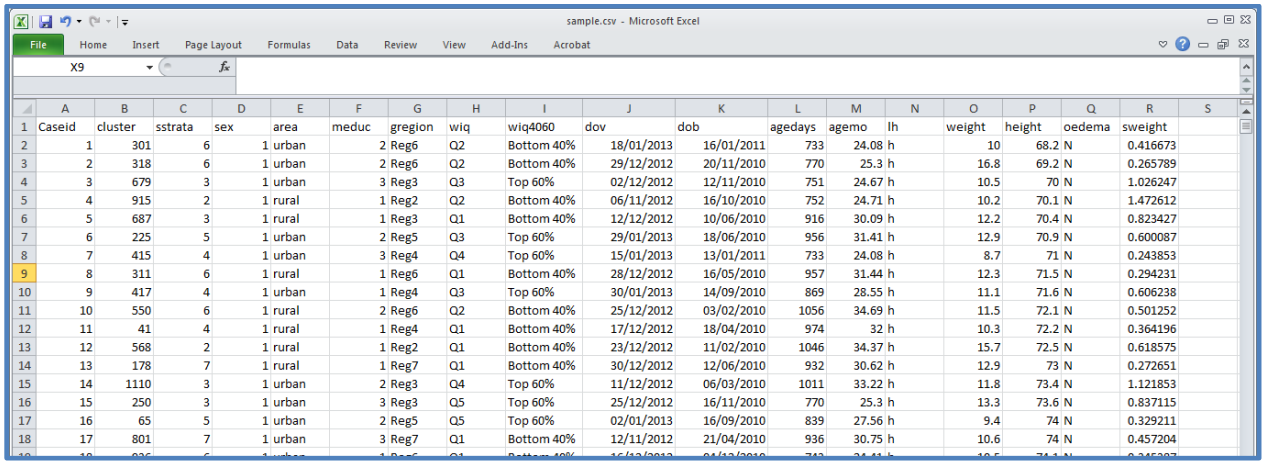
1. Data preparation for Anthro Survey Analyser

The standard analysis of survey anthropometric data, as recommended by WHO, comprises of the calculation of z-scores for each child based on the WHO Child Growth Standards, the creation of flagging variables to exclude implausible data according to the WHO flagging system, and the calculation of prevalence estimates and z-score summary statistics. In order to have the best accuracy for the output estimates, the user should know what the compulsory variables are as well as the recommended format for each of the mapped (input) variables.

The Anthro Survey Analyser does include validation checks for each mapped input variable used for the analysis, and provides user-friendly messages to guide the user in detecting potential mismatches. However, the user is strongly encouraged to perform **preparation of the data prior** to importing the file into the Anthro Survey Analyser. Table 1 provides guidance on accepted values for each of the variables to be mapped as input to the analysis and information on whether the variable is compulsory.

The data file to be imported should be in a **comma delimited format (.csv).** The file can be created in any spreadsheet software used for the organization, analysis, and storage of data in tabular form such as Microsoft Excel. Once the data is properly organised it can be saved as or transferred to a ".csv" format.

Attention: This application is based on R code. Therefore any variable label can only contain characters, numbers, "_", and "-". It **should not** include spaces or symbols. This also applies to the file name to be imported. For example, names such as "country survey.csv" or "survey2013&2014" **are not accepted**.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	Caseid	cluster	sstrata	sex	area	meduc	gregion	wiq	wiq4060	dov	dob	agedays	agemo	lh	weight	height	oedema	sweight	
2	1	301	6	1	urban	2	Reg6	Q2	Bottom 40%	18/01/2013	16/01/2011	733	24.08	h	10	68.2	N	0.416673	
3	2	318	6	1	urban	2	Reg6	Q2	Bottom 40%	29/12/2012	20/11/2010	770	25.3	h	16.8	69.2	N	0.265789	
4	3	679	3	1	urban	3	Reg3	Q3	Top 60%	02/12/2012	12/11/2010	751	24.67	h	10.5	70	N	1.026247	
5	4	915	2	1	rural	1	Reg2	Q2	Bottom 40%	06/11/2012	16/10/2010	752	24.71	h	10.2	70.1	N	1.472612	
6	5	687	3	1	rural	1	Reg3	Q1	Bottom 40%	12/12/2012	10/06/2010	916	30.09	h	12.2	70.4	N	0.823427	
7	6	225	5	1	urban	2	Reg5	Q3	Top 60%	29/01/2013	18/06/2010	956	31.41	h	12.9	70.9	N	0.600087	
8	7	415	4	1	urban	3	Reg4	Q4	Top 60%	15/01/2013	13/01/2011	733	24.08	h	8.7	71	N	0.243853	
9	8	311	6	1	rural	1	Reg6	Q1	Bottom 40%	28/12/2012	16/05/2010	957	31.44	h	12.3	71.5	N	0.294231	
10	9	417	4	1	urban	1	Reg4	Q3	Top 60%	30/01/2013	14/09/2010	869	28.55	h	11.1	71.6	N	0.606238	
11	10	550	6	1	rural	2	Reg6	Q2	Bottom 40%	25/12/2012	03/02/2010	1056	34.69	h	11.5	72.1	N	0.501252	
12	11	41	4	1	rural	1	Reg4	Q1	Bottom 40%	17/12/2012	18/04/2010	974	32	h	10.3	72.2	N	0.364196	
13	12	568	2	1	rural	1	Reg2	Q1	Bottom 40%	23/12/2012	11/02/2010	1046	34.37	h	15.7	72.5	N	0.618575	
14	13	178	7	1	rural	1	Reg7	Q1	Bottom 40%	30/12/2012	12/06/2010	932	30.62	h	12.9	73	N	0.272651	
15	14	1110	3	1	urban	2	Reg3	Q4	Top 60%	11/12/2012	06/03/2010	1011	33.22	h	11.8	73.4	N	1.121853	
16	15	250	3	1	urban	3	Reg3	Q5	Top 60%	25/12/2012	16/11/2010	770	25.3	h	13.3	73.6	N	0.837115	
17	16	65	5	1	urban	2	Reg5	Q5	Top 60%	02/01/2013	16/09/2010	839	27.56	h	9.4	74	N	0.329211	
18	17	801	7	1	urban	3	Reg7	Q1	Bottom 40%	12/11/2012	21/04/2010	936	30.75	h	10.6	74	N	0.457204	

[5] shiny: Web Application Framework for R. https://cran.r-project.org/web/packages/shiny.

Figure 1. File preparation.

Table 1. Data preparation: compulsory variables and accepted values/formats.

Variable	Compulsory or Optional?	Accepted values and other details
Age related variables: Date of birth & Date of visit (recommended) or Age (in days or in months)	Compulsory	Date of birth AND Date of visit: DD/MM/YYYY - The use of the two date variables for calculating the exact age of the child is the recommended, best practice approach. - **Note:** if DAY is missing for the date of birth, it should be replaced by 15. If month or year is missing, the date value should be set to missing/blank. - If Date of birth and Date of visit are provided, the mapping of the variable Age will not be available to the user. Age: numeric - in days: calculated as date of visit minus date of birth (integer value). - in months: calculated as age in days divided by 30.4375 (float value). In this case, decimals should always be provided for more accurate calculations of z-scores. **Note:** For all cases where age is missing, only results for weight-for-height will be computed and children will be accounted for the total sample size (0 to 5 years), but not classified in the age groups.
Sex	Compulsory	Numeric or text. For male (1/"M"/"m") and for female (2/"F"/"f")
Weight	Optional	Numeric, float value (in kilograms with decimals)
Length or height	Optional	Numeric, float value (in centimetres with decimals)
LH measure (Standing or Recumbent position for height or length measurement)	Optional	Character. Recumbent length ("L" or "l") or standing height ("H" or "h"). **Note:** It is recommended that recumbent length is used for children aged less than 731 days and standing height for those aged 731 or more days. As such, if this information is missing, the tool applies the values of "L" or "H" according to this recommendation.
Oedema	Optional	Character. For no oedema ("N", "n", or "1") and for oedema cases ("Y", "y", or "2"). **Notes:** - For all cases where this information is not provided, the tool's code considers the cases as having no oedema. - Z-scores for all weight-related indexes will be set to zero when oedema is present. - For prevalence calculation purposes, children with oedema are classified as having severe malnutrition (weight-for-height<-3SD, weight-for-age<-3SD and BMI-for-age<-3SD).

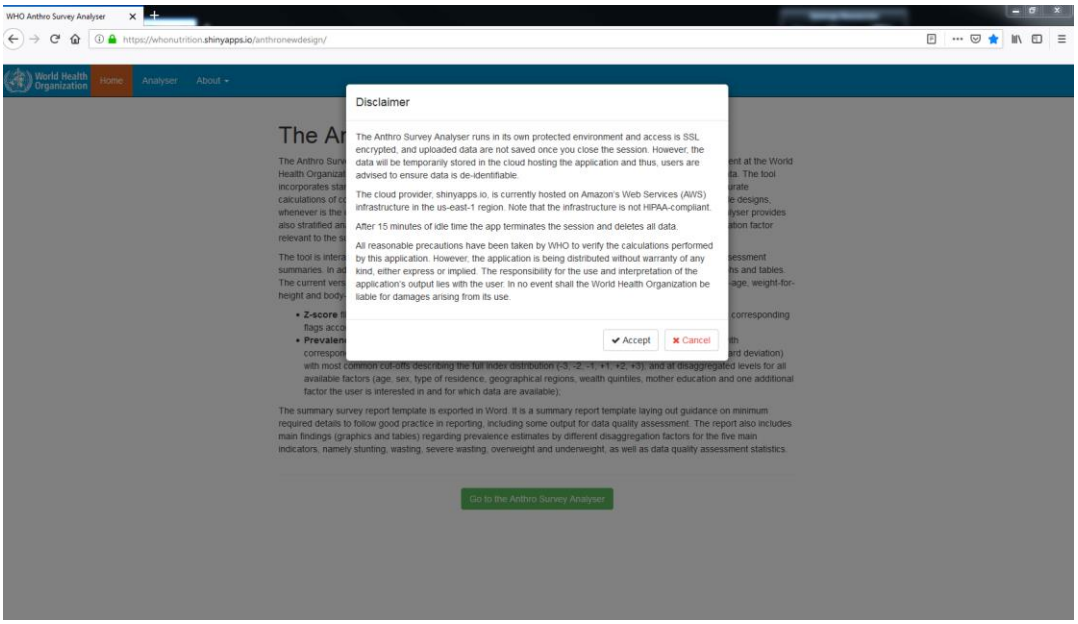
Sampling weight	Optional	Numeric float - If not provided, all children will be assumed to have identical weights (=1), that is, unweighted analysis will be carried out. - If provided, all children with missing sampling weights will be excluded from the analysis.
Cluster	Optional	Numeric integer - If not provided, all children will be assumed to have identical cluster, i.e. a one-cluster design, with the default value of the cluster set to be equal to one. - If provided, all children with missing cluster will be excluded from the sample. **Note:** Clusters must be nested within strata. This means one cluster cannot belong to more than one strata. In that case, the application will not calculate prevalence estimates.
Strata	Optional	Numeric integer - If not provided, all children will be assumed to have identical strata, i.e. a one-strata design where the default strata value is equal to one. - If provided, all children with missing strata will be excluded from the sample.
Residence type	Optional	Numeric integer or character – recommended values: “Rural” or “Urban” - Any values are accepted. The recommended labels however are preferable for the purpose of output interpretation.
Geographical region	Optional	Numeric integer or character
Wealth quintiles	Optional	Numeric integer or character. 1=poorest; 2,3,4,5=richest (in this order)
Mother’s education	Optional	Numeric integer or character – recommended values: “None”, “Primary” and “Secondary” - Any number of categories or values are accepted for the analysis, provided sample sizes are sufficient in all categories. However the common, standard recommended categories are no education, primary school, and secondary school or higher (“None”, “Primary” and “Secondary”). **Note:** Mother’s education refers to the highest level of schooling attained by the mother
Other grouping variable	Optional	Numeric or character - Any variable that is of interest for obtaining results from stratified analysis.
Filter variable(s)	Optional	Numeric or character Note: Binary variables (0/1 or Yes /No) are preferable to facilitate the selection of included records by the applied filter.
*Missing data recoding		Blank/empty cell - In case of missing value codes such as 9999, 9998, etc., the cells with missing values should be replaced with a blank/empty cell before uploading the file in the application.

2. Uploading the file

1. Enter the following URL in the browser of your preference (e.g. Google Chrome, Mozilla Firefox).

https://whonutrition.shinyapps.io/anthro

The website displayed should be as shown in Figure 2. The acceptance of the disclaimer is required to use the tool.



