World Health Organization

WHO Micronutrient Survey Analyser

Quick Guide

December 2024

Caution note on data privacy

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

Disclaimer

The WHO Micronutrient Survey Analyser runs in its own protected environment and access is SSL encrypted, and uploaded data are 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 WHO opened an account, which is payable based on the number of hours used per month (fixed). As such, users should be mindful not to leave the application open without using. To avoid unnecessary time spent, the application is set to close after 15 minutes of idle time. After its closure, the user has to re-upload the file and re-map their variables for the analyses.

Link to the WHO Micronutrient Survey Analyser

https://worldhealthorg.shinyapps.io/micronutrients-analyser/

Acknowledgements

The WHO Micronutrient Survey Analyser's development was overseen and conceptualized by Monica C Flores-Urrutia from the WHO Monitoring and Surveillance (WHO MNF) Unit, Department of Nutrition and Food Safety under the supervision and leadership of Elaine Borghi, Unit Head (WHO MNF). Monica C Flores-Urrutia, Giovanna Gatica-Dominguez and Elaine Borghi (WHO MNF) worked on the design and content of the application. Dirk Shumacher developed the first prototype of the online application and Zev Ross (ZevRoss - Know Your Data) developed the final version, implemented data entry validation checks and user friendless enhancements.

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Contents

1. The WHO Micronutrient Survey Analyser

The Micronutrient Survey Analyser is an online tool developed by the Department of Nutrition and Food Safety (WHO), that allows the user to perform comprehensive analysis of micronutrient status survey data for all populations. The analyses are based on the WHO guidelines on assessing micronutrient status of individuals and populations[1]. The version V.01 of the tool provides results for four biomarker indicators: **haemoglobin, ferritin, urinary iodine concentration (UIC)** and **iron deficiency anaemia (IDA)**. In the future, the tool will include other micronutrient biomarkers.

This online tool is designed to build country capacity on data analysis and reporting on population-level micronutrient status. It aims to enhance good practices in collecting survey data, analysing and reporting results. **Users should read this *Quick Guide* before entering their data, as it contains guidance on data preparation for assuring accuracy of analysis.**

Who uses the Micronutrient Survey Analyser?

The Micronutrient Survey Analyser is a useful tool for individuals in institutions such as the Ministry of Health, National Statistics Offices, agencies or programs specialized in data collection, research centres, any other institution or key actors responsible for data analysis of micronutrient status indicators. It can particularly aid those who do not have access to standard statistical software to analyse surveys.

What are the key features of the Micronutrient Survey Analyser?

- **Standard analysis** according to the WHO recommended cutoffs to define micronutrient status of populations disaggregated by age, sex, pregnancy status, type of residence and sub-regions/districts available. It also provides calculations of confidence intervals and standard errors around the estimates in complex sample designs and methodology.[2] For each biomarker, weighted and unweighted sample sizes are provided. These analyses are presented in short and long formats.
- **Data quality assessment** takes into consideration input data distributions, adjusted data distributions, and percentage of missing and implausible data.
- In addition to the online **graphics** and **tables** that can be easily downloaded, the tool provides a **data quality report** and a **summary report** template already including main findings and key outputs for data quality assessment based on existing best practices for reporting.

[1] WHO guidelines can be found on the Vitamin and Mineral Nutrition Information System (VMNIS) webpage https://www.who.int/teams/nutrition-and-food-safety/databases/vitamin-and-mineral-nutrition-information-system

[2] R package Survey. Available at https://cran.r-project.org/web/packages/survey/survey.pdf By Thomas Lumley. 2015. (Accessed 08 July 2024).

What are the main outputs of the Micronutrient Survey Analyser?

- **Individual classification file:** Provides individual classifications of micronutrient status according to WHO recommended cutoffs to define micronutrient status of populations.
- **Short format prevalence file** according to the WHO recommended cutoffs standard analysis; includes prevalence estimates with corresponding standard errors and confidence intervals, and summary statistics (mean and standard deviation).
- **Long format prevalence file** using a wide range of cutoffs; includes prevalence estimates with corresponding standard errors and confidence intervals, and summary statistics (mean and standard deviation).
- **Data quality report** provides histograms and figures depicting data distribution and missing and implausible values.
- **Summary report** provides a summary of the data quality assessment and prevalence results.

All results for short and long format prevalence files are provided at overall and disaggregated levels for available stratification variables (age, sex, type of residence, geographical regions, wealth quintiles, mother education and one additional factor the user is interested in and for which data are available).

2. Steps to analyse surveys

This tool is based on R code plus the Shiny R package. As such, there are some basic rules that will allow its efficient use. Moreover, the analyses of surveys containing micronutrient data requires that many of the input variables are defined according to the specific formats or codes. The steps described in the following sections will also facilitate the use of the tool.

The tool allows analysis of micronutrient status for all populations. It is highly recommended to analyse the dataset by population group

A. Data file preparation

Attention: This application is based on R code. Any variable label can only contain characters, and numbers. 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

The user is strongly encouraged to perform the **data file preparation** prior to importing the data file into the Micronutrients Survey Analyser. To have the best accuracy in the output estimates, the user should know the compulsory variables and the accepted or recommended values/formats for each of the mapped variables.

The Micronutrients Survey Analyser includes validation checks for each variable mapped as input for the analysis. It provides user-friendly messages for some key variables (e.g., biomarker unit measurement, elevation) to guide the user to detect potential mismatches.

Table 1 provides guidance on accepted values for each of the mapped variables that serve as inputs to the analysis. It also distinguishes whether a variable is compulsory or optional for the biomarker analysis.

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

Table 1. Data preparation file

Mapping group	Variable	Compulsory or optional	Value / description	Accepted values	Unit	Notes
Age mapping	Date of birth	Compulsory	DD/MM/YYYY or MM/DD/YYYY			Both variables, date of birth and date of visit, should be provided to calculate age in days (date of visit minus date of birth). This is the recommended best practice approach, specially for children under five. If DAY is missing for the date of birth, a new variable should be created by imputing the missing day by 15 in the analysis file before importing the dataset (e.g. ??/05/2014 should be set as 15/05/2014). In turn, if month or year is missing, the date value should be set to missing/blank. When date of birth and date of missing are missing in the analysis dataset for any reason, the software allows for the analysis to be performed based on a variable that contains age (in days, months or years). However, this is not the best practice, if date of birth was used to calculate age should be retained in the dataset and used. If age is missing, that individual case will be excluded from the analysis and considered as 'missing'
	Date of measurement	Compulsory	DD/MM/YYYY or MM/DD/YYYY			
	Age in days or months	Compulsory if Date of birth and Date of measurement are not available				Age in days: calculated as date of visit minus date of birth (integer value). Age in months should be calculated as age in days divided by 30.4375 (float value). If age is missing, that individual case will be excluded from the analysis and considered as 'missing'
	Age in years	Compulsory if Date of birth, Date of measurement, and in months are not available				This is common for school age children, adolescents and adult populations. If age is missing, that individual case will be excluded from the analysis and considered as 'missing'
Sex mapping	Sex	Compulsory	Numeric or text	For Male (1/ "M"/ "m") and for Female (2/ "F"/ "f")		If dataset contains only one sex, this variable should still be provided, otherwise the tool will not allow to continue as this is a compulsory variable.

Mapping group	Variable	Compulsory or optional	Value / description	Accepted values	Unit	Notes
Pregnancy status mapping	Pregnancy status	Optional	Numeric or text	For Yes ("Y", “y”, or “1”), No (“N”, “n”, or “2”), Unknown ("unk" or "3" or blank)		When Unknown ("unk" or "3" or blank), it will be categorized as "not pregnant"
	Lactating status	Optional	Numeric or text	For Yes (“Y”, “y”, or “1”), No (“N”, “n”, or “2”)		
	Pregnancy weeks	Optional	Numeric			
	Pregnancy months	Optional	Numeric			
Biomarker specific	Haemoglobin	Compulsory (if haemoglobin indicator is selected)	Numeric, float value		g/L, g/dL	
	Ferritin	Compulsory (if ferritin biomarker is selected)	Numeric, float value		µg/L	
	Urinary iodine concentration	Compulsory (if urinary iodine concentration biomarker is selected)	Numeric, float value		µg/L	
Adjustments for haemoglobin	Elevation	Compulsory (if haemoglobin biomarker is selected)	Numeric, float value, also option none			Elevation is a compulsory variable and it should always be reported in the dataset. Even when no elevation data is collected, a variable for ‘elevation’ should be created and set as “0” for all individuals without reported elevation. When elevation is not reported, that individual case will be excluded from the analysis and considered as ‘missing’
	Smoking status	Optional (if haemoglobin is selected)	Numeric or text, also option none	For Yes (“Y”, “y”, or “1”), No (“N”, “n”, or “2”), Unknown ("unk" or "3")		When ‘smoking status’ is mapped and no value is reported, the tool will consider this value as “no smoking”
	Number of cigarettes per day	Optional (if haemoglobin is selected)	Numeric, float value, also option none			
	Malaria	Optional (if haemoglobin is selected)	Whether malaria test was positive	For Yes (“Y”, “y”, or “1”) and No (“N”, “n”, or “2”)		This variable does not influence in the estimation of micronutrient status prevalence and other measurements
Adjustments for inflammation	CRP	Optional (if ferritin is selected)	Numeric, float value,also option none		mg/L	
	AGP	Optional (if ferritin is selected)	Numeric, float value,also option none		g/L	

Mapping group	Variable	Compulsory or optional	Value / description	Accepted values	Unit	Notes
	Malaria	Optional (if haemoglobin is selected)	Whether malaria test was positive	For Yes ("Y", "y", or "1") and No ("N", "n", or "2")		
Contextual factors	Time of taking the sample	Optional	Time when the sample was taken	For all indicators: - Morning - Casual - Rainy season -Summer		This variable does not influence the estimation of most micronutrient status prevalence and other measurements, but it influences the cutoffs for defining deficiency status in some micronutrients, e.g. zinc
Survey design	Strata	Optional	Numeric			Each individual / household should be assigned to a strata and cluster; these design-related variables are considered by the analyses to boost the stability of estimated variance. If not provided, it will be assumed that all individuals belong to the same unique strata/cluster. All individuals with missing cluster data will be excluded from the analysis sample. Note: The calculation of prevalence estimates requires cluster labels to be nested within each stratum; i.e. cluster labels are unique for each stratum (usually sequentially). In instances of non-nested clusters, the tool will require the user to confirm that this was done on purpose and prevalence estimates will be calculated regardless.
	Cluster	Optional	Numeric			Each individual / household should be assigned to a strata and cluster; these design-related variables are considered by the analyses to boost the stability of estimated variance. If not provided, it will be assumed that all individuals belong to the same unique strata/cluster. All individuals with missing cluster data will be excluded from the analysis sample. Notes: The calculation of prevalence estimates requires cluster labels to be nested within each stratum; i.e. cluster labels are unique for each stratum (usually sequentially). In instances of non-nested clusters, the tool will require the user to confirm that this was done on purpose and prevalence estimates will be calculated regardless. Whenever provided, this variable is used for performing data quality assessment stratified to help interpretation.
	Team	Optional	Numeric			
	Sample weight	Optional	Numeric, float			A sampling weight must be assigned to everyone in the sample to compensate for unequal probabilities of case selection in a sample, usually owing to the design. All individuals not assigned a sampling weight should be excluded from analyses for generating micronutrient

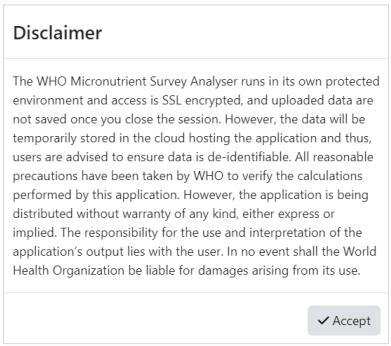
Mapping group	Variable	Compulsory or optional	Value / description	Accepted values	Unit	Notes
						estimates but remain in the data set for reporting purposes. If sampling weights are not provided, the sample will be assumed to be self-weighted, i.e. the sampling weight equals one (unweighted analyses will be carried out).
	Area or residence type	Optional	Numeric or text	Numeric integer or character. Recommended values: “Rural” or “Urban"		
Further attributes	Geographical region	Optional	Numeric or text			
	Other region	Optional	Numeric or text			
	Wealth quintile	Optional	Numeric or text	1, 2, 3, 4, 5; or Q1, Q2, Q3, Q4, Q5; whereby 1=poorest and 5=richest, in ascending order		
	Mother's education	Optional	Numeric or text	0,1,2,3,4 ; following standard recommended categories where by: 0=None, 1=Primary education, 2= Secondary education; 3= Higher education.		
	Other filter	Optional	Numeric or text	Any variable that is of interest (e.g. micronutrient interventions received, migration status) for obtaining results from stratified analysis		Binary variables (0/1 or Yes /No) are preferable to facilitate the selection of included records by the applied filter.