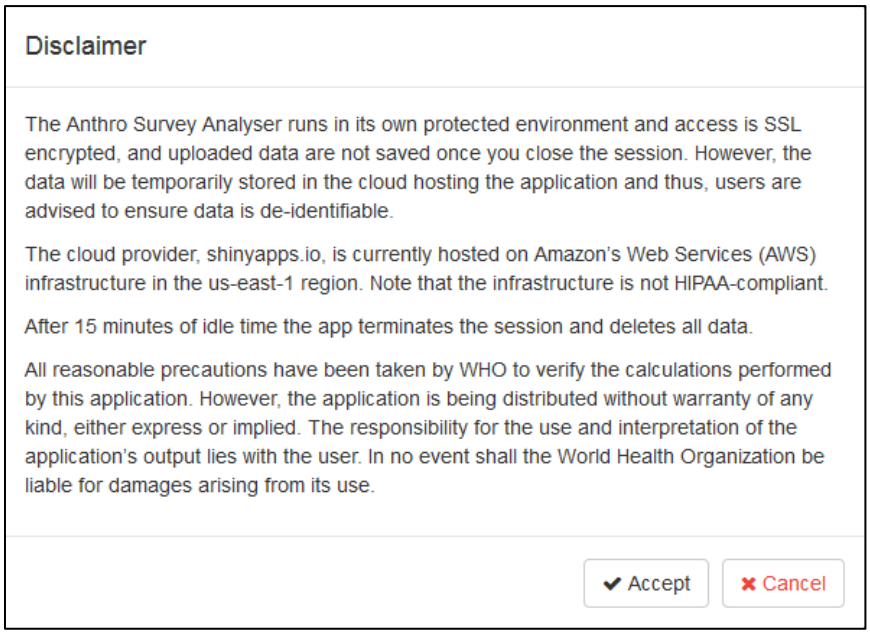


Figure 2. Disclaimer.

2. Once “Upload data” is activated, click on “Browse” and select the file that contains the dataset to be analysed. Refer to Figure 3. Keep in mind that the uploaded files are required to be in a csv format.

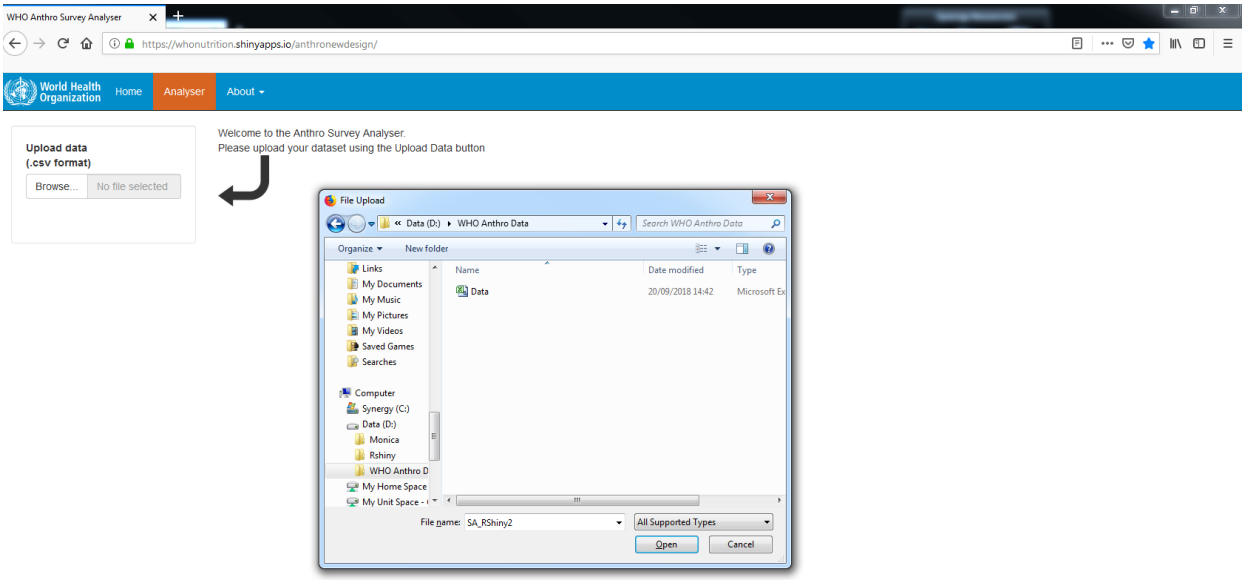


Figure 3. Analysis dataset file upload.

3. Variable mapping

Variable mapping requires the user to manually select the variables from the dataset that corresponds to the variables used for analysis. As a part of the data validation, only the formats specified in Table 1 is possible for each variable selection, as seen in Figure 4.

The tool is able to recognise the correct format for each variable. In the instance that no variable-specific format is found in any of the available variables in the dataset, a pop-up message, as shown in Figure 5, will be seen.

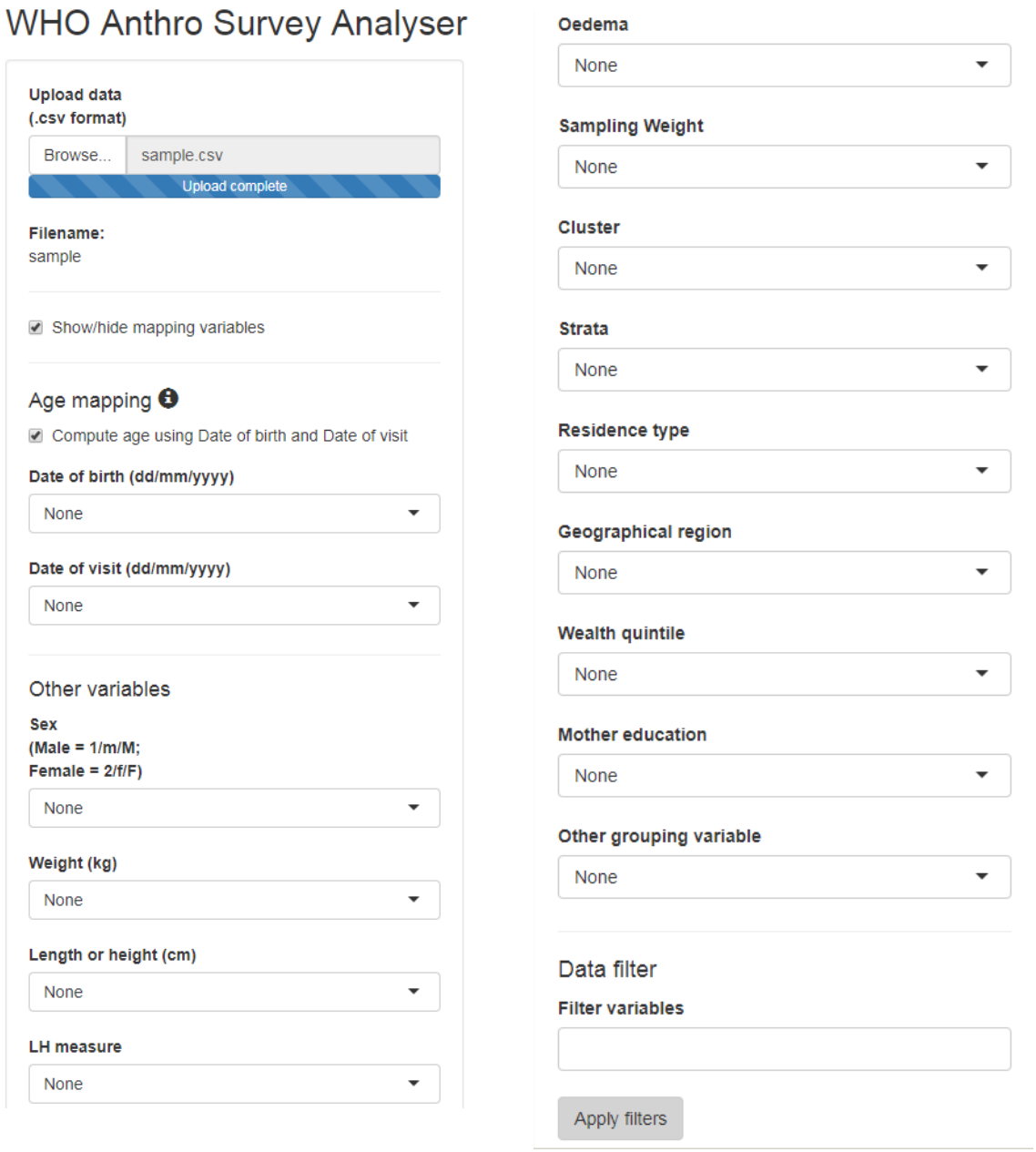


Figure 4. Variable mapping.

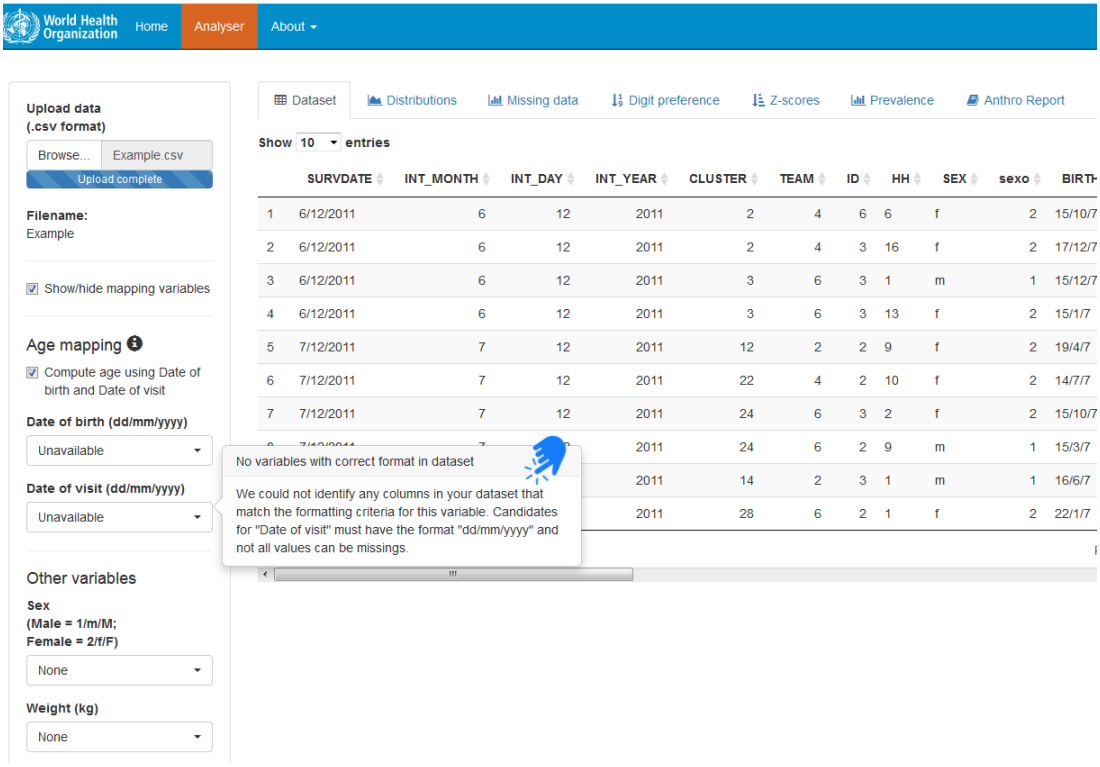


Figure 5. Variable mapping pop-up message when no variable available in the dataset matches the required format.

Age mapping

Age calculation based on date of birth and date of visit variables is the **default and recommended approach**. In this instance, the checkbox “Compute age using Date of birth and Date of visit” is checked, as seen in Figure 5.

If for any reason this is not the approach desired, the user has to **uncheck** that box for the mapping of the “Age” field to become available (Figure 6).

If the age variable is to be mapped, the user should indicate the unit for Age. **Note:** if age is provided in months, its values should contain decimals for accurate calculation of the age-based indicators’ z-scores, such as stunting and underweight. Age in days is therefore preferable to age in months. The user also needs to check the checkbox for “Age unit in months” if the age variable is indeed mapped in months.

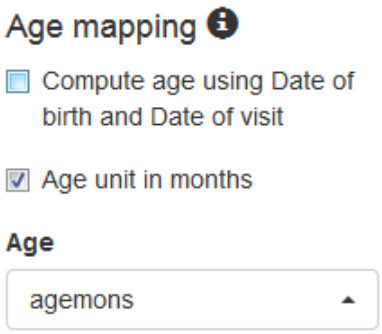


Figure 6. Age mapping when user chooses to use an exiting variable for information on age.

4. Outcome visualisation and quality assessment

Dataset

The complete uploaded spreadsheet, including unmapped variables, will appear under the "Dataset"tab. The final dataset is displayed on the right side of the mapping (based on the filter selection, if any).

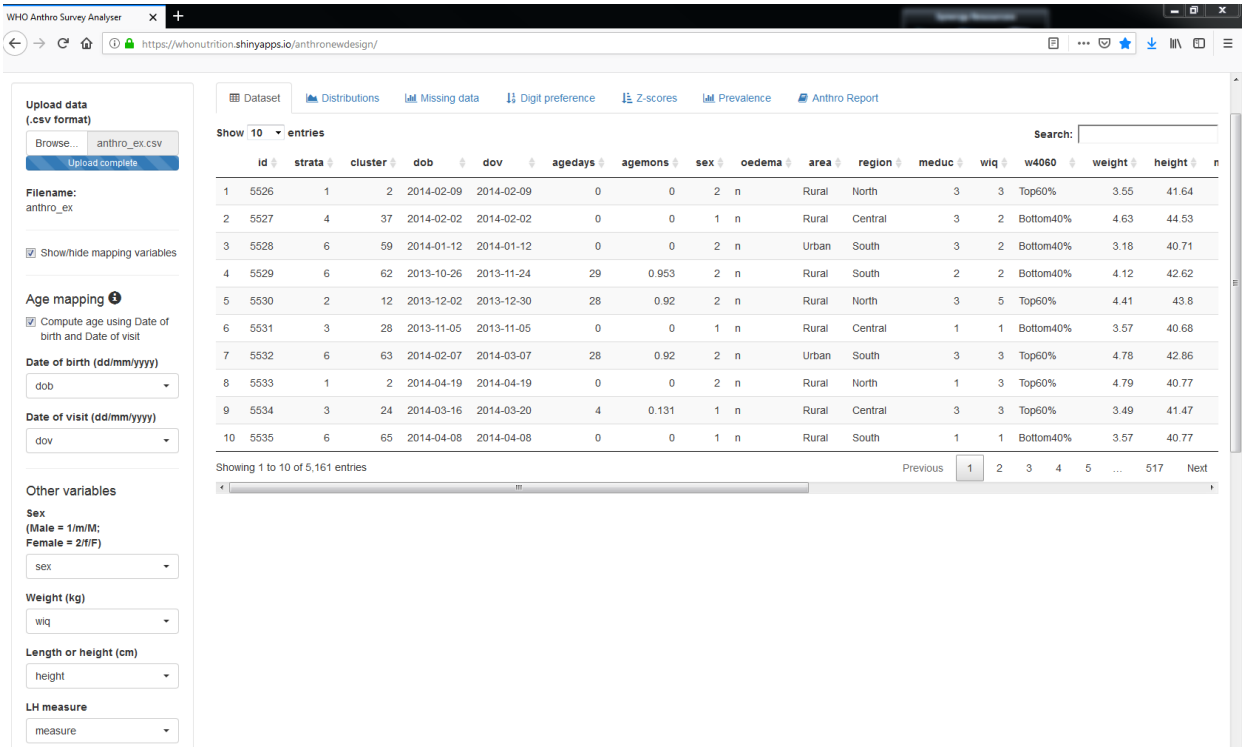


Figure 7. Dataset display

Data visualisation

Frequency distribution

The tool provides frequency distributions of the input variables age group, weight, and height, which can be found by clicking the “Distributions” tab. The option to visualize the distribution by different stratifications is offered for the group variables mapped. For example, it might be useful to look at the age distribution by sex, or by any other of the stratification factors, to look at potential sampling patterns that indicate biases.

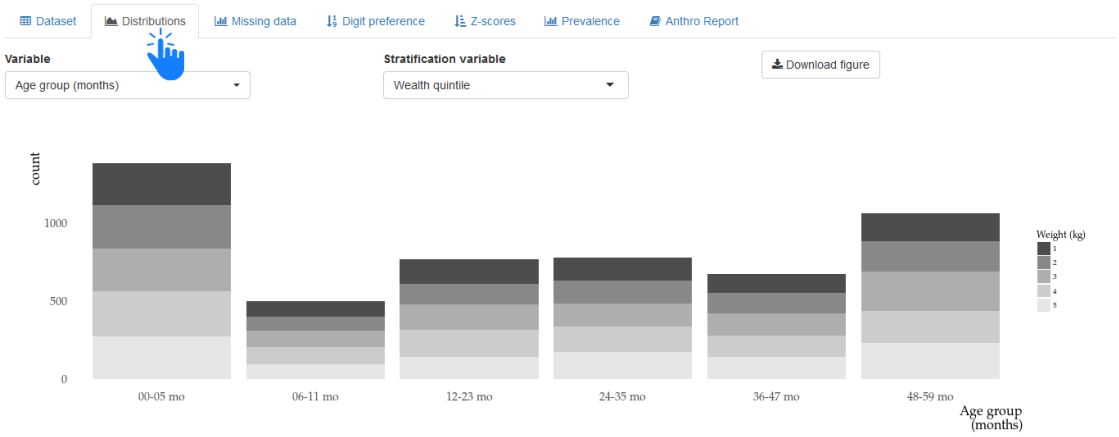


Figure 8. Frequency distribution by age and wealth quintiles.

Missing data

The proportion of missing data is visualised for each of the mapped variables; refer to Figure 9 for an example. These visualisations can be found under the “Missing Data” tab.

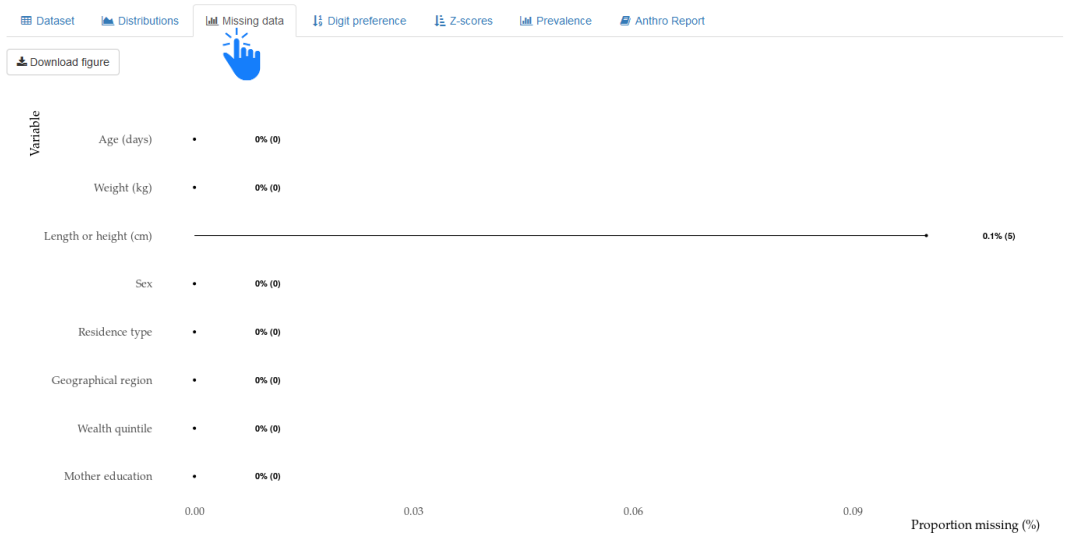


Figure 9. Missing data for data quality assessment.

Digit Preference

Digit preference for weight (kg) and length/height (cm) at one-decimal precision can be analysed. Please note that future versions of this application will incorporate other digit preference options, as recommended by the harmonized best practice manual on antrhopometric data quality assurance.

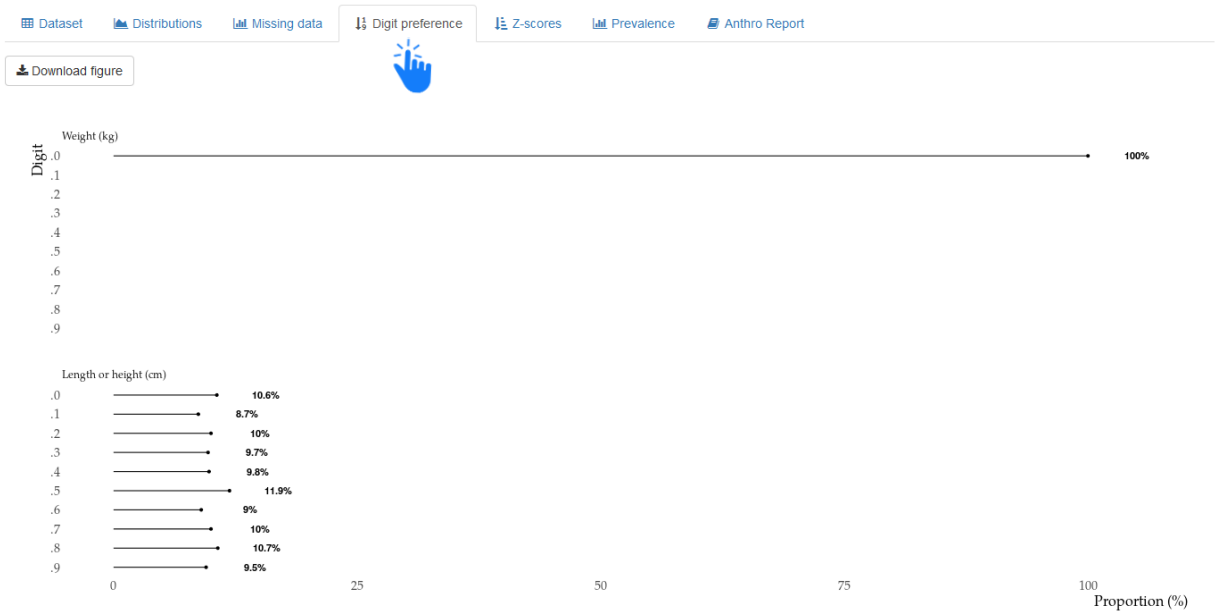


Figure 10. Digit preference in data quality assessment.

5. Z-score calculations and quality assessment

Calculate Z-score by clicking on the button "Click to calculate z-scores".

The "Z-scores" tab contains functionalities to: 1) calculate z-scores for each observation; 2) flag outlying observations as outlined by the WHO flagging system (refer to Table 2); 3) visualisation of the z-score distributions for each of the five main anthropometric indicators of stunting, wasting, severe wasting, overweight, and underweight; and 4) download a csv file containing the original dataset as well as the calculated z-scores and z-score flags. Figure 11 shows the steps to follow. **Note:** Prevalences will not be calculated before the z-scores are calculated.

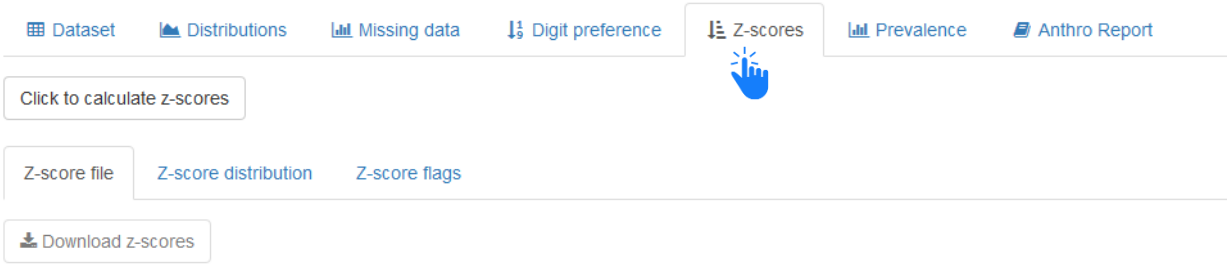


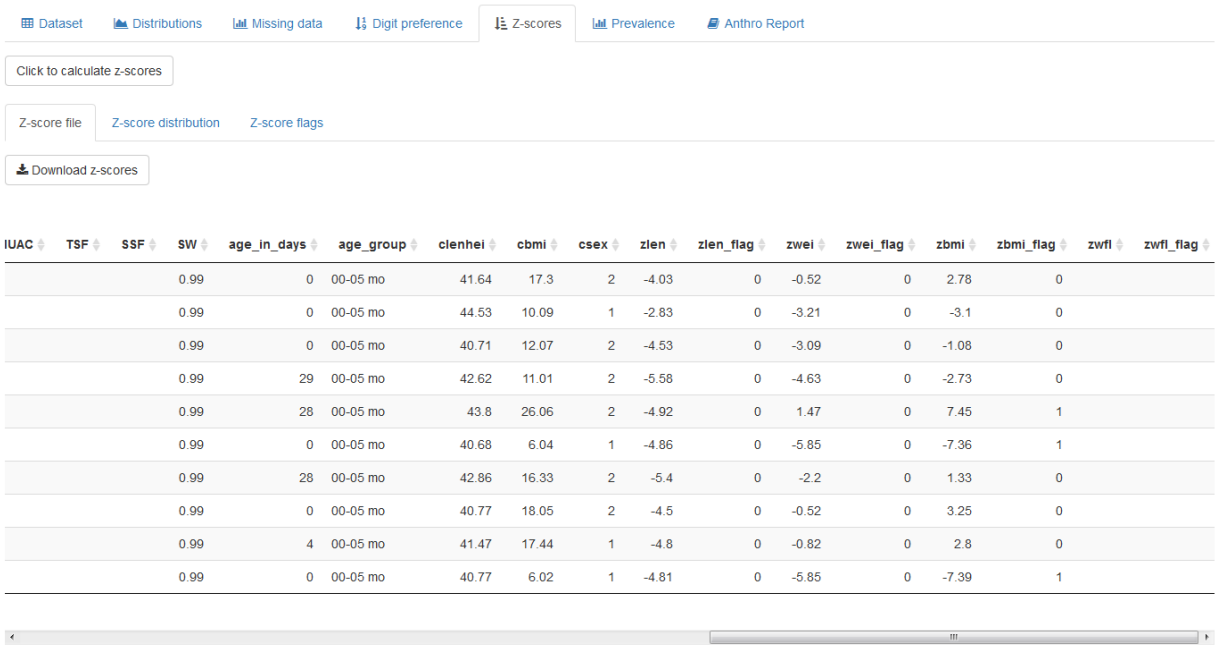
Figure 11. Z-score calculation and visualization features.