All numeric and float values are considered in the analysis. Missing value codes such as 99, 999, 998 etc. are considered actual values

B. Data setup

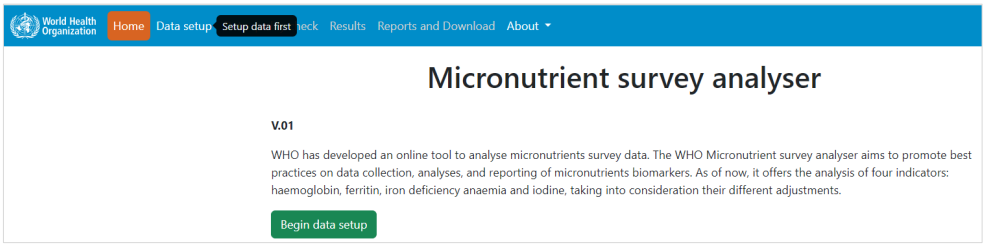
1. Enter the URL address of the Micronutrient Survey Analyser into the browser: https://worldhealthorg.shinyapps.io/micronutrients-analyser

2. Please read and 'Accept' the disclaimer message to continue.



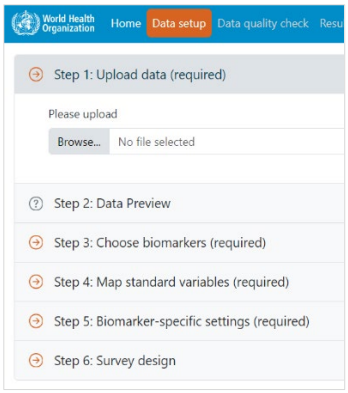
3. Click on the green '**Begin data setup**' button (**Figure 1**).

Figure 1. **Micronutrient survey analyser homepage with data setup prompt**



4. The '**Data setup'** module has 6 required steps which must be completed before proceeding (**Figure 2**).

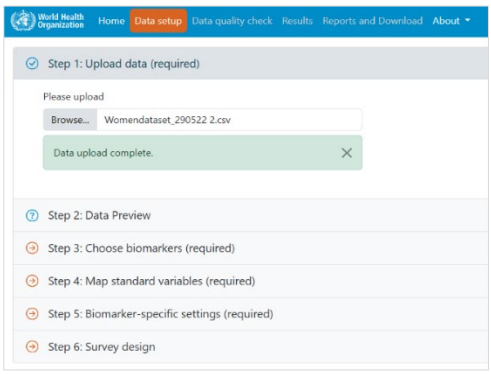
Figure 2. **The 6 steps for data setup**



Step 1: Upload data (required)

Click on the 'Browse' button and select the dataset file to upload. The file must be in Comma Delimited format (*.csv). The tool will give a prompt when the upload is complete (**Figure 3**).

Figure 3. CSV format data file upload



Step 2: Data preview

Open the drop-down arrow for [**Step 2: Data Preview**]. A table of all the variables in the dataset will be shown to allow users to check the uploaded dataset (**Figure 4**). Scroll to the right using the scroll bar to see more columns or click on the page number buttons beneath the table. Users can opt to see more rows per page by using the drop-down menu ("Show X entries" where 15 rows is the default). Each column can also be filtered.

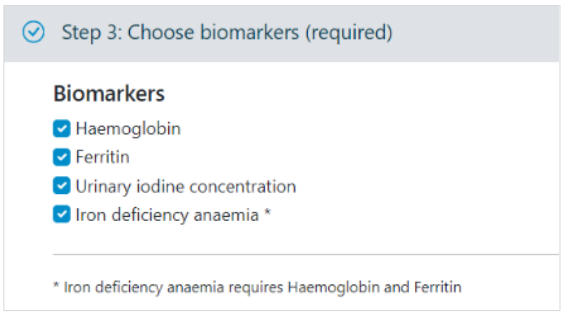
Figure 4. Data preview table

ID	STRATA	CLUSTER	SAMPLE_WEIGHT	TEAM	DOB	DOM	AGEYEARS	SEX	PREGNANCYSTATUS	PREGNANCYMONTHS	LACTATINGSTATUS	REGION	OTHER_REGION	RESIDENCE
	All	All	All	All	All	All	All	All	All	All	All	All	All	All
2344	3	109	1.988679857	3	15/11/1980	8/1/2013	32	2	2		2	1	1	
2343	3	109	1.988679857	3	15/98/1977	8/1/2013	36	2	2			1	1	
2336	3	109	1.988679857	3	15/03/1984	9/1/2013	28	2	2		1	1	1	
2345	3	109	1.988679857	3	15/11/1992	8/1/2013	20	2	2			1	1	
2342	3	109	1.988679857	3	15/11/1979	8/1/2013	33	2	2		2	1	1	
2339	3	109		3		9/1/2013		2				1	1	
2340	3	109	1.988679857	3	15/08/1986	9/1/2013	26	2	2		1	1	1	
2338	3	109	1.988679857	3	15/04/1979	9/1/2013	33	2	2		2	1	1	
2335	3	109	1.988679857	3	15/11/1989	9/1/2013	23	2	2		2	1	1	
2341	3	109		3		8/1/2013		2				1	1	
2334	3	109	1.988679857	3	15/05/1966	9/1/2013	46	2	2			1	1	
2337	3	109	1.988679857	3	15/03/1990	9/1/2013	22	2	2			1	1	
47	3	110	2.147951455	3	15/07/1992	28/12/2012	20	2	2		1	1	1	
48	3	110	2.147951455	3	15/03/1983	29/12/2012	29	2	2			1	1	
46	3	110	2.147951455	3	15/07/1977	29/12/2012	35	2	2			1	1	

Step 3: Choose biomarkers

Open the drop-down arrow for [**Step 3: Choose biomarkers (required)**]. Tick the biomarkers that are of interest for the analysis – **Haemoglobin**, **Ferritin**, **UIC**, and/or **IDA** (this indicator requires data for haemoglobin and ferritin). The tool allows analysis of multiple biomarkers at the same time (**Figure 5**).

Figure 5. **Selection of biomarkers for analysis**

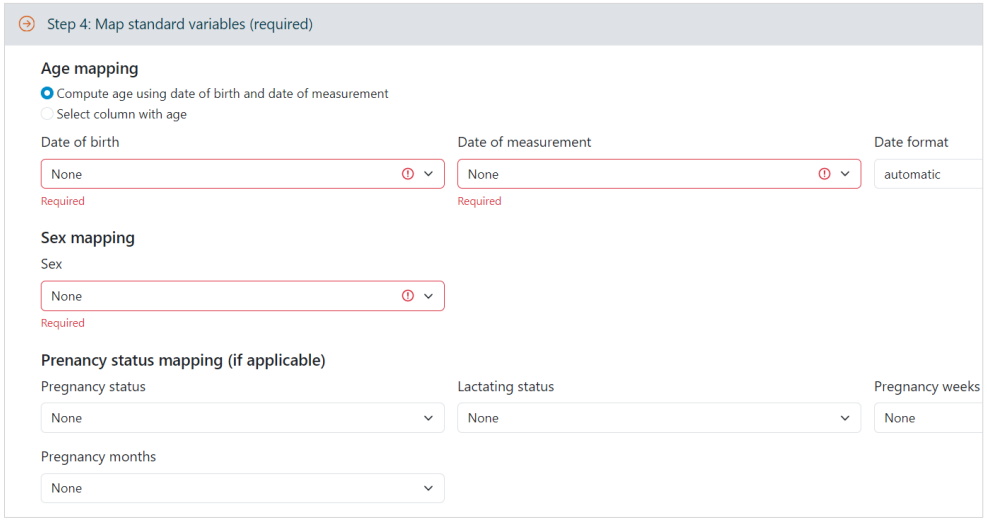


Step 4: Map standard variables

Open the drop-down arrow for [**Step 4: Map standard variables (required)**]. Select the input variables to map for *Age*, *Sex*, and *Pregnancy status* (**Figure 6**). Please refer to **Table 1** for accepted values.

As part of data validation tests, only required formats will be allowed for selection, e.g. if the required format for a variable is numeric, the user will not be allowed to select any variable that contains a character or text for that field

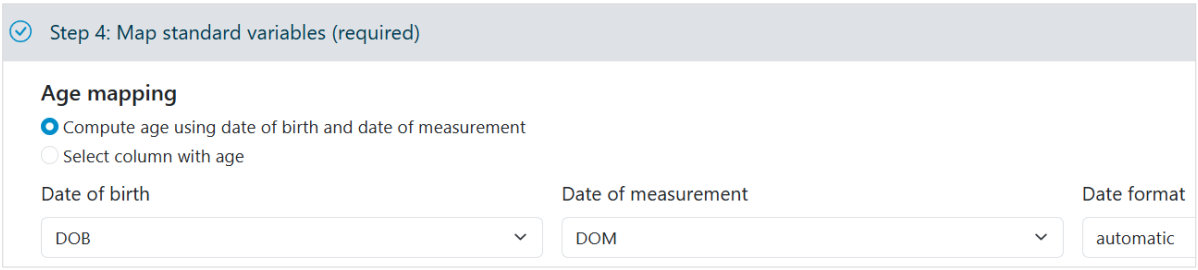
Figure 6. **Mapping variables for Age, Sex, and Pregnancy status**



Age mapping

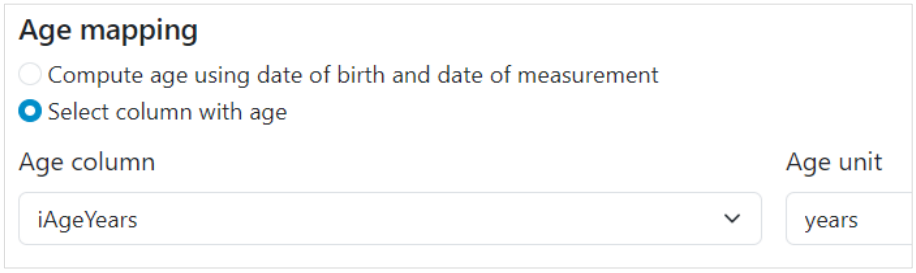
Age calculation based on Date of birth and Date of measurement variables is the default and recommended approach. If the radio button ***Compute age using date of birth and date of measurement*** is selected, choose the variables from the drop-down menu – Date of birth (DOB), Date of measurement (DOM), and Date format (**Figure 7**). Users may select the date format to be either DD-MM-YYYY or MM-DD-YYYY (DD-MM-YYYY by default).