Table 2. WHO flagging system for implausibility checking.

Indexes	Lower SD	Upper SD
Weight-for-age	<-6	>+5
Length/height-for-age	<-6	>+6
Weight-for-lenght/height	<-5	>+5
Body mass index-for-age	<-5	>+5

Source: WHO Anthro 2005. WHO Anthro for Personal Computers Manual. Software for assessing growth and development of the world's children. Geneva: WHO, 2006 (http://www.who.int/childgrowth/software/WHOAnthro2005_PC_Manual.pdf).

Once the z-scores are calculated by clicking on the "Click to calculate z-scores" button, they are shown on-screen (please refer to Figure 12). You can then download the file containing those calculated z-scores by clicking on the "Download z-scores" button. The file will contain all rows in the original file uploaded (including the rows excluded by any filter applied), with a column indicating whether the child was selected for the final sample (variable "included" with values TRUE or FALSE). Table 3 specifies the contents of the added columns.



IUAC	TSF	SSF	SW	age_in_days	age_group	clenhei	cbmi	csex	zlen	zlen_flag	zwei	zwei_flag	zbmi	zbmi_flag	zwfl	zwfl_flag
			0.99	0	00-05 mo	41.64	17.3	2	-4.03	0	-0.52	0	2.78	0		
			0.99	0	00-05 mo	44.53	10.09	1	-2.83	0	-3.21	0	-3.1	0		
			0.99	0	00-05 mo	40.71	12.07	2	-4.53	0	-3.09	0	-1.08	0		
			0.99	29	00-05 mo	42.62	11.01	2	-5.58	0	-4.63	0	-2.73	0		
			0.99	28	00-05 mo	43.8	26.06	2	-4.92	0	1.47	0	7.45	1		
			0.99	0	00-05 mo	40.68	6.04	1	-4.86	0	-5.85	0	-7.36	1		
			0.99	28	00-05 mo	42.86	16.33	2	-5.4	0	-2.2	0	1.33	0		
			0.99	0	00-05 mo	40.77	18.05	2	-4.5	0	-0.52	0	3.25	0		
			0.99	4	00-05 mo	41.47	17.44	1	-4.8	0	-0.82	0	2.8	0		
			0.99	0	00-05 mo	40.77	6.02	1	-4.81	0	-5.85	0	-7.39	1		

Figure 12. Z-scores display.

Table 3. Z-score outputed file – added variables.

Variable	Description
age_group	Age group
age_in_days	Age in days for deriving z-score
clenhei*	Converted length/height based on information whether the child was measure standing (h or H) or laying down (l or L)
cbmi	BMI value based on weight and clenhei
csex	Sex for deriving z-score
zlen	Length/Height-for-age z-score
zlen_flag	Flag for zlen<-6 or zlen>6
zwei	Weight-for-age z-score
zwei_flag	Flag for zwei<-6 or zwei>5
zbmi	BMI-for-age z-score
zbmi_flag	Flag for zbmi<-5 or zbmi>5

* **Note:** It is recommended that recumbent length is used for children aged less than 731 days and standing height is used for children aged 731 or more days. As such, if this information **is** missing (mapped variable corresponding to “LH Measure”), the tool’s code imputes the values as “L” or “H” according to this recommendation. When the variable “LH Measure” is provided, height values (h or H) will be converted to length if child is younger than 731 days of age, by adding 0.7 cm to its original height value. In contrast, length values (l or L) will be converted to height if child is 731 days of age or older, by subtracting 0.7 cm from the child’s original length value.

Z-score distributions

Smoothed emprical density distributions are displayed for each of the anthropometric indexes, as well as by any of the stratification factors (refer to Figure 13).

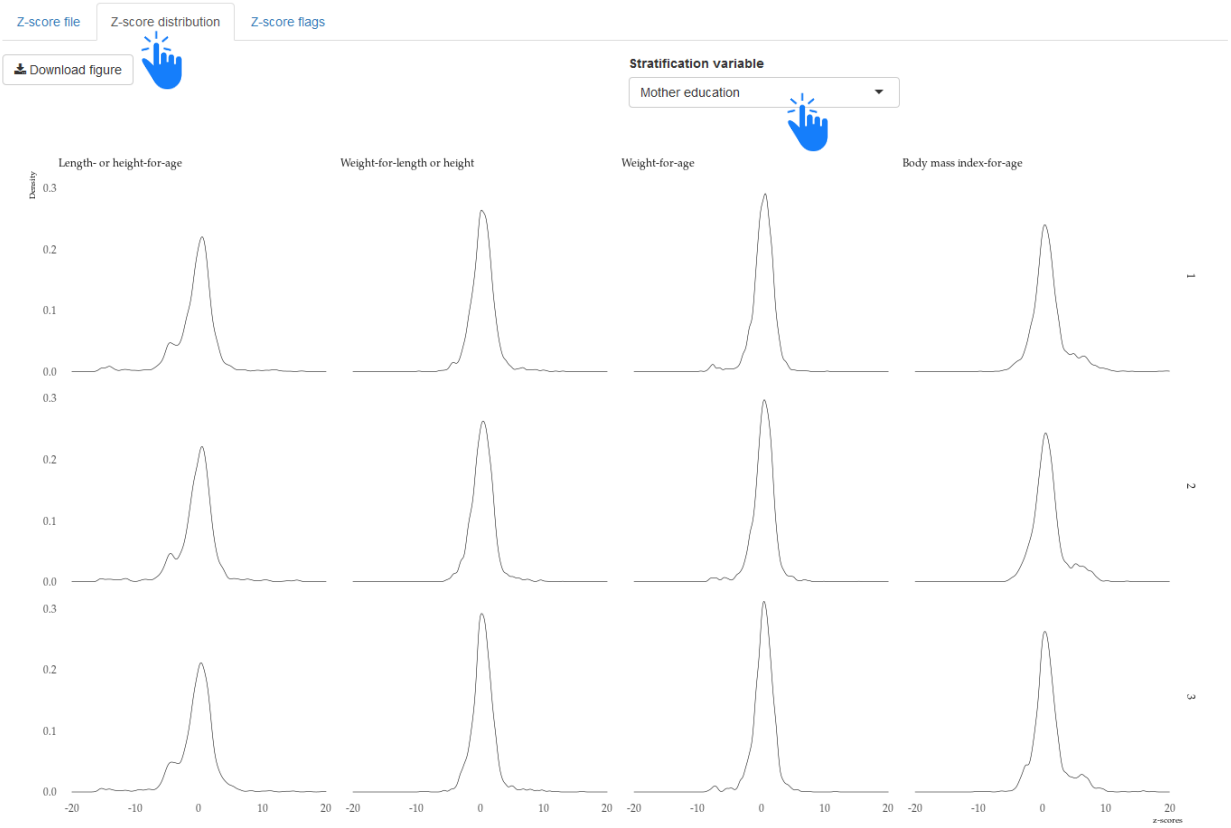


Figure 13. Z-score distribution by mother education.

Show z-score flags

A graphical display of the proportions of flagged z-scores for each of the indexes, based on the WHO flagging system, is shown (refer to Figure 14).

Figure 14. Proportion of z-score flags per index.

6. Calculation of prevalence estimates

The Anthro Survey Analyser calculates the prevalence estimates with the corresponding standard errors and confidence intervals in a format called the "**expanded format**". An expanded format includes z-score summary statistics, of mean and standard deviation, with cut-offs describing the full index distribution (at -3, -2, -1, +1, +2, +3) and at disaggregated levels for all available factors (such as age, sex, type of residence, geographical regions, wealth quintiles, mother education and one additional factor that the user is interested in and for which data are available).

Each of the indexes, when associated with the specific recommended cut-offs, results in indicators. The most commonly used indicators in assessing child nutrition status for national surveys are shown in Table 4. Assessment based on mid-arm upper circumference assessment, albeit used in many situations, is not included in this version of this application.

Table 4. Most common anthropometric indicators to assess child nutrition status in national nutrition surveys.

Indicators	Definitions
Stunting	Height-for-age < -2SD
Severe wasting	Weight for Height < -3 SD
Wasting	Weight for Height < -2 SD
Overweight	Weight for Height > +2 SD
Underweight	Weight-for-age < -2SD

Oedema

For each of the indicators, prevalence calculations are based on all valid z-scores. When information on oedema is provided, children with oedema are classified as having severe malnutrition. This means their z-scores for the indexes of weight-for-height, weight-for-age, and BMI-for-age are considered to be below the -3SD cut-off, and are accounted for as such in the prevalence calculation. However, as their weights are invalid, their z-scores are set to missing; i.e. as a result, their z-scores are not accounted for in the calculations for mean z-score or z-score standard deviation for these indexes.

All the calculations for the standard errors and confidence intervals are based on the approaches for complex sampling designs (R package Survey[3]).

Calculate prevalence

Calculating the prevalence estimates must be done after the z-score calculations have been completed. To calculate the prevalences, click on the tab "Prevalence" and then "Click to calculate prevalences" (Figure 15).

Figure 15. Functionality for calculating prevalence estimates.

Once prevalence estimates are calculated, the original dataset with the expanded output will appear in the window, as shown in Figure 16.

	rowname	HAZ_pop	HAZ_unwpop	HA_3_r	HA_3_se	HA_3_ll	HA_3_ul	HA_2_r	HA_2_se	HA_2_ll	HA_2_ul	HA_1_r	HA_1_se	HA_1_ll	HA_1_ul	HA
1	All	13731.6	13685	4.05	0.2448	3.59	4.56	11.68	0.4679	10.79	12.63	31.88	0.6512	30.62	33.18	1
2	Age group: 00-05 mo	1552.2	1465	4.45	0.6463	3.34	5.91	10.06	0.925	8.38	12.02	25.13	1.4751	22.35	28.14	2
3	Age group: 06-11 mo	1531.5	1467	2.97	0.4918	2.15	4.11	8.19	0.8395	6.68	9.99	20.78	1.2699	18.4	23.38	2
4	Age group: 12-23 mo	2904.5	2680	5.26	0.529	4.32	6.4	13.74	0.8655	12.12	15.52	33.56	1.204	31.24	35.96	1
5	Age group: 24-35 mo	2724.3	2921	4.52	0.4728	3.67	5.54	13.59	0.8708	11.97	15.39	35.17	1.2957	32.67	37.75	1
6	Age group: 36-47 mo	2573.5	2636	4.04	0.524	3.13	5.2	11.86	0.939	10.14	13.83	32.84	1.2835	30.37	35.4	
7	Age group: 48-59 mo	2445.7	2516	2.51	0.3951	1.84	3.41	10.13	0.8196	8.63	11.86	36.47	1.3314	33.9	39.12	
8	Sex: Female	6715.4	6638	3.45	0.2801	2.94	4.05	10.71	0.5476	9.69	11.84	30.68	0.8507	29.04	32.38	1
9	Sex: Male	7016.2	7047	4.61	0.3296	4.01	5.31	12.6	0.6007	11.47	13.83	33.04	0.8327	31.42	34.69	1
10	Age + sex: 00-05 mo.Female	768.9	716	2.64	0.7048	1.56	4.43	6.87	1.011	5.14	9.14	22.34	1.958	18.74	26.42	2

Figure 16. Prevalence estimates and z-score summary statistics in the expanded format.

You can also download a file all of the prevalence estimates by clicking on”Download prevalences”. The downloaded file would also include accuracy measures for all indexes and cut-offs (“filename_prevalence.csv”), as presented in Figure 16. Table 5 explains variable labels for the columns in the downloaded file.

Table 5. Labels for variables in the outputted file with prevalence estimates and other summary statistics.

Index		Cut-offs		Suffix	
HA	Height-for-age	*_3*	Prevalence corresponding to <-3SD	*_pop*	Weighted sample size
WA	Weight-for-age	*_2*	Prevalence corresponding to <-2SD	*_unwpop*	Unweighted sample size
BMI	Body-mass-index-for-age	*_1*	Prevalence corresponding to <-1SD	*_r*	Mean/prevalence
WH	Weight-for-height	*1*	Prevalence corresponding to >+1SD	*_ll*	95% confidence interval lower limit
HA_WH	Combined indicator based on height-for-age and weight-for-height (stunted & overweight)	*2*	Prevalence corresponding to >+2SD	*_ul*	95% confidence interval upper limit
		3	Prevalence corresponding to >+3SD	*_stdev*	Standard Deviation
				_se	Standard error

Examples:	
WHZ_pop	weight-for-height weighted sample size
HA_r	height-for-age z-score mean
WA_stdev	weight-for-age z-score standard deviation
WH2_r	prevalence of weight-for-height >+2 SD (overweight)
WH_r	Mean weight-for-height z-score
BMI_2_se	Prevalence of BMI-for-age <-2 SD standard error
BMI_3_ll	Prevalence of BMI-for-age <-3 SD 95% confidence interval lower limit
HA_2_WH_2_ul	Prevalence of children Height-for-age and weight-for-height combined (stunted & wasted) lower 95% confidence interval limit

SAMPLE REPORT TEMPLATE

This function allows the user to export a summary report template in Word, laying out guidance on the requirements needed to follow good practice in reporting. The sections on details of survey design, measure instruments, description of the sample, and other information are to be completed by the user. This is important to enhance transparency and survey design, coverage, and data quality evaluation.

The report also includes main findings (graphics and tables) regarding prevalence estimates by different disaggregation factors for the five main indicators, namely: stunting, wasting, severe wasting, overweight, and underweight. It also includes main data quality assessment statistics, as proportion of missing age, weight, or height, digit preference for length and weight, proportion of flagged z-scores, and z-score distributions by the various stratification factors available.

Click on the “Generate & download report” button located in the “Anthro Report” tab. It might take several minutes for the report to be prepared for downloading. Refer to Figure 17.

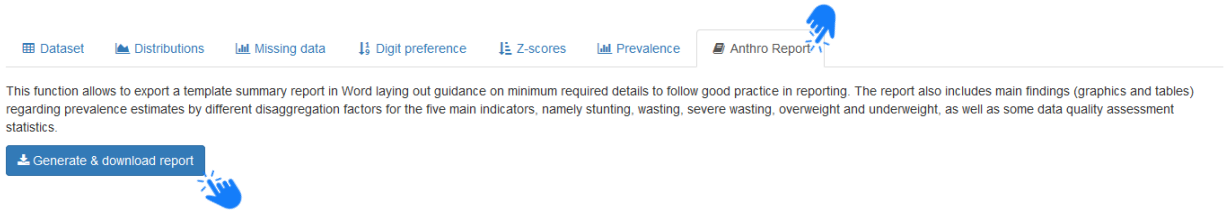


Figure 17. Generating the summary report template for a survey dataset.

An example of the summary report template follows in the Appendix.

Figure 18

APPENDIX: EXAMPLE OF SUMMARY REPORT

SURVEY TITLE

ADD SURVEY DETAILS - STUDY LOCATION, STUDY PERIOD, ETC

AUTHOR

Recommended citation:

Report template with results from WHO Anthro Survey Analyser

Analysis date: 2018-02-02 14:00:23

Link: https://whonutrition.shinyapps.io/anthro/

Overall survey results summary

Outcome plots

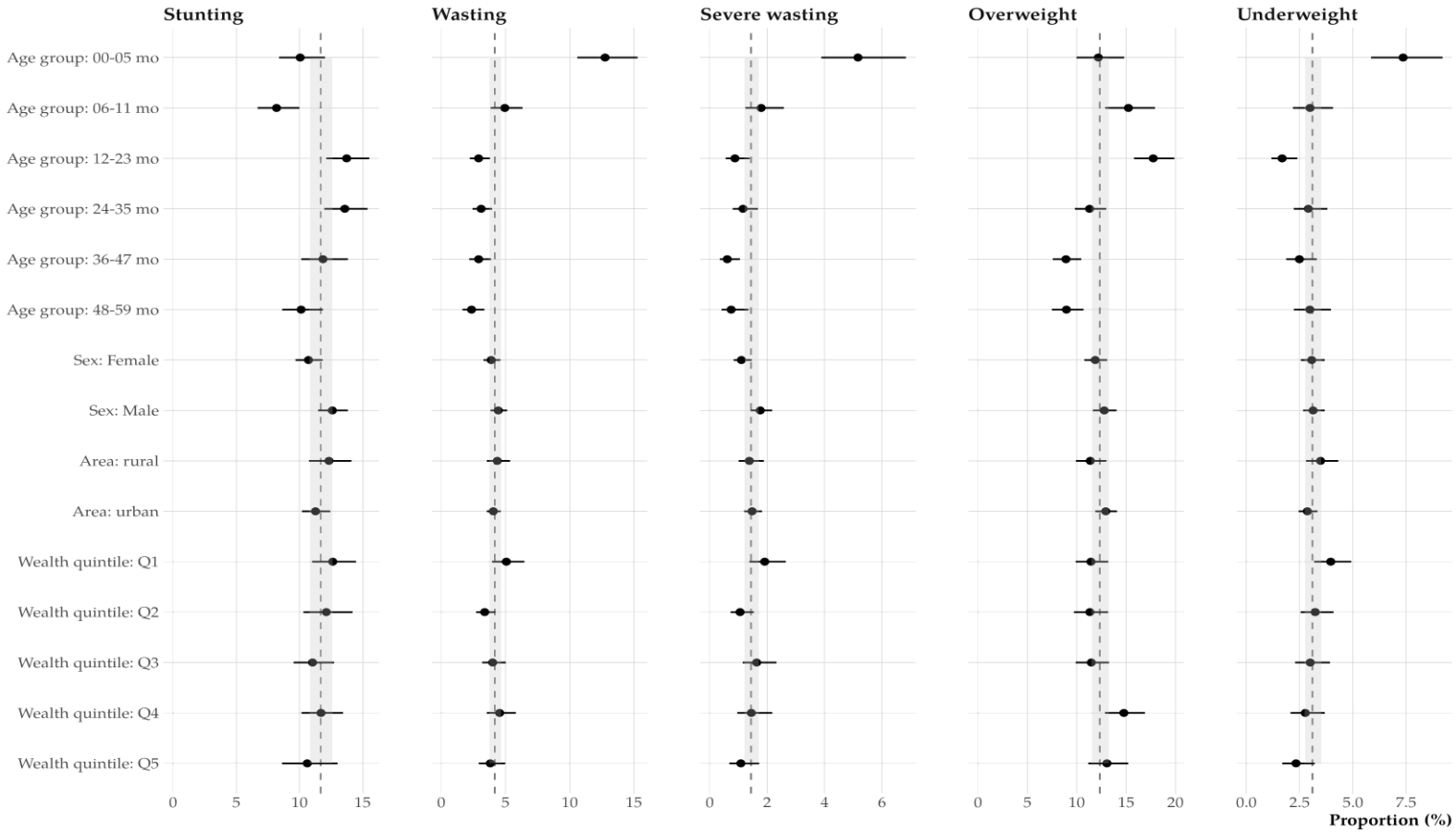


Figure 1: Nutritional status by stratification variable

Summary on survey description

Sample size:

The original sample was of 14701 children. There were 14701 children retained after filtering for **[INSERT DETAILS OF ANY FILTERING APPLIED]**; height measurements were obtained for 13790 (93.8%) children and weight measurements were obtained for 13854 (94.2%). There were 0 (0%) children with missing information on sex and there were 56 (0.4%) children with missing age.

There were 8 cases of oedema reported.

Sample design:

Household listing (source or how was it done to update existing information)

Training of field staff: How many, how many teams, how many measurements per team per day

Standardization

Equipment and calibration

Data collection period

Data collection: Start: **[enter month and year the survey started MM/YYYY]**; End: **[enter month and year the survey ended MM/YYYY]**

Data entry

Supervision

Other survey context important for the interpretation of results

Seasonality (e.g. harvest and malaria)

Climate conditions (e.g. monsoon, drought, natural catastrophes)

Epidemics, high mortality

Security issues, civil unrest

Population groups not covered (e.g. slums, refugees)

Summary of survey analysis

Data processing: Software …..

Data cleaning:

Imputations:

Data quality indicators and assessment

Flags:

Flags were calculated as follows:…

There were 63 (0.5%) flags for length- or height-for-age, 15 (0.1%) flags for weight-for-age, 126 (0.9%) flags for body mass index-for-age, 114 (0.8%) flags for weight-for-length or height.

Missing data and missing data by age group and type of residence

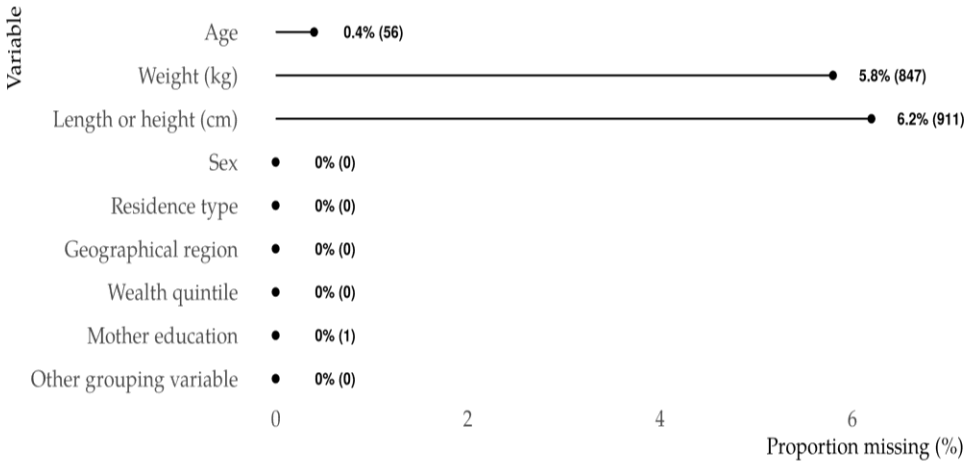


Figure 2: Missing data

Digit heaping charts (with mapping variable labels)

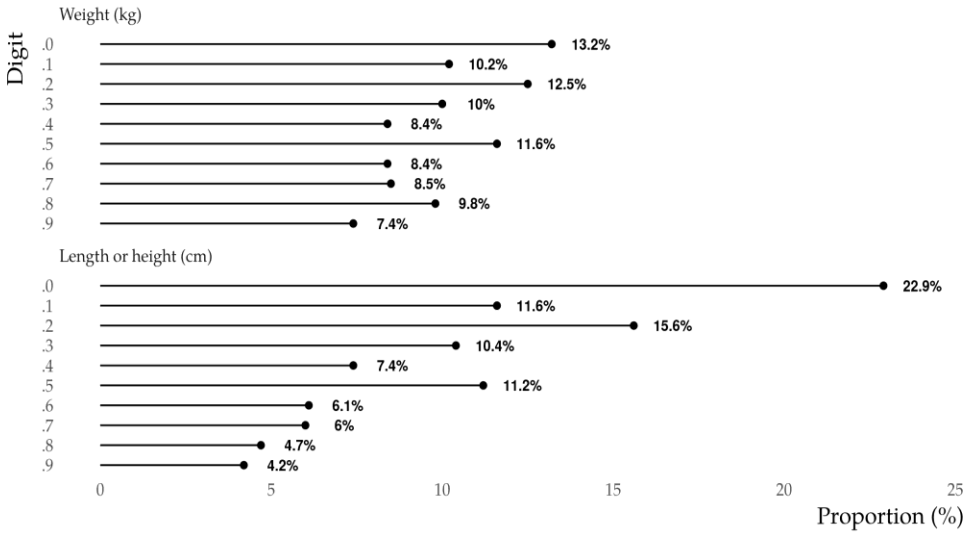


Figure 3: Digit preference for weight & height measurements

Distribution issues:

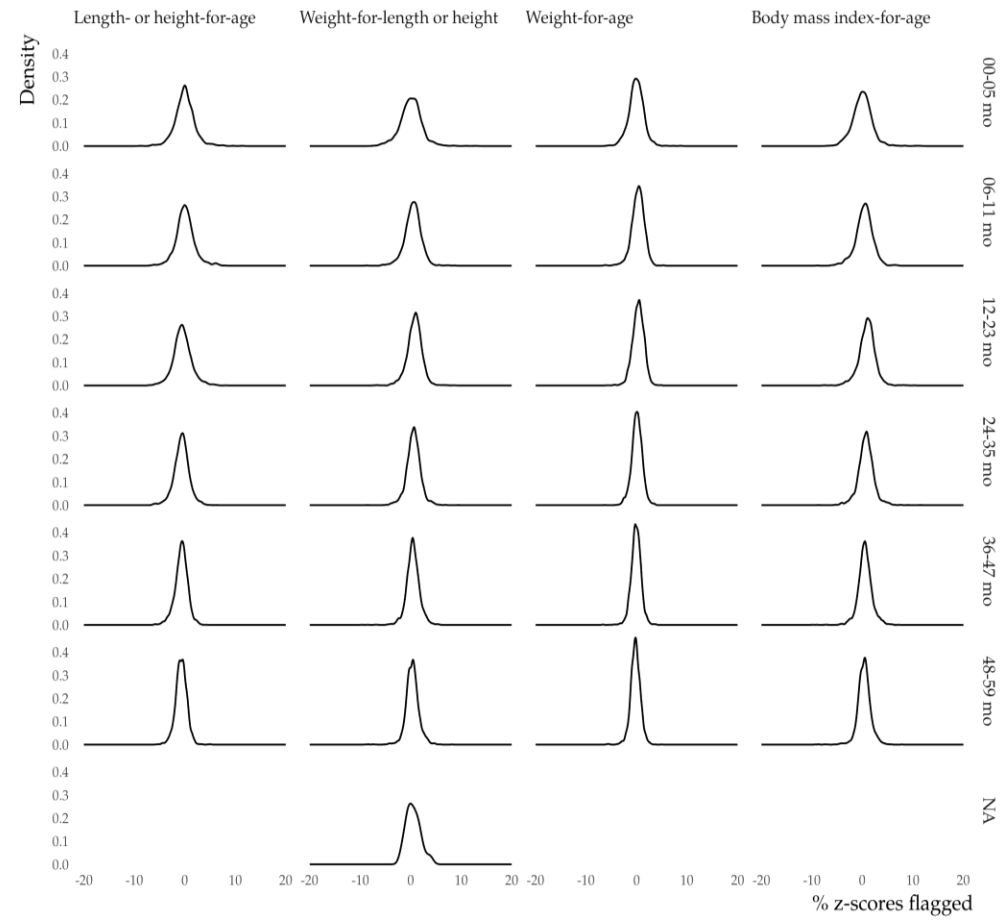


Figure 4: Z-score distributions by age group

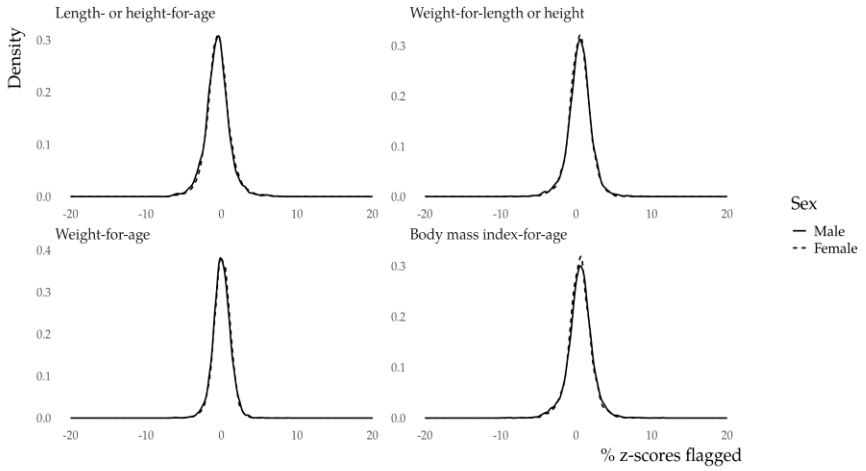


Figure 5: Z-score distributions by sex

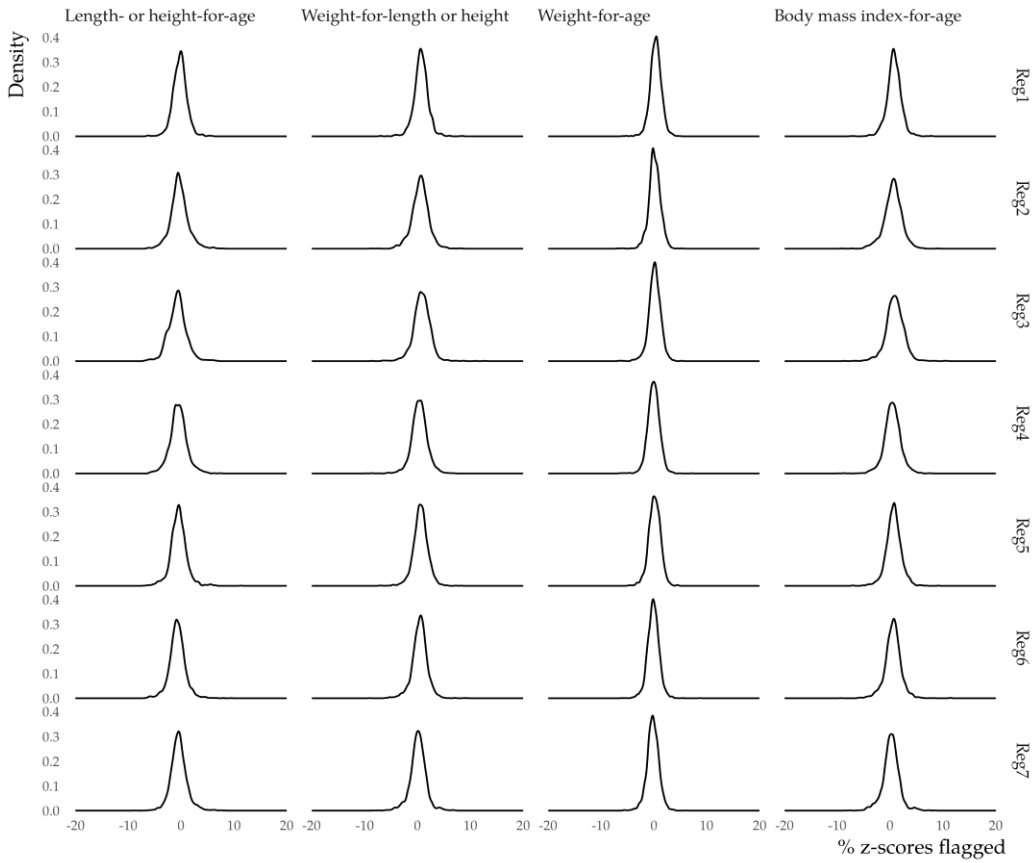


Figure 6: Z-score distributions by geographical region

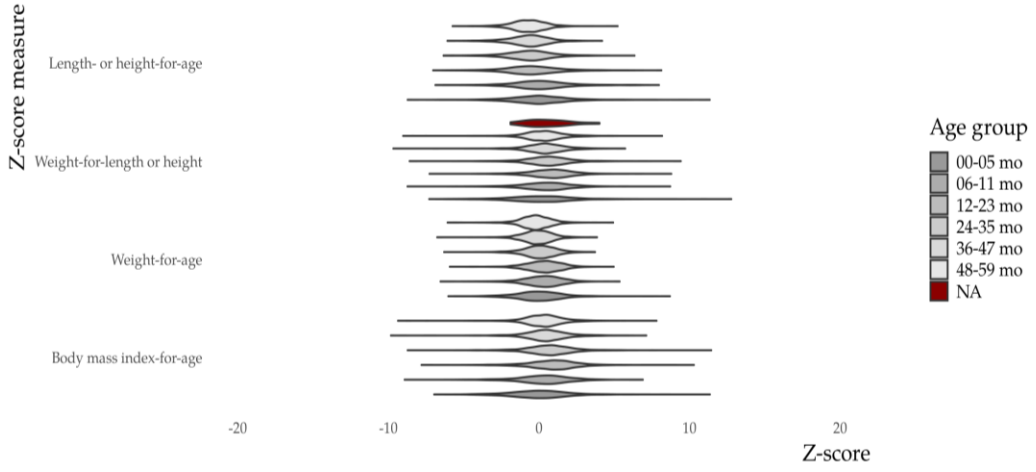


Figure 7: z-score distribution violin plot by age group

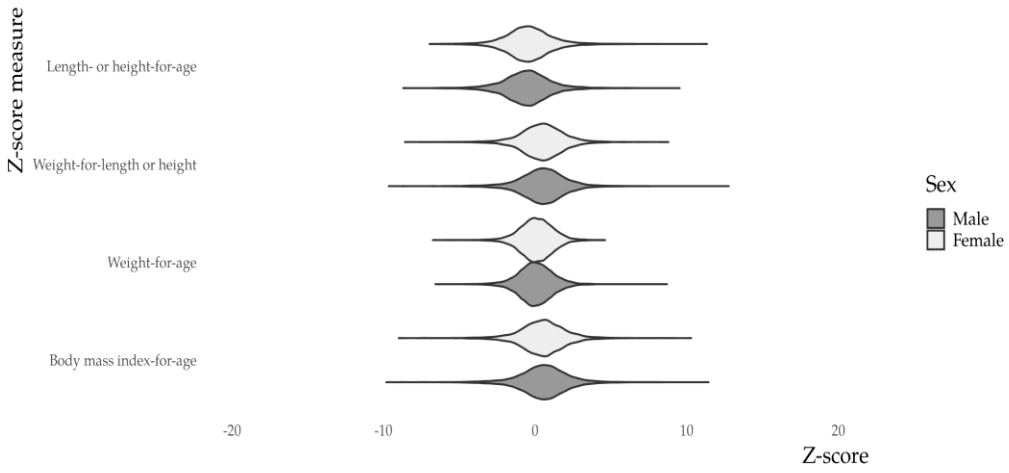


Figure 8: z-score distribution violin plot by sex

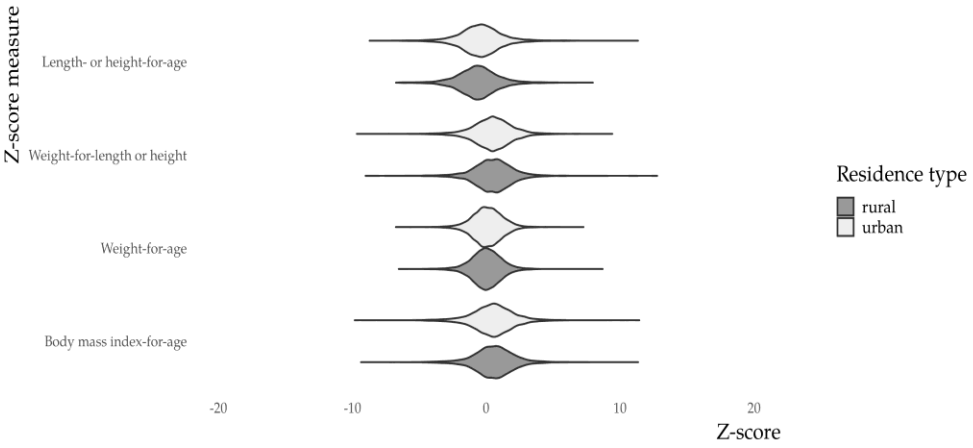


Figure 9: z-score distribution violin plot by residence type

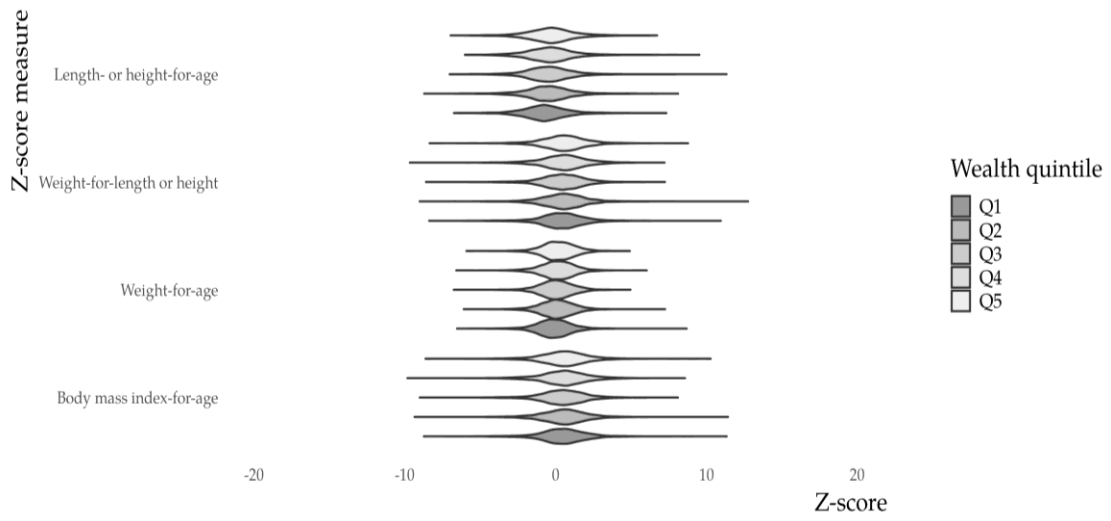


Figure 10: z-score distribution violin plots by wealth quintile

Appendix: Nutritional status tables

Height-for-age

Group	Weighted N	Unweighted N	-3SD (95% CI)	-2SD (95% CI)	z-score mean (95% CI)	z-score SD
All	13731.6	13685	4.0 (3.6; 4.6)	11.7 (10.8; 12.6)	-0.4 (-0.4; -0.4)	1.47
Age group: 00-05 mo	1552.2	1465	4.5 (3.3; 5.9)	10.1 (8.4; 12.0)	0.0 (-0.1; 0.1)	1.64
Age group: 06-11 mo	1531.5	1467	3.0 (2.1; 4.1)	8.2 (6.7; 10.0)	0.1 (0.0; 0.2)	1.60
Age group: 12-23 mo	2904.5	2680	5.3 (4.3; 6.4)	13.7 (12.1; 15.5)	-0.4 (-0.4; -0.3)	1.69
Age group: 24-35 mo	2724.3	2921	4.5 (3.7; 5.5)	13.6 (12.0; 15.4)	-0.5 (-0.6; -0.5)	1.42
Age group: 36-47 mo	2573.5	2636	4.0 (3.1; 5.2)	11.9 (10.1; 13.8)	-0.6 (-0.7; -0.5)	1.24
Age group: 48-59 mo	2445.7	2516	2.5 (1.8; 3.4)	10.1 (8.6; 11.9)	-0.7 (-0.7; -0.6)	1.11
Sex: Female	6715.4	6638	3.5 (2.9; 4.0)	10.7 (9.7; 11.8)	-0.4 (-0.4; -0.3)	1.46
Sex: Male	7016.2	7047	4.6 (4.0; 5.3)	12.6 (11.5; 13.8)	-0.5 (-0.5; -0.4)	1.48
Age + sex: 00-05 mo.Female	768.9	716	2.6 (1.6; 4.4)	6.9 (5.1; 9.1)	0.2 (0.0; 0.3)	1.62
Age + sex: 06-11 mo.Female	746.7	711	2.6 (1.5; 4.3)	7.8 (5.7; 10.5)	0.2 (0.0; 0.3)	1.57
Age + sex: 12-23 mo.Female	1409.6	1305	4.2 (3.0; 5.7)	11.5 (9.4; 13.9)	-0.3 (-0.4; -0.2)	1.66
Age + sex: 24-35 mo.Female	1333.2	1422	4.3 (3.2; 5.8)	13.4 (11.2; 15.8)	-0.5 (-0.6; -0.4)	1.39
Age + sex: 36-47 mo.Female	1261.0	1272	3.9 (2.8; 5.4)	11.9 (9.6; 14.6)	-0.6 (-0.7; -0.5)	1.24
Age + sex: 48-59 mo.Female	1195.9	1212	2.3 (1.4; 3.7)	10.0 (8.0; 12.3)	-0.6 (-0.7; -0.5)	1.11
Age + sex: 00-05 mo.Male	783.3	749	6.2 (4.4; 8.7)	13.2 (10.4; 16.6)	-0.2 (-0.4; -0.1)	1.64
Age + sex: 06-11 mo.Male	784.7	756	3.4 (2.2; 5.1)	8.6 (6.6; 11.1)	0.0 (-0.1; 0.2)	1.62
Age + sex: 12-23 mo.Male	1494.9	1375	6.3 (5.0; 8.0)	15.9 (13.6; 18.5)	-0.5 (-0.6; -0.3)	1.70
Age + sex: 24-35 mo.Male	1391.1	1499	4.7 (3.6; 6.2)	13.8 (11.7; 16.3)	-0.6 (-0.7; -0.5)	1.45
Age + sex: 36-47 mo.Male	1312.4	1364	4.2 (3.1; 5.8)	11.8 (9.6; 14.5)	-0.6 (-0.7; -0.5)	1.24
Age + sex: 48-59 mo.Male	1249.8	1304	2.7 (1.8; 4.1)	10.3 (8.4; 12.5)	-0.7 (-0.8; -0.6)	1.11
Area: rural	5262.5	4827	4.3 (3.5; 5.2)	12.3 (10.8; 14.1)	-0.5 (-0.6; -0.4)	1.44
Area: urban	8469.1	8858	3.9 (3.4; 4.6)	11.3 (10.2; 12.4)	-0.4 (-0.4; -0.3)	1.49
Geographical region: Reg1	4825.1	1746	2.0 (1.4; 2.9)	7.3 (5.8; 9.0)	-0.2 (-0.3; -0.1)	1.30
Geographical region: Reg2	1543.3	1404	5.3 (4.0; 7.0)	12.6 (10.5; 15.2)	-0.3 (-0.5; -0.2)	1.63
Geographical region: Reg3	1952.1	1685	7.0 (5.2; 9.4)	19.2 (15.7; 23.3)	-0.7 (-0.8; -0.5)	1.61
Geographical region: Reg4	1021.1	2194	5.3 (4.3; 6.4)	15.4 (13.3; 17.8)	-0.5 (-0.6; -0.4)	1.60
Geographical region: Reg5	1996.4	1912	4.1 (3.2; 5.3)	10.7 (9.1; 12.5)	-0.5 (-0.6; -0.4)	1.44
Geographical region: Reg6	801.4	2218	5.6 (4.5; 7.0)	15.6 (13.8; 17.6)	-0.7 (-0.8; -0.6)	1.49
Geographical region: Reg7	1592.2	2526	3.8 (2.9; 4.9)	11.8 (10.0; 13.9)	-0.4 (-0.5; -0.3)	1.49
Wealth quintile: Q1	2982.0	3223	3.9 (3.2; 4.9)	12.6 (11.0; 14.5)	-0.6 (-0.7; -0.5)	1.40
Wealth quintile: Q2	3021.7	2808	4.5 (3.6; 5.7)	12.1 (10.3; 14.2)	-0.4 (-0.5; -0.4)	1.49
Wealth quintile: Q3	2737.6	2851	4.1 (3.2; 5.1)	11.0 (9.5; 12.7)	-0.4 (-0.5; -0.3)	1.43
Wealth quintile: Q4	2634.4	2641	4.0 (3.1; 5.1)	11.7 (10.2; 13.4)	-0.3 (-0.4; -0.3)	1.49
Wealth quintile: Q5	2355.9	2162	3.6 (2.7; 4.9)	10.6 (8.6; 13.0)	-0.2 (-0.3; -0.1)	1.53