Figure 7. **Age mapping using date of birth and date of measurement**



If for any reason the variables Date of birth and Date of measurement are not available, the user must choose the radio button ***Select column with age*** (**Figure 8**). Choose the variable from the drop-down menu for Age column and Age unit.

Figure 8. **Age mapping using column with age**

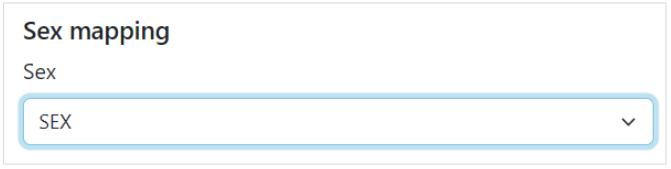


Note: If age is provided in months, its values should contain decimals for accurate calculation of the age. Age in days is preferable to age in months. Age in years can also be provided.

Sex mapping

Choose the variable from the drop-down menu for sex (**Figure 9**).

Figure 9. **Sex mapping**

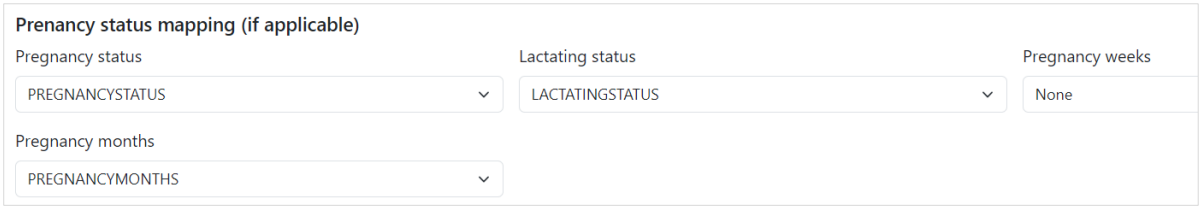


Pregnancy status mapping (if applicable)

Choose the appropriate variable from the drop-down menu for Pregnancy status, Lactating status, Pregnancy weeks, and Pregnancy months, if available (**Figure 10**).

Note: When pregnancy status is unknown ("unk" or "3" or blank), it will be categorized as 'not pregnant'

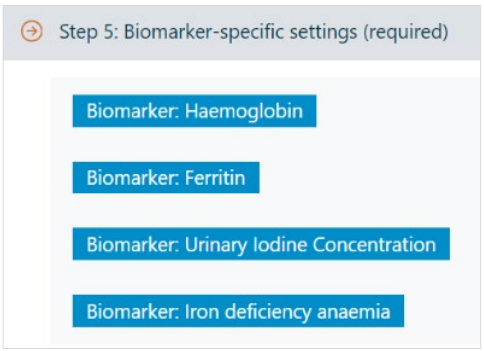
Figure 10. Pregnancy status mapping



Step 5: Biomarker-specific settings

Open the drop-down arrow for [**Step 5: Biomarker-specific settings (required)**]. The biomarkers selected in Step 3 will be shown here for further inputs. Click on the biomarker label to fill each one out (**Figure 11**).

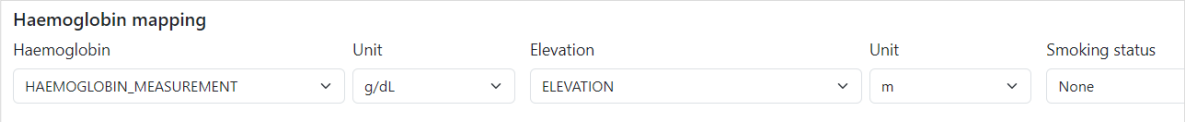
Figure 11. Variable input section for selected biomarkers



Biomarker: Haemoglobin

Haemoglobin mapping requires input of measurement, elevation and/or smoking status (**Figure 12**). Please refer to **Table 1** for descriptions of variables and accepted values. The tool follows the cutoffs recommended by WHO guidelines[3]. Please refer to Section 3 in this Quick Guide for biomarker cutoffs and adjustments for inflammation.

Figure 12. Variables for Haemoglobin



The user has the option to analyse haemoglobin concentrations by using the units g/dL and g/L. A warning message may appear if the percentage of missing and implausible values are higher than 70% (**Figure 13**). If smoking status is mapped and there are missing values, the tool will also prompt the user with a message to check the data (**Figure 14**).

Figure 13. Message alert to check the data or input variable

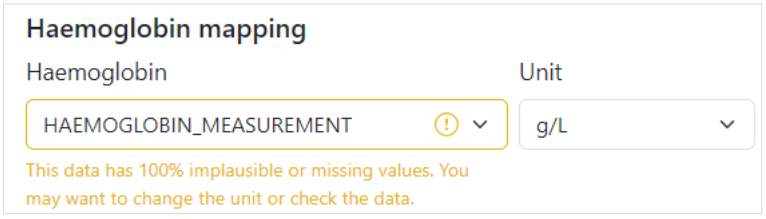
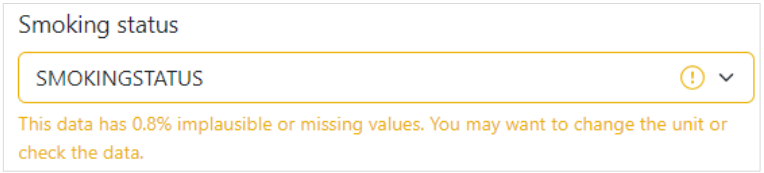


Figure 14. Message alert to check the data for smoking status

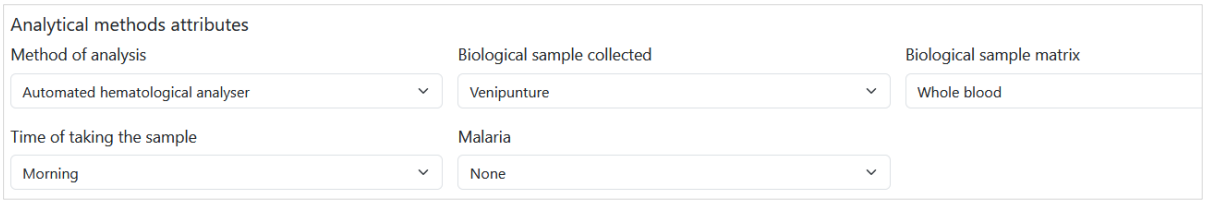


- ***It is necessary to specify the unit of measurement for haemoglobin. The tool converts the value to g/dL or g/L.***
- ***Elevation is a compulsory variable. The tool will consider as 'missing' the individuals that do not have elevation specified.***
- ***Adjustment for smoking should be done when smoking status is known. In the tool, smoking status is an optional variable***

[3] Guideline on haemoglobin cutoffs to define anaemia in individuals and populations. Geneva: World Health Organization; 2024. Licence: CC BY-NC-SA 3.0 IGO. https://www.who.int/publications/i/item/9789240088542

The **analytical methods attributes** are standard mapping selections that convey information on the methods used for the assessment of biomarkers and contextual factors that are relevant for the survey (**Figure 15**). Currently, these attributes do not influence the calculations for prevalence but will appear on the Summary report.

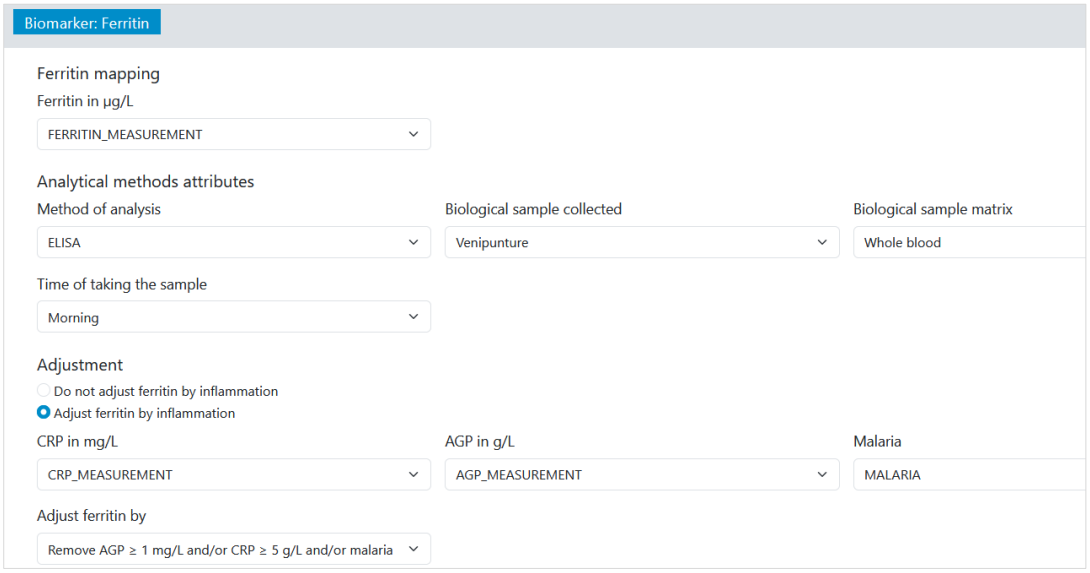
Figure 15. Input variables for analytical methods and contextual factors



Biomarker: Ferritin

Figure 16 shows the input variable for Ferritin. Please refer to **Table 1** for descriptions of variables and accepted values. The tool allows the user to select any of the four inflammation adjustments as recommended by WHO. Please refer to Section 3 in this Quick Guide for biomarker cutoffs and adjustments for inflammation.

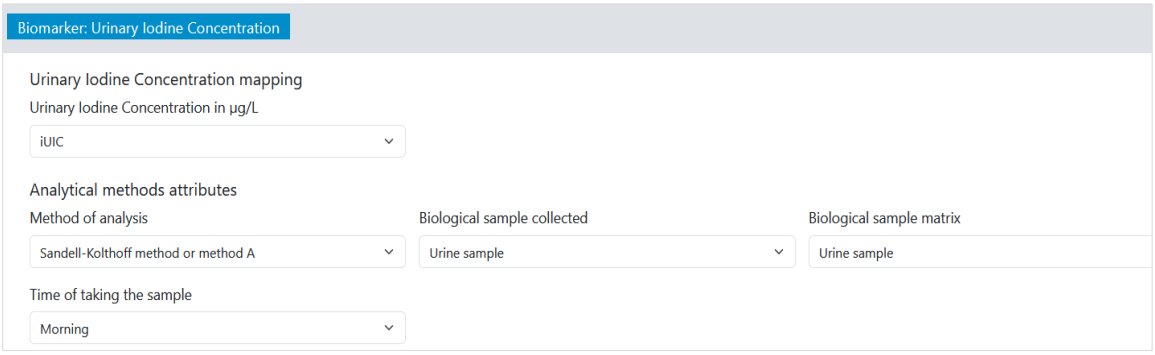
Figure 16. Input variables for Ferritin



Biomarker: UIC

Figure 17 shows the input variable for Urinary Iodine Concentration (UIC). Please refer to **Table 1** for descriptions of variables and accepted values.