Maternal education: 1	2510.6	3077	4.9 (4.1; 6.0)	14.2 (12.4; 16.1)	-0.6 (-0.7; -0.5)	1.47
Maternal education: 2	2394.6	2410	4.3 (3.3; 5.7)	12.0 (10.2; 14.1)	-0.5 (-0.6; -0.5)	1.44
Maternal education: 3	8826.1	8197	3.7 (3.2; 4.3)	10.9 (9.9; 12.0)	-0.3 (-0.4; -0.3)	1.47
Other grouping: Bottom 40%	6003.6	6031	4.2 (3.6; 5.0)	12.4 (11.1; 13.8)	-0.5 (-0.6; -0.5)	1.45
Other grouping: Top 60%	7728.0	7654	3.9 (3.3; 4.6)	11.1 (10.0; 12.4)	-0.3 (-0.4; -0.3)	1.48

Weight-for-age

Group	Weighted N	Unweighted N	-3SD (95% CI)	-2SD (95% CI)	z-score mean (95% CI)	z-score SD
All	13855.2	13796	0.8 (0.7; 1.0)	3.1 (2.7; 3.5)	0.1 (0.1; 0.2)	1.12
Age group: 00-05 mo	1584.9	1496	2.5 (1.7; 3.7)	7.4 (5.9; 9.2)	0.0 (-0.1; 0.1)	1.37
Age group: 06-11 mo	1552.4	1489	1.0 (0.6; 1.7)	3.0 (2.2; 4.1)	0.4 (0.3; 0.5)	1.21
Age group: 12-23 mo	2932.4	2712	0.5 (0.3; 0.9)	1.7 (1.2; 2.4)	0.4 (0.4; 0.5)	1.12
Age group: 24-35 mo	2752.7	2944	0.4 (0.2; 0.9)	2.9 (2.2; 3.8)	0.2 (0.1; 0.2)	1.03
Age group: 36-47 mo	2585.7	2640	0.8 (0.4; 1.4)	2.5 (1.9; 3.3)	0.0 (-0.1; 0.0)	0.99
Age group: 48-59 mo	2447.0	2515	0.6 (0.3; 1.1)	3.0 (2.2; 4.0)	-0.1 (-0.2; -0.1)	0.98
Sex: Female	6762.6	6689	0.9 (0.6; 1.2)	3.1 (2.6; 3.7)	0.2 (0.1; 0.2)	1.11
Sex: Male	7092.6	7107	0.8 (0.6; 1.0)	3.1 (2.7; 3.7)	0.1 (0.1; 0.2)	1.13
Age + sex: 00-05 mo.Female	776.1	727	1.6 (0.9; 2.9)	5.3 (3.6; 7.7)	0.2 (0.0; 0.3)	1.33
Age + sex: 06-11 mo.Female	752.9	719	0.6 (0.2; 2.0)	2.2 (1.3; 3.6)	0.5 (0.4; 0.6)	1.12
Age + sex: 12-23 mo.Female	1424.9	1320	0.6 (0.3; 1.1)	1.5 (0.9; 2.4)	0.5 (0.4; 0.6)	1.07
Age + sex: 24-35 mo.Female	1346.8	1436	0.7 (0.3; 1.8)	3.3 (2.3; 4.8)	0.2 (0.1; 0.2)	1.03
Age + sex: 36-47 mo.Female	1263.8	1273	1.3 (0.6; 2.5)	3.3 (2.3; 4.9)	-0.1 (-0.2; 0.0)	1.00
Age + sex: 48-59 mo.Female	1198.1	1214	0.9 (0.4; 2.1)	3.5 (2.2; 5.3)	-0.2 (-0.3; -0.1)	1.02
Age + sex: 00-05 mo.Male	808.8	769	3.4 (2.1; 5.4)	9.3 (7.1; 12.1)	-0.1 (-0.3; 0.0)	1.39
Age + sex: 06-11 mo.Male	799.6	770	1.4 (0.8; 2.4)	3.8 (2.5; 5.5)	0.4 (0.3; 0.5)	1.28
Age + sex: 12-23 mo.Male	1507.5	1392	0.5 (0.2; 1.2)	1.8 (1.1; 3.0)	0.4 (0.3; 0.5)	1.16
Age + sex: 24-35 mo.Male	1405.9	1508	0.1 (0.0; 0.3)	2.5 (1.8; 3.5)	0.2 (0.1; 0.2)	1.03
Age + sex: 36-47 mo.Male	1322.0	1367	0.3 (0.1; 1.0)	1.7 (1.1; 2.5)	0.0 (0.0; 0.1)	0.97
Age + sex: 48-59 mo.Male	1248.9	1301	0.3 (0.1; 0.7)	2.5 (1.8; 3.5)	-0.1 (-0.1; 0.0)	0.94
Area: rural	5316.5	4864	1.0 (0.7; 1.5)	3.5 (2.8; 4.3)	0.1 (0.0; 0.2)	1.12
Area: urban	8538.7	8932	0.7 (0.5; 1.0)	2.9 (2.5; 3.3)	0.2 (0.1; 0.2)	1.12
Geographical region: Reg1	4853.4	1757	0.5 (0.3; 1.0)	1.8 (1.2; 2.6)	0.3 (0.3; 0.4)	1.09
Geographical region: Reg2	1562.2	1421	0.6 (0.2; 1.5)	2.9 (2.0; 4.3)	0.1 (0.1; 0.2)	1.10
Geographical region: Reg3	1990.6	1713	1.2 (0.7; 1.8)	3.8 (2.9; 5.1)	0.1 (0.0; 0.2)	1.11
Geographical region: Reg4	1027.6	2209	0.8 (0.5; 1.3)	3.7 (2.9; 4.7)	0.0 (-0.1; 0.0)	1.10
Geographical region: Reg5	2009.0	1922	1.1 (0.6; 1.9)	3.6 (2.5; 5.2)	0.1 (0.0; 0.2)	1.13
Geographical region: Reg6	805.9	2230	1.1 (0.7; 1.7)	3.9 (3.2; 4.9)	-0.1 (-0.2; 0.0)	1.09
Geographical region: Reg7	1606.5	2544	1.1 (0.7; 1.6)	4.9 (3.9; 6.2)	-0.1 (-0.2; -0.1)	1.14
Wealth quintile: Q1	3020.8	3249	1.3 (0.9; 2.0)	4.0 (3.2; 4.9)	0.0 (-0.1; 0.0)	1.12
Wealth quintile: Q2	3050.8	2835	0.8 (0.5; 1.3)	3.2 (2.5; 4.1)	0.1 (0.1; 0.2)	1.12
Wealth quintile: Q3	2753.7	2872	1.0 (0.6; 1.6)	3.0 (2.3; 3.9)	0.1 (0.1; 0.2)	1.12
Wealth quintile: Q4	2647.4	2654	0.4 (0.2; 0.7)	2.8 (2.1; 3.7)	0.2 (0.2; 0.3)	1.09
Wealth quintile: Q5	2382.3	2186	0.5 (0.3; 0.9)	2.3 (1.7; 3.2)	0.3 (0.2; 0.4)	1.13
Maternal education: 1	2530.8	3096	0.6 (0.4; 1.0)	3.7 (3.0; 4.5)	0.0 (-0.1; 0.0)	1.07
Maternal education: 2	2423.2	2430	1.4 (0.8; 2.2)	3.2 (2.4; 4.2)	0.1 (0.0; 0.2)	1.12
Maternal education: 3	8900.8	8269	0.8 (0.6; 1.0)	2.9 (2.5; 3.4)	0.2 (0.2; 0.3)	1.13
Other grouping: Bottom 40%	6071.7	6084	1.1 (0.8; 1.4)	3.6 (3.0; 4.2)	0.1 (0.0; 0.1)	1.12
Other grouping: Top 60%	7783.5	7712	0.7 (0.5; 0.9)	2.7 (2.3; 3.2)	0.2 (0.2; 0.3)	1.11