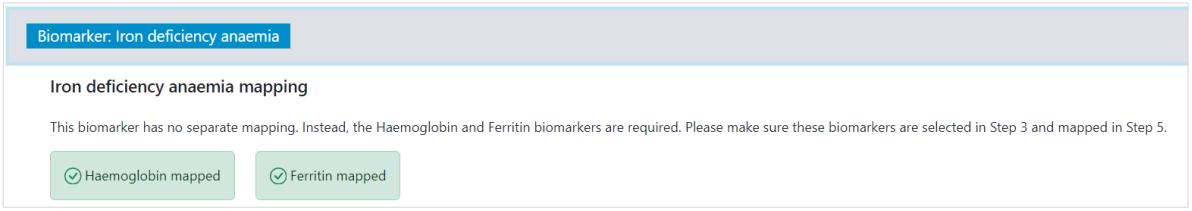
Figure 17. Input variables for UIC



Biomarker: IDA

As IDA is a composite indicator of hemoglobin and ferritin values, mapping the latter two variables is needed for analysis (**Figure 18**).

Figure 18. Mapping IDA using inputs variables for Haemoglobin and Ferritin



Step 6: Survey design

The purpose of stratification in survey design is to ensure that the sample is representative of the population of interest and divides the population into homogeneous groups (typically geographic groups) before sampling. Stratification in the sampling design helps to reduce sampling errors when introduced at the initial stage of sampling (its effect on the sampling error is minor when introduced at the second or later stages).

Strata and Cluster

- **Strata** should not be confused with survey domains, i.e., a population subgroup for which separate survey estimates are desirable (e.g., urban/rural areas). Both categories may be the same but do not need to be.
- A **cluster** is a group of neighbouring households that usually serves as the Primary Sampling Unit (PSU) for efficient field work. Each child/household should be assigned to a cluster and strata, and analyses should consider that information to boost the stability of the estimated variance.

- **Team** is a valuable stratifier (if available) as most of the data quality assessment checks are done by survey teams assigned to collect data in specific geographical regions

Sampling weights

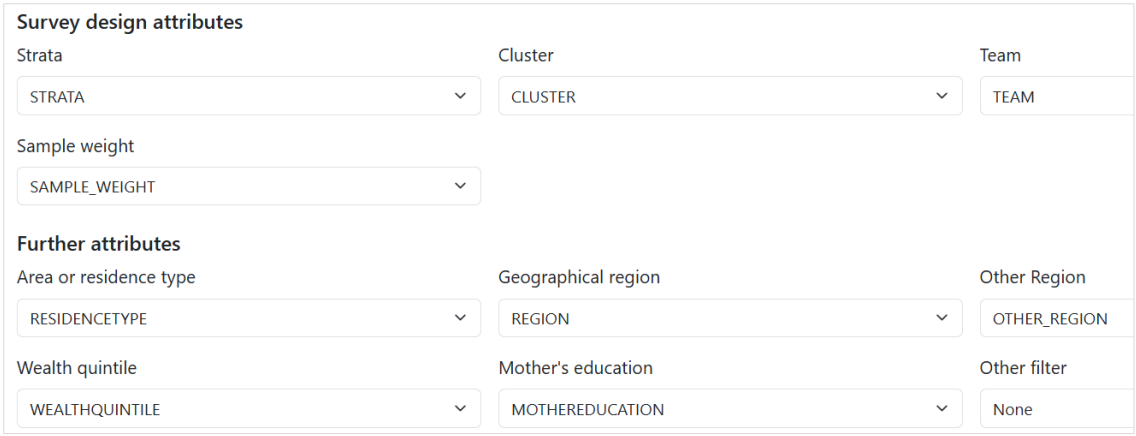
- A sampling statistician should create the weights.
- A sampling weight must be assigned to everyone in the sample to compensate for unequal probabilities of case selection in a sample, usually owing to the design. In a self-weighted sample, the weight is the same for each child (usually equals to 1 for simplicity).
- To derive micronutrient indicator estimates, appropriate sampling weights should be applied in each survey while taking into consideration sample stratification. This is done to make sure that the sample population is fully representative.
- Sampling weights can also be adjusted for non-responses.

Stratified analysis for population sub-groups (when available)

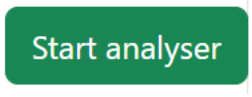
- The most common population disaggregation factors are age (different age groups), sex (male or female), type of residence (urban or rural) and regions or districts. For age grouping, standard analysis relies on the exact age in days (where available) to define age groups in months or years. One month is equivalent to 30.4375 days.
- Monitoring equity is of increasing importance for health and development. Disaggregated analysis is also recommended to derive estimates by wealth quintiles (1=lowest, 2, 3, 4, 5=highest) and mother's education (no education, primary school and secondary school or higher), whenever this is possible.

Open the drop-down arrow for [**Step 6: Survey design]** and select the survey design attributes (**Figure 19**).

Figure 19. Survey design attributes



The tool allows users to analyse other existing attributes in the datasets by using 'Other filter' and selecting the relevant input variable (e.g., receipt micronutrient supplementation). Once all required variables have been inputted, click on the green Start analyser button:



In the modules that follow, all figures can be downloaded for further analysis.

C. Data quality check

Missing data

- Missing value codes such as 99, 999, 998 etc. are considered actual values. Missing values should be treated as “blank”
- Any recoding of missing values or imputation should be made by creating a new variable. The original variables should always be retained since their presence in the file guarantees data reproducibility and transparency.
- It is important that all records, including those with missing values in all measurements or sampling weights, are available for analysis, since they are important for data quality assessment (e.g., non-response).
- Imputation of missing day of birth: if only the month and year of birth are provided, it is recommended that the missing information for the day of birth be imputed. This can be done in different ways, but the use of day 15 for all missing days of birth is recommended in the standard analysis. The approach used for imputing the date of birth and the number or proportion of cases falling on the imputed day should be mentioned in the report for data quality assessment.
- If the month or year of birth is missing, then the date of birth and, consequently the age should be considered as missing.
- If age is missing, that individual case will be excluded from the analysis and considered as ‘missing’

The tool will give a warning message when there are missing and/or implausible values for the following variables: biomarker concentration, elevation, and smoking status

The following figures provide visualization examples for missing data (**Figures 20-26**).

Figure 20. **Percentage (number of cases) of individuals missing information on selected biomarkers and inflammation factors used in the analysis**

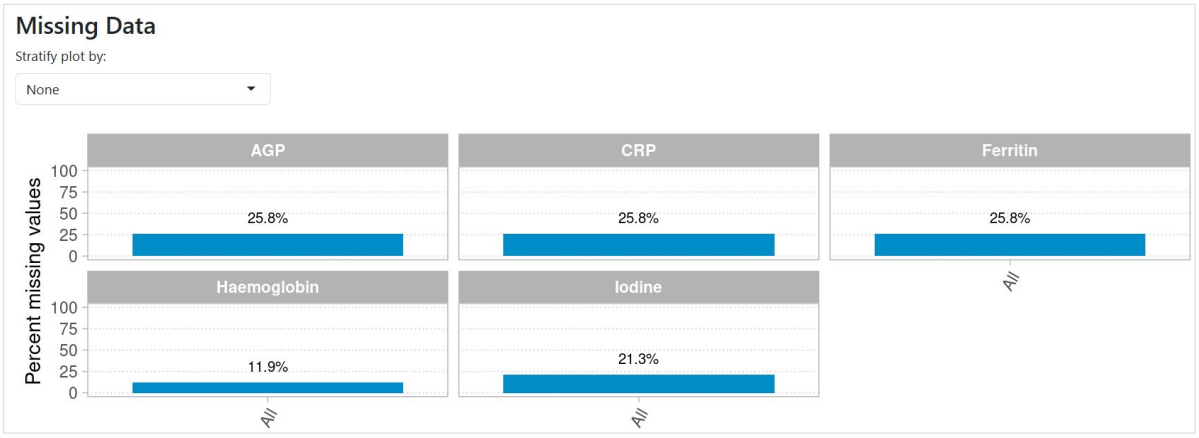


Figure 21. **Percentage (number of cases) of individuals missing information on selected biomarkers and inflammation factors used in the analysis, stratified by age**

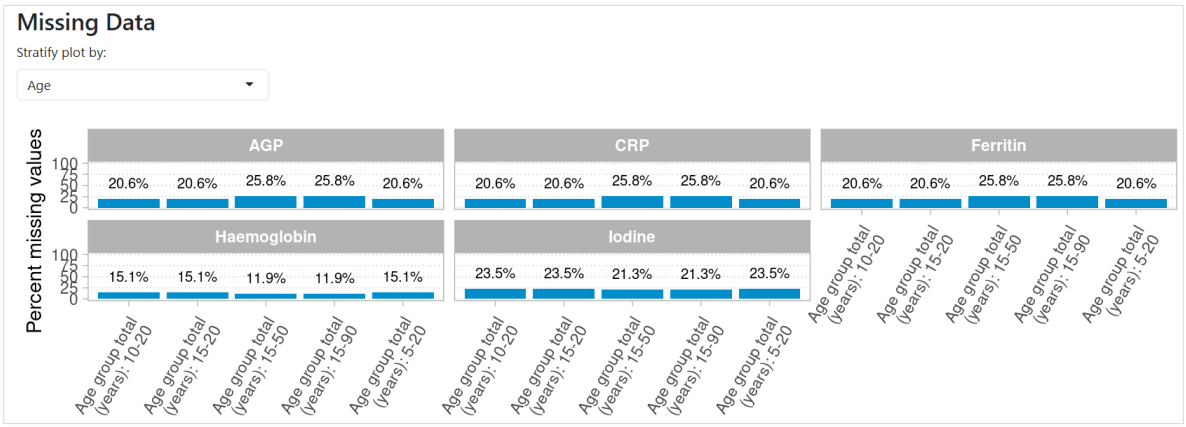


Figure 22. **Percentage (number of cases) of individuals missing information on selected biomarkers and inflammation factors used in the analysis, stratified by sex**

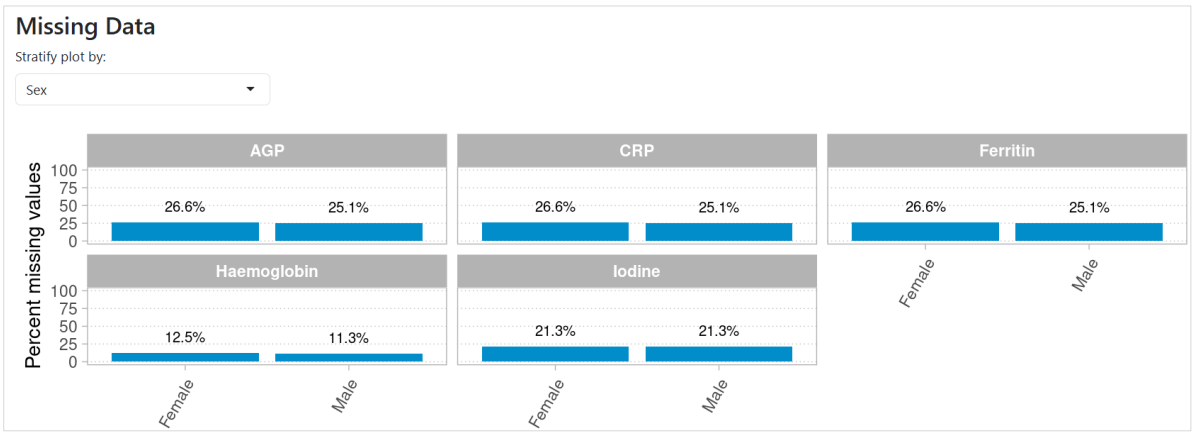


Figure 23. **Percentage (number of cases) of individuals missing information on selected biomarkers and inflammation factors used in the analysis, stratified by area**

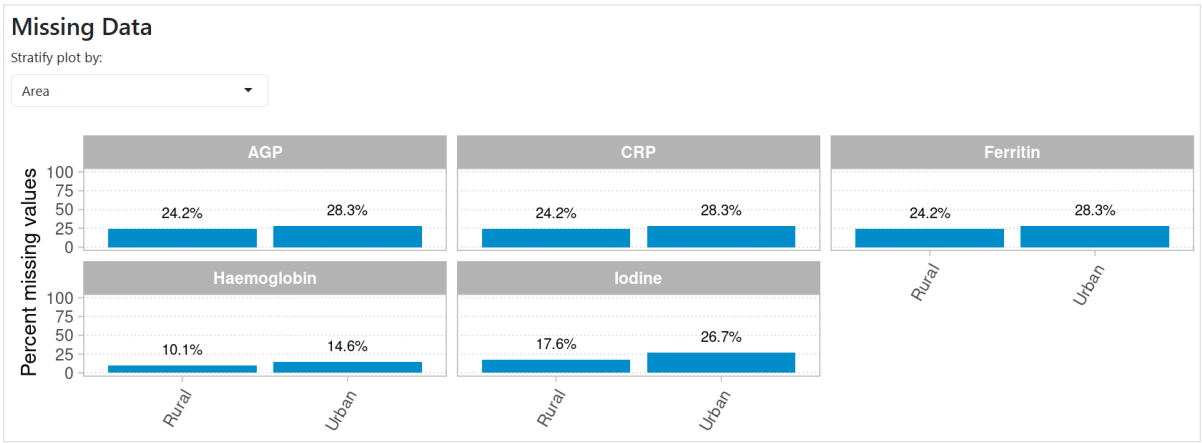


Figure 24. **Percentage (number of cases) of individuals missing information on selected biomarkers and inflammation factors used in the analysis, stratified by region**

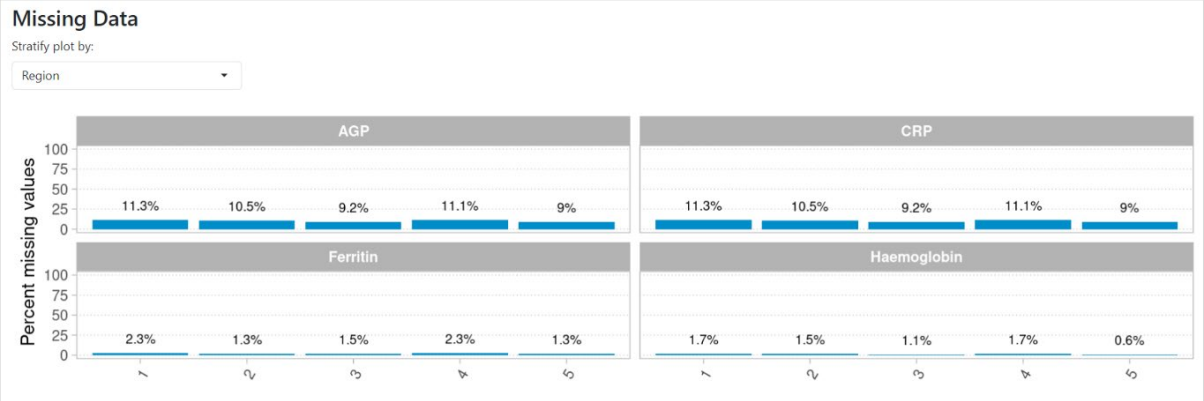


Figure 25. **Percentage (number of cases) of individuals missing information on selected biomarkers and inflammation factors used in the analysis, stratified by Other region**

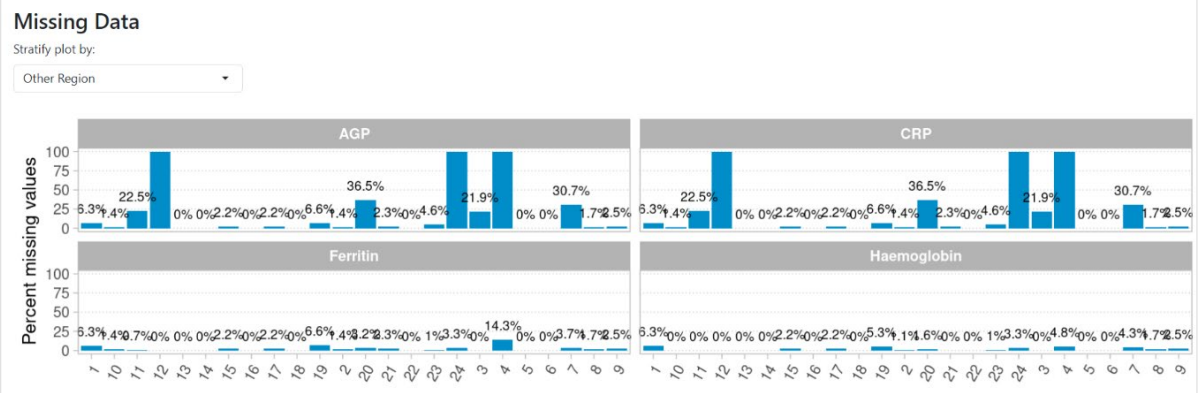
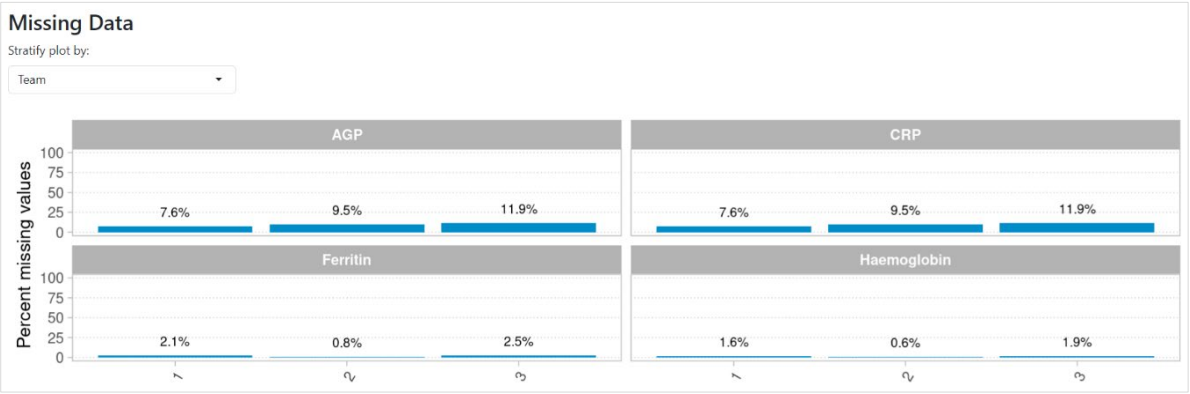


Figure 26. **Percentage (number of cases) of individuals missing information on selected biomarkers and inflammation factors used in the analysis, stratified by team**



Input data distributions

Input data distributions consider inputted data without adjustments or removal of implausible values (see Implausible values section). This feature is helpful for users to see the raw distribution of the data and to flag outliers. These variables can also be further stratified by other relevant variables (e.g., sex, age, region) (**Figures 27-28**).

To enhance the visualization of the distribution of inputted and adjusted data, the tool allows the user to select a minimum value and a maximum value for the x-axis to observe a wider or narrower distribution. In addition, due to abnormal distributions of most micronutrient biomarkers status data, the tool allows the selection of 'Number of bars' to closely observe the data frequency.

Figure 27. Age distribution without stratification

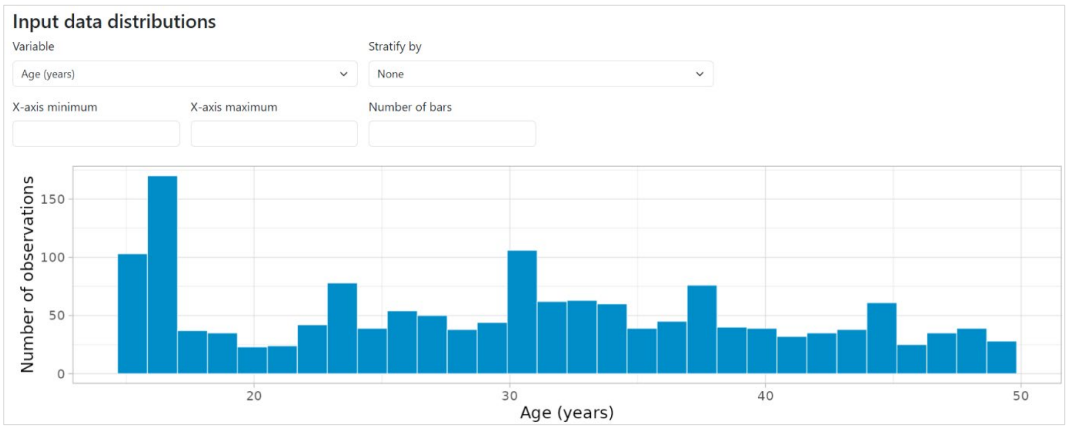
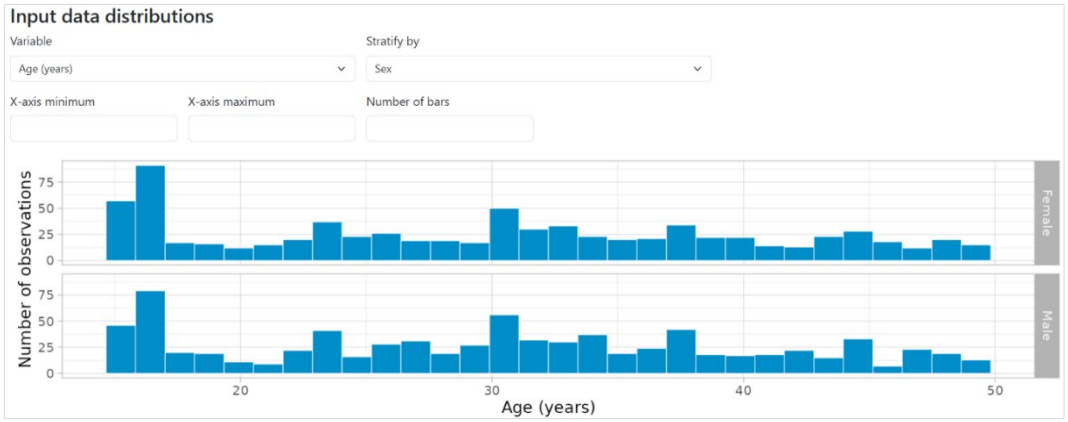


Figure 28. Age distribution stratified by sex



Haemoglobin

In this example for haemoglobin, the 'Number of bars' for the histogram (100 bars) helps users to visualize the data frequency including implausible values (**Figure 29-31**). Users can adjust the number of bars as necessary using the arrows in the box.

Figure 29. **Haemoglobin distribution without stratification**

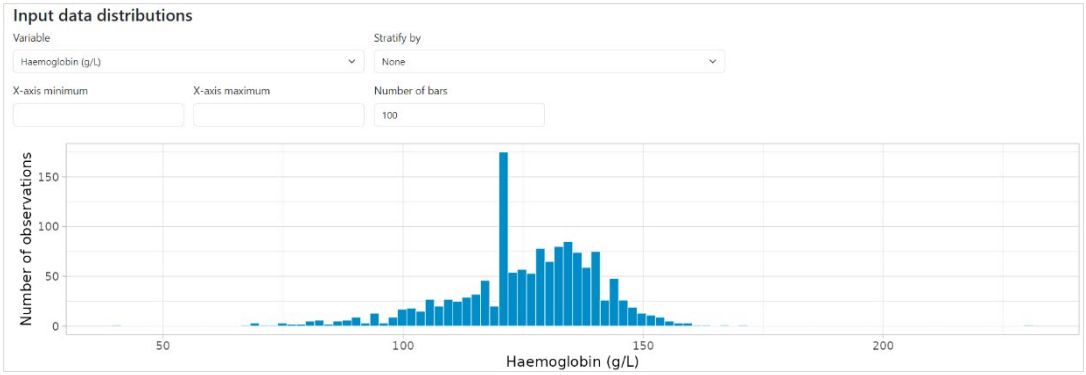


Figure 30. **Haemoglobin distribution stratified by sex**

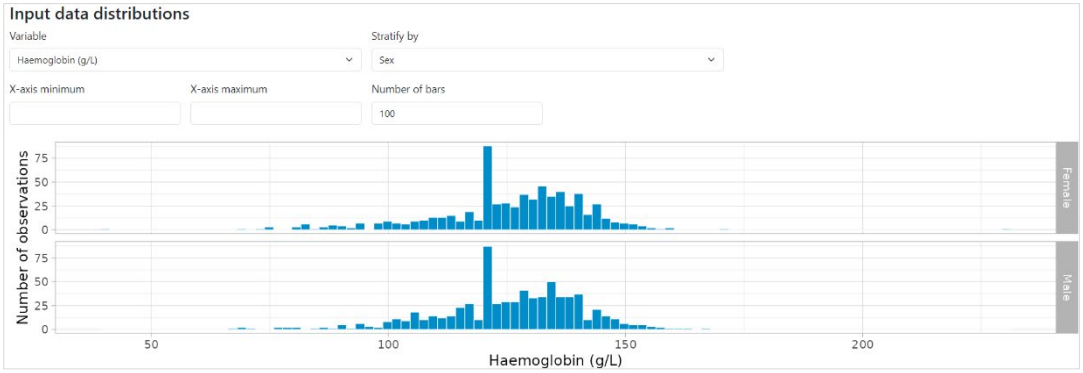
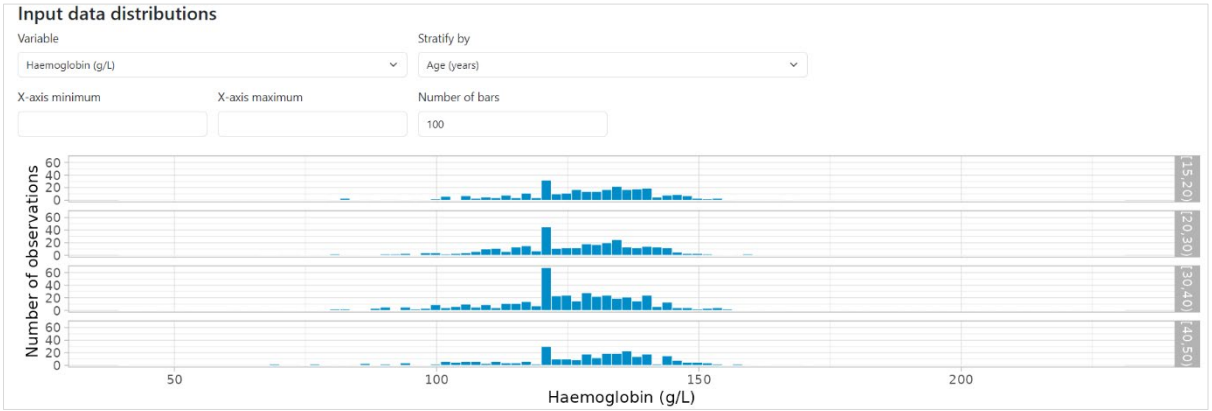


Figure 31. **Haemoglobin distribution stratified by age in years**



Ferritin

The dataset below for ferritin is a clear example where inputting the 'x-axis minimum / maximum' and 'Number of bars' features will help users to better observe the data frequency (for instance, skewness and kurtosis). In this example, the x-axis minimum value is 0 and the maximum value is 500, and the number of bars to depict the histogram is 300 (**Figure 32-34**).

Figure 32. Ferritin distribution without stratification

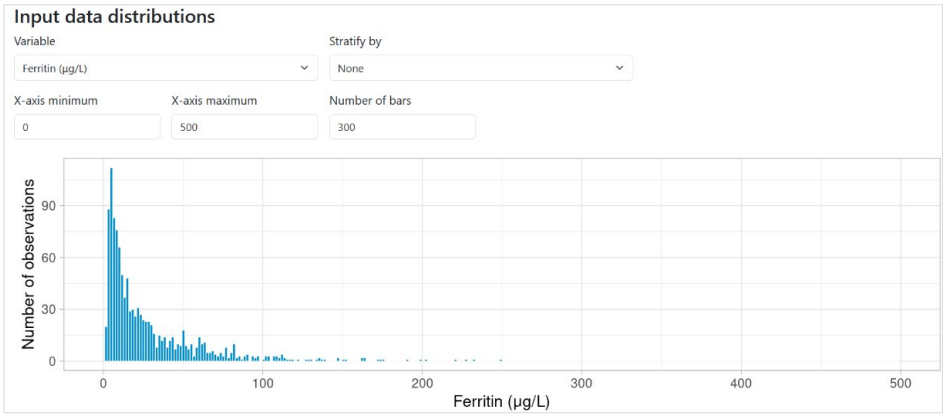


Figure 33. Ferritin distribution stratified by sex

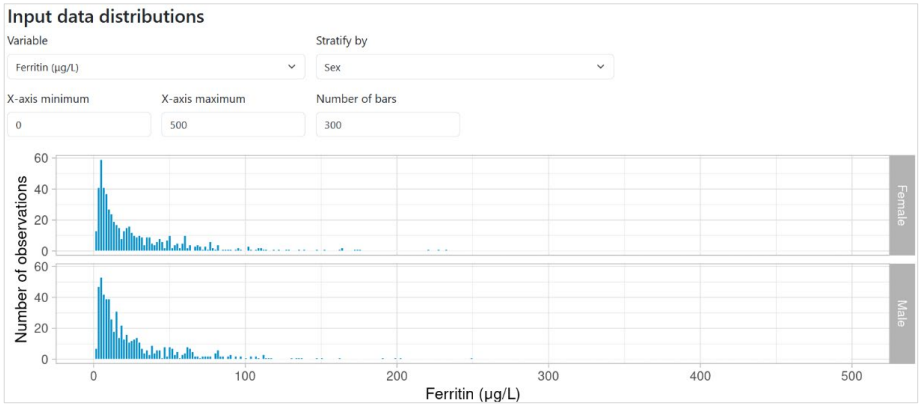
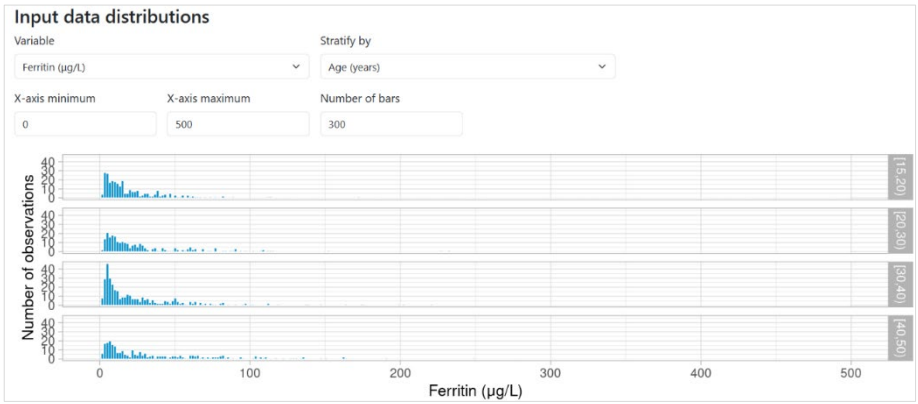


Figure 34. Ferritin distribution stratified by age



UIC

In this example for UIC, the 'Number of bars' also helps users to visualize the data frequency (**Figure 35-37**).

Figure 35. UIC distribution without stratification

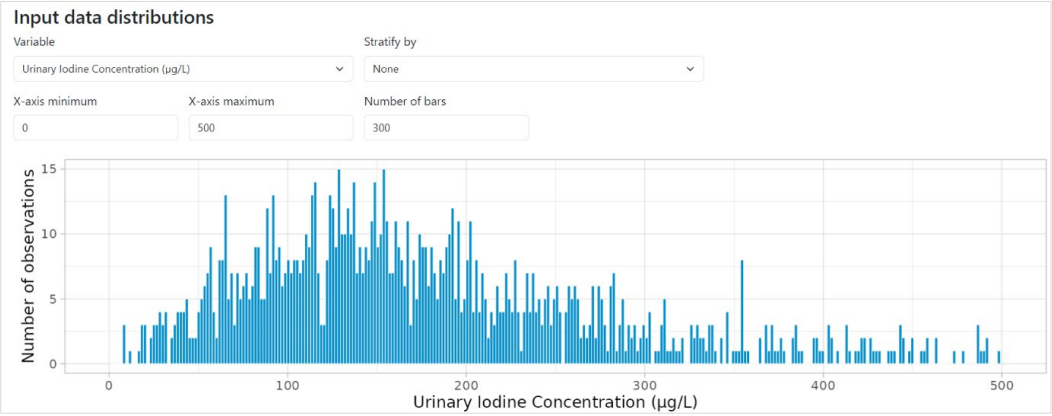


Figure 36. UIC distribution stratified by sex

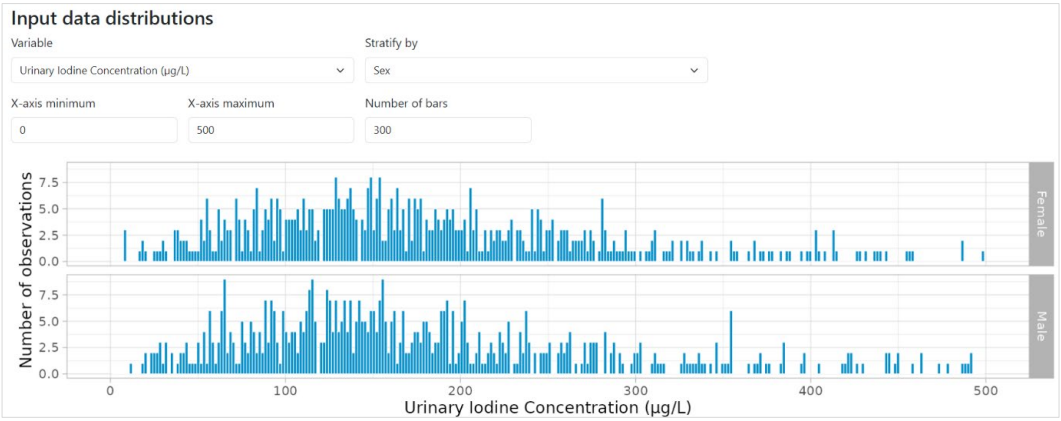
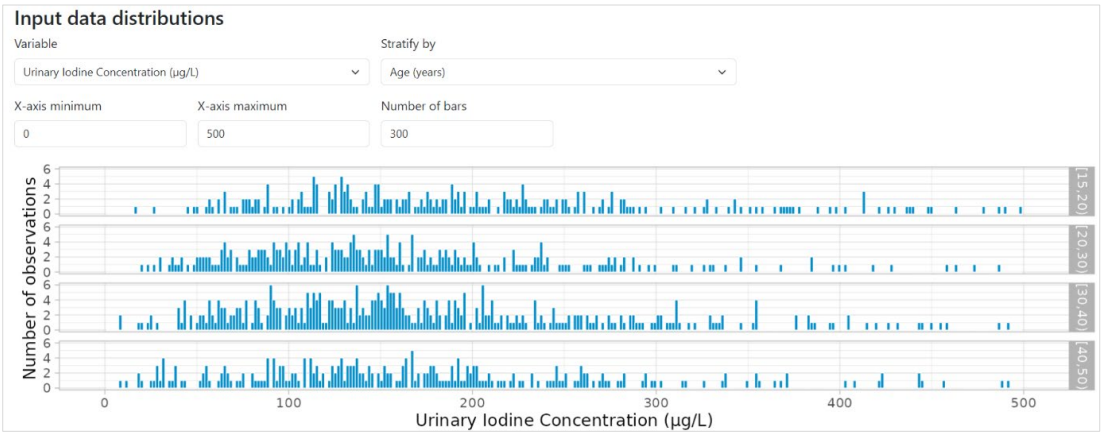


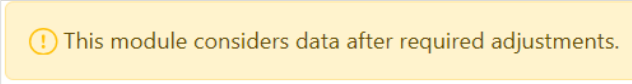
Figure 37. UIC distribution stratified by age



Adjusted biomarker distributions

Adjusted data distributions consider the data after adjustments (e.g., by elevation, smoking, inflammation) and removal of implausible values and missing values. An alert message will notify the user that the data distribution has been adjusted (**Figure 38**). This module provides histograms to observe the frequency distribution with an accompanying data table to observe normality measures. Not all biomarkers need adjustments. For such biomarkers, this section is not relevant (i.e., UIC).

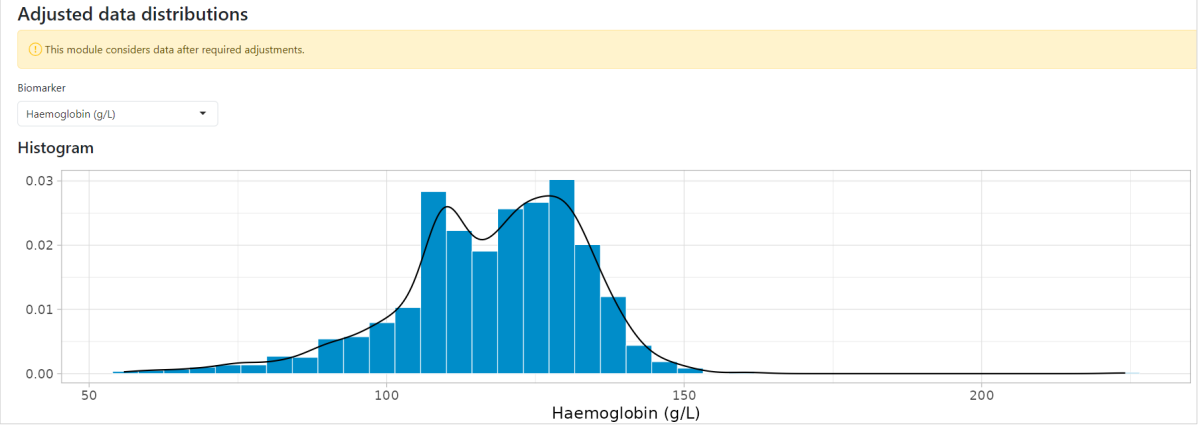
Figure 38. Alert message for data distribution adjustment



Haemoglobin

The histogram below describes the data after relevant adjustments are made (e.g., elevation, smoking status, inflammation). It provides information on the normality of data for observation purposes (**Figure 39**).

Figure 39. Adjusted Haemoglobin distribution

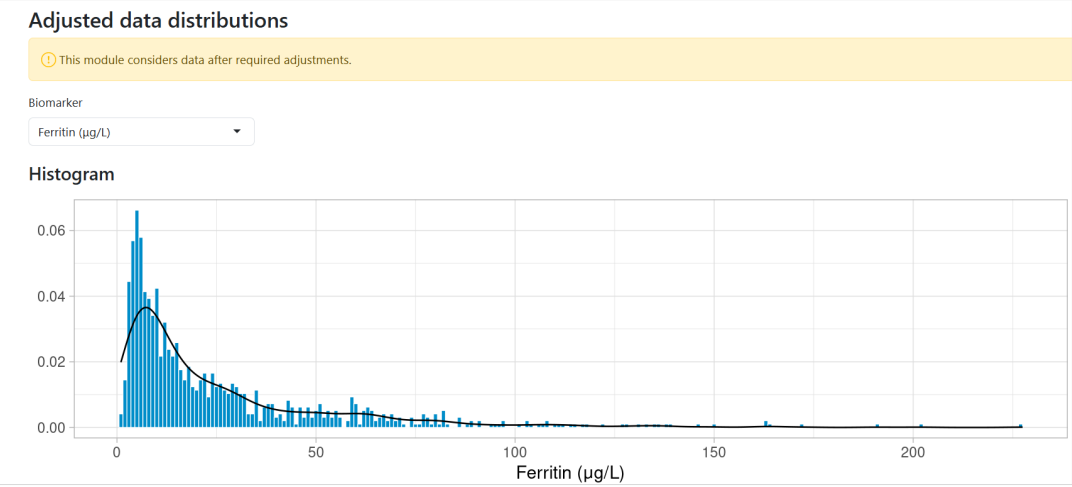


Summary table

Characteristic	Level	N	SD	Mean	Skew	Kurtosis
Sex	Female	670	16.22	117.80	-0.34	6.26
Sex	Male	703	15.02	117.70	-0.75	4.05
Area	Urban	544	15.55	117.98	-0.62	3.52
Area	Rural	829	15.66	117.59	-0.47	6.49
Total	Total	1373	15.61	117.75	-0.53	5.33

Ferritin

Figure 40. Adjusted Ferritin distribution



Implausible values

The tool considers implausible values for Haemoglobin and Ferritin (**Table 2**). Implausible values are considered as 'missing' after required adjustments.

The tool does not consider any values as implausible for Urinary iodine concentration, CRP, and AGP

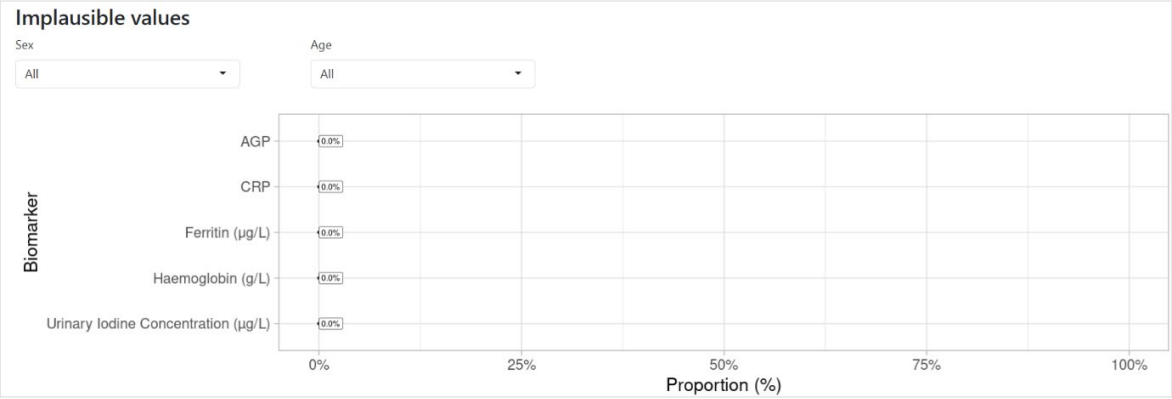
Table 2. Implausible values for Haemoglobin and Ferritin

Micronutrient biomarker	Values considered implausible
Haemoglobin	Below 40 g/L and 200 g/L
Ferritin	Below 0.5 µg/L and above 1000 µg/L

For data quality assessment, implausible values are measured from the input data. For prevalence calculations, implausible values are removed after adjustments are done.

The image below shows the proportion (%) of implausible values in the dataset for each biomarker. A detailed summary table accompanies the graph (**Figure 41**).

Figure 41. **Proportion (%) of implausible values for biomarkers**



D. Results

Individual classification

The individual classification file provides information on how each individual value on the uploaded dataset was classified according to WHO recommended cutoffs (**Figure 42**). Users can download the results as CSV or Excel files (**Figure 43**).

Figure 42. **Individual classification results**

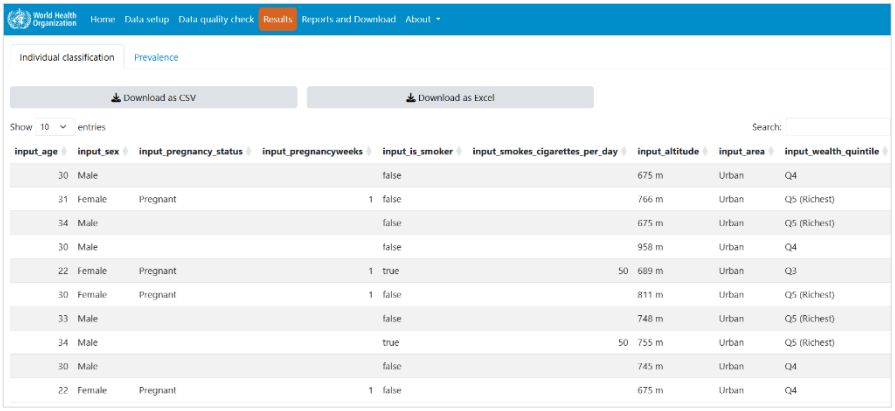
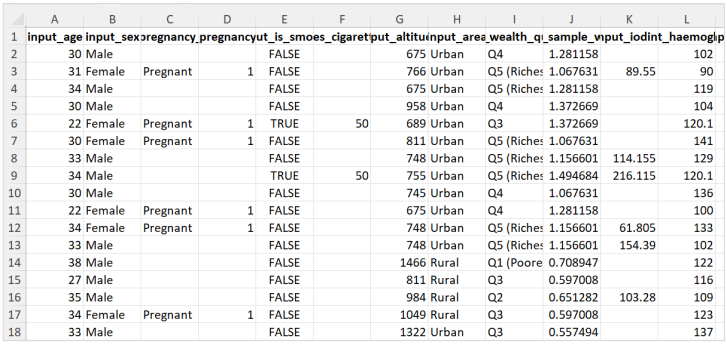


Figure 43. Data file for individual classifications



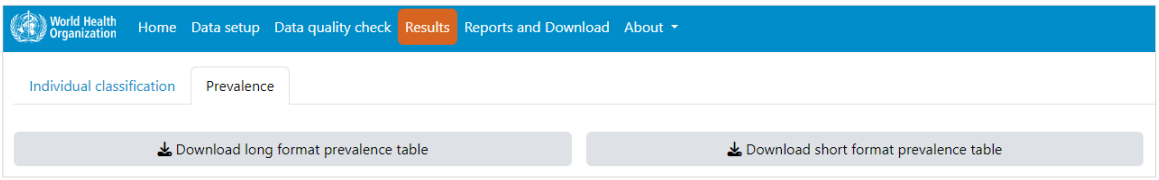
	A	B	C	D	E	F	G	H	I	J	K	L
1	input_age	input_sex	pregnancy	pregnancy	ut_is_smoes_cigaret		put_altitu	input_area	wealth_q	sample_w	put_iodint_haemoglp	
2	30	Male			FALSE		675	Urban	Q4	1.281158		102
3	31	Female	Pregnant	1	FALSE		766	Urban	Q5 (Riches	1.067631	89.55	90
4	34	Male			FALSE		675	Urban	Q5 (Riches	1.281158		119
5	30	Male			FALSE		958	Urban	Q4	1.372669		104
6	22	Female	Pregnant	1	TRUE	50	689	Urban	Q3	1.372669		120.1
7	30	Female	Pregnant	1	FALSE		811	Urban	Q5 (Riches	1.067631		141
8	33	Male			FALSE		748	Urban	Q5 (Riches	1.156601	114.155	129
9	34	Male			TRUE	50	755	Urban	Q5 (Riches	1.494684	216.115	120.1
10	30	Male			FALSE		745	Urban	Q4	1.067631		136
11	22	Female	Pregnant	1	FALSE		675	Urban	Q4	1.281158		100
12	34	Female	Pregnant	1	FALSE		748	Urban	Q5 (Riches	1.156601	61.805	133
13	33	Male			FALSE		748	Urban	Q5 (Riches	1.156601	154.39	102
14	38	Male			FALSE		1466	Rural	Q1 (Poore	0.708947		122
15	27	Male			FALSE		811	Rural	Q3	0.597008		116
16	35	Male			FALSE		984	Rural	Q2	0.651282	103.28	109
17	34	Female	Pregnant	1	FALSE		1049	Rural	Q3	0.597008		123
18	33	Male			FALSE		1322	Urban	Q3	0.557494		137

Prevalence

The tool allows users to download prevalence data in two formats (MS Excel files) (**Figure 44**):

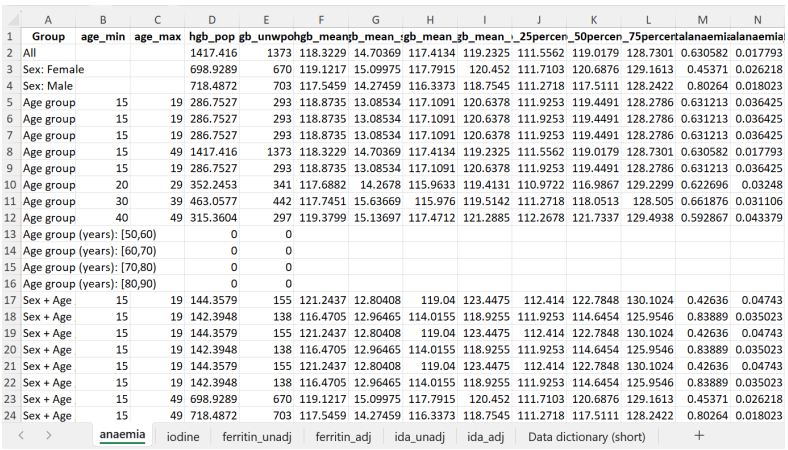
- **Short format:** Includes prevalence estimates using WHO recommended cutoffs with corresponding standard errors and confidence intervals, and summary statistics (mean and standard deviation) (see **Annex 1** for short format data dictionary)
- **Long format:** Includes prevalence estimates of a wide range of cutoffs with corresponding standard errors and confidence intervals, and summary statistics (mean and standard deviation) (see **Annex 2** for long format data dictionary)

Figure 44. Prevalence results file in long or short formats



The data file contains tabs for the selected biomarkers with unadjusted and adjusted values (for Ferritin and IDA), and a Data dictionary (**Figure 45**).

Figure 45. Prevalence results file



	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Group	age_min	age_max	hgb_pop	gb_unwpo	hgb_mean	gb_mean_	gb_mean_	gb_mean_	_25percen	_50percen	_75percen	talanaemia	ianaemia
2	All			1417.416	1373	118.3229	14.70369	117.4134	119.2325	111.5562	119.0179	128.7301	0.630582	0.017793
3	Sex: Female			698.9289	670	119.1217	15.09975	117.7915	120.452	111.7103	120.6876	129.1613	0.45371	0.026218
4	Sex: Male			718.4872	703	117.5459	14.27459	116.3373	118.7545	111.2718	117.5111	128.2422	0.80264	0.018023
5	Age group	15	19	286.7527	293	118.8735	13.08534	117.1091	120.6378	111.9253	119.4491	128.2786	0.631213	0.036425
6	Age group	15	19	286.7527	293	118.8735	13.08534	117.1091	120.6378	111.9253	119.4491	128.2786	0.631213	0.036425
7	Age group	15	19	286.7527	293	118.8735	13.08534	117.1091	120.6378	111.9253	119.4491	128.2786	0.631213	0.036425
8	Age group	15	49	1417.416	1373	118.3229	14.70369	117.4134	119.2325	111.5562	119.0179	128.7301	0.630582	0.017793
9	Age group	15	19	286.7527	293	118.8735	13.08534	117.1091	120.6378	111.9253	119.4491	128.2786	0.631213	0.036425
10	Age group	20	29	352.2453	341	117.6882	14.2678	115.9633	119.4131	110.9722	116.9867	129.2299	0.622696	0.03248
11	Age group	30	39	463.0577	442	117.7451	15.63669	115.976	119.5142	111.2718	118.0513	128.505	0.661876	0.031106
12	Age group	40	49	315.3604	297	119.3799	15.13697	117.4712	121.2885	112.2678	121.7337	129.4938	0.592867	0.043379
13	Age group (years): [50,60)			0	0									
14	Age group (years): [60,70)			0	0									
15	Age group (years): [70,80)			0	0									
16	Age group (years): [80,90)			0	0									
17	Sex + Age	15	19	144.3579	155	121.2437	12.80408	119.04	123.4475	112.414	122.7848	130.1024	0.42636	0.04743
18	Sex + Age	15	19	142.3948	138	116.4705	12.96465	114.0155	118.9255	111.9253	114.6454	125.9546	0.83889	0.035023
19	Sex + Age	15	19	144.3579	155	121.2437	12.80408	119.04	123.4475	112.414	122.7848	130.1024	0.42636	0.04743
20	Sex + Age	15	19	142.3948	138	116.4705	12.96465	114.0155	118.9255	111.9253	114.6454	125.9546	0.83889	0.035023
21	Sex + Age	15	19	144.3579	155	121.2437	12.80408	119.04	123.4475	112.414	122.7848	130.1024	0.42636	0.04743
22	Sex + Age	15	19	142.3948	138	116.4705	12.96465	114.0155	118.9255	111.9253	114.6454	125.9546	0.83889	0.035023
23	Sex + Age	15	49	698.9289	670	119.1217	15.09975	117.7915	120.452	111.7103	120.6876	129.1613	0.45371	0.026218
24	Sex + Age	15	49	718.4872	703	117.5459	14.27459	116.3373	118.7545	111.2718	117.5111	128.2422	0.80264	0.018023

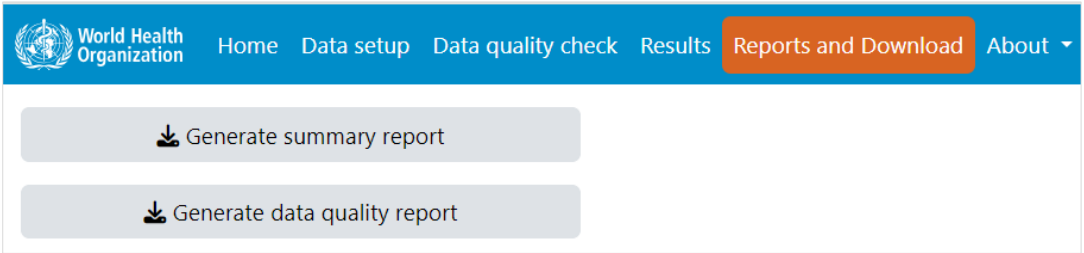
anaemia | iodine | ferritin_unadj | ferritin_adj | ida_unadj | ida_adj | Data dictionary (short)

E. Reports and Downloads

This section generates downloadable **summary reports** and **data quality reports.**

The **Data Quality Report** provides a consolidated summary of the chosen biomarkers, including all figures and data tables generated by the tool. The **Summary report** provides a summary of the data quality assessment and prevalence results (**Figure 46**).

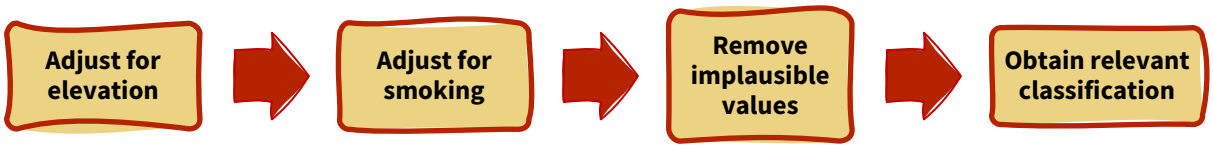
Figure 46. Data quality report generation



3. Biomarker cutoffs and adjustments

Haemoglobin (g/L)

The tool follows the analytical process below for Haemoglobin:



Cutoffs to define anaemia in individuals and populations

Population	No anaemia	Anaemia			
		Total anaemia	Mild	Moderate	Severe
Children (0–23 months)	≥105	<105	95–104	70–94	<70
Children (24-59 months)	≥110	<110	100–109	70–99	<70
Children (5–11 years)	≥115	<115	110–114	80–109	<80
Children (12–14 years non-pregnant girls)	≥120	<120	110–119	80–109	<80
Children (12–14 years boys)	≥120	<120	110–119	80–109	<80
Adults (15 and above non-pregnant women)	≥120	<120	110–119	80–109	<80
Adults (15 and above men)	≥130	<130	110–129	80–109	<80
Pregnancy (if only pregnancy is reported, without weeks or trimester)	≥110	<110	100–109	70–99	<70
First trimester	≥110	<110	100–109	70–99	<70
Second trimester	≥105	<105	95-104	70-94	<70
Third trimester	≥110	<110	100–109	70–99	<70

Adjustments

- **Formula for elevation (in meters)**

  Haemoglobin adjustment (g/L) =

  haemoglobin value − (0.0056384 x elevation) + (0.0000003 x elevation^2)

Table 3. **Adjustments to haemoglobin for smoking status and cigarettes per day**

Cigarettes