Weight-for-height

Group	Weighted N	Unweighted N	-3SD (95% CI)	-2SD (95% CI)	+2SD (95% CI)	+3SD (95% CI)	z-score mean (95% CI)	z-score SD
All	13670.5	13637	1.4 (1.2; 1.7)	4.2 (3.7; 4.7)	12.3 (11.5; 13.3)	3.3 (2.9; 3.8)	0.5 (0.5; 0.6)	1.38
Age group: 00-05 mo	1521.9	1435	5.2 (3.9; 6.8)	12.8 (10.6; 15.3)	12.2 (10.0; 14.8)	3.9 (2.9; 5.4)	0.1 (0.0; 0.2)	1.78
Age group: 06-11 mo	1535.1	1469	1.8 (1.2; 2.6)	4.9 (3.8; 6.3)	15.2 (12.9; 17.9)	4.0 (2.9; 5.4)	0.6 (0.5; 0.7)	1.46
Age group: 12-23 mo	2894.3	2670	0.9 (0.6; 1.4)	2.9 (2.2; 3.8)	17.7 (15.8; 19.9)	4.2 (3.2; 5.4)	0.8 (0.8; 0.9)	1.35
Age group: 24-35 mo	2713.1	2909	1.2 (0.8; 1.7)	3.1 (2.4; 3.9)	11.3 (9.8; 13.0)	2.7 (2.1; 3.6)	0.6 (0.5; 0.7)	1.29
Age group: 36-47 mo	2558.8	2620	0.6 (0.4; 1.1)	2.9 (2.2; 3.9)	8.9 (7.6; 10.5)	2.8 (2.1; 3.7)	0.5 (0.4; 0.6)	1.22
Age group: 48-59 mo	2427.6	2492	0.7 (0.4; 1.4)	2.3 (1.6; 3.4)	9.0 (7.5; 10.7)	2.7 (2.0; 3.6)	0.4 (0.4; 0.5)	1.22
Sex: Female	6692.6	6626	1.1 (0.8; 1.5)	3.9 (3.3; 4.6)	11.9 (10.8; 13.1)	3.1 (2.6; 3.6)	0.5 (0.5; 0.6)	1.34
Sex: Male	6977.9	7011	1.8 (1.4; 2.2)	4.4 (3.8; 5.1)	12.8 (11.6; 14.0)	3.6 (3.0; 4.2)	0.6 (0.5; 0.6)	1.41
Age + sex: 00-05 mo.Female	749.7	701	2.9 (1.8; 4.6)	10.9 (8.0; 14.5)	12.1 (9.3; 15.6)	4.3 (2.8; 6.7)	0.2 (0.0; 0.4)	1.66
Age + sex: 06-11 mo.Female	748.9	714	1.3 (0.6; 2.5)	4.7 (3.2; 6.8)	15.7 (12.2; 20.1)	3.4 (2.1; 5.5)	0.6 (0.5; 0.8)	1.40
Age + sex: 12-23 mo.Female	1410.2	1302	0.6 (0.3; 1.4)	2.4 (1.5; 3.6)	16.5 (14.0; 19.4)	3.9 (2.7; 5.6)	0.8 (0.7; 0.9)	1.31
Age + sex: 24-35 mo.Female	1331.2	1421	1.1 (0.6; 1.9)	2.8 (1.9; 4.1)	11.1 (9.2; 13.3)	2.7 (1.9; 3.8)	0.6 (0.5; 0.7)	1.28
Age + sex: 36-47 mo.Female	1253.9	1265	0.8 (0.4; 1.5)	3.3 (2.3; 4.8)	7.4 (5.7; 9.5)	2.0 (1.2; 3.4)	0.4 (0.3; 0.5)	1.20
Age + sex: 48-59 mo.Female	1185.2	1199	0.8 (0.3; 2.1)	2.6 (1.6; 4.4)	9.4 (7.3; 12.1)	2.5 (1.6; 3.9)	0.4 (0.3; 0.5)	1.24
Age + sex: 00-05 mo.Male	772.2	734	7.4 (5.2; 10.3)	14.6 (11.6; 18.3)	12.2 (9.1; 16.4)	3.6 (2.2; 5.6)	0.0 (-0.2; 0.2)	1.88
Age + sex: 06-11 mo.Male	786.2	755	2.3 (1.5; 3.5)	5.2 (3.7; 7.2)	14.8 (11.8; 18.2)	4.6 (3.0; 6.8)	0.5 (0.4; 0.7)	1.52
Age + sex: 12-23 mo.Male	1484.1	1368	1.1 (0.6; 1.9)	3.4 (2.4; 4.8)	18.9 (16.1; 22.1)	4.4 (3.1; 6.2)	0.9 (0.7; 1.0)	1.38
Age + sex: 24-35 mo.Male	1381.9	1488	1.3 (0.8; 2.0)	3.4 (2.5; 4.5)	11.5 (9.4; 14.1)	2.8 (1.9; 4.1)	0.6 (0.5; 0.7)	1.31
Age + sex: 36-47 mo.Male	1304.9	1355	0.4 (0.2; 1.1)	2.5 (1.6; 3.9)	10.4 (8.5; 12.7)	3.5 (2.5; 4.8)	0.5 (0.5; 0.6)	1.24
Age + sex: 48-59 mo.Male	1242.4	1293	0.7 (0.3; 1.4)	2.1 (1.3; 3.2)	8.5 (6.7; 10.8)	2.9 (1.9; 4.3)	0.5 (0.4; 0.6)	1.20
Area: rural	5240.5	4813	1.4 (1.0; 1.9)	4.4 (3.5; 5.4)	11.4 (9.9; 13.0)	3.2 (2.6; 3.9)	0.5 (0.4; 0.6)	1.35
Area: urban	8430.0	8824	1.5 (1.2; 1.8)	4.0 (3.5; 4.6)	12.9 (11.9; 14.1)	3.4 (2.9; 4.0)	0.6 (0.5; 0.6)	1.39
Geographical region: Reg1	4800.9	1737	0.8 (0.5; 1.3)	2.6 (1.9; 3.6)	12.3 (10.5; 14.4)	2.9 (2.1; 3.9)	0.7 (0.6; 0.7)	1.27
Geographical region: Reg2	1535.2	1396	2.2 (1.4; 3.6)	6.5 (5.0; 8.4)	13.4 (11.5; 15.6)	4.5 (3.5; 5.8)	0.5 (0.4; 0.6)	1.52
Geographical region: Reg3	1939.7	1671	1.6 (1.1; 2.4)	4.4 (3.4; 5.6)	17.5 (14.9; 20.6)	4.6 (3.6; 5.9)	0.7 (0.6; 0.8)	1.44
Geographical region: Reg4	1019.2	2194	1.7 (1.2; 2.6)	5.0 (3.9; 6.2)	11.1 (9.4; 13.0)	3.4 (2.6; 4.6)	0.4 (0.3; 0.5)	1.41
Geographical region: Reg5	1988.4	1902	1.1 (0.7; 1.9)	3.9 (2.6; 5.9)	12.3 (10.6; 14.3)	3.1 (2.3; 4.2)	0.6 (0.5; 0.7)	1.34
Geographical region: Reg6	799.5	2214	1.7 (1.3; 2.4)	4.7 (3.9; 5.7)	10.3 (8.8; 12.0)	3.1 (2.3; 4.1)	0.4 (0.4; 0.5)	1.36
Geographical region: Reg7	1587.5	2523	2.5 (1.8; 3.5)	5.9 (4.8; 7.3)	6.9 (5.6; 8.6)	2.4 (1.6; 3.5)	0.1 (0.0; 0.2)	1.41
Wealth quintile: Q1	2977.3	3234	1.9 (1.4; 2.6)	5.1 (4.0; 6.5)	11.4 (9.9; 13.2)	3.2 (2.5; 4.1)	0.5 (0.4; 0.5)	1.39
Wealth quintile: Q2	2999.2	2788	1.1 (0.7; 1.5)	3.4 (2.7; 4.2)	11.3 (9.7; 13.2)	2.8 (2.1; 3.7)	0.5 (0.5; 0.6)	1.34
Wealth quintile: Q3	2719.8	2832	1.6 (1.1; 2.3)	4.0 (3.2; 5.0)	11.5 (9.9; 13.3)	2.4 (1.8; 3.2)	0.5 (0.5; 0.6)	1.33
Wealth quintile: Q4	2624.2	2629	1.4 (1.0; 2.2)	4.5 (3.5; 5.8)	14.8 (12.9; 16.9)	4.5 (3.6; 5.7)	0.6 (0.5; 0.7)	1.44

Group	Weighted N	Unweighted N	-3SD (95% CI)	-2SD (95% CI)	+2SD (95% CI)	+3SD (95% CI)	z-score mean (95% CI)	z-score SD
Wealth quintile: Q5	2350.1	2154	1.1 (0.7; 1.7)	3.8 (2.9; 5.0)	13.1 (11.2; 15.2)	3.8 (2.9; 5.0)	0.6 (0.5; 0.7)	1.39
Maternal education: 1	2508.4	3087	1.5 (1.0; 2.1)	4.8 (3.8; 6.0)	11.3 (9.7; 13.1)	3.2 (2.5; 4.1)	0.4 (0.4; 0.5)	1.39
Maternal education: 2	2377.1	2391	1.3 (0.9; 2.0)	4.0 (3.1; 5.2)	12.3 (10.7; 14.1)	3.1 (2.3; 4.1)	0.6 (0.5; 0.6)	1.34
Maternal education: 3	8784.8	8158	1.5 (1.2; 1.8)	4.0 (3.5; 4.7)	12.7 (11.6; 13.8)	3.4 (2.9; 4.0)	0.6 (0.5; 0.6)	1.38
Other grouping: Bottom 40%	5976.5	6022	1.5 (1.2; 1.9)	4.2 (3.5; 5.0)	11.4 (10.2; 12.7)	3.0 (2.4; 3.6)	0.5 (0.4; 0.5)	1.36
Other grouping: Top 60%	7694.0	7615	1.4 (1.1; 1.8)	4.1 (3.6; 4.8)	13.1 (12.0; 14.3)	3.6 (3.1; 4.2)	0.6 (0.5; 0.6)	1.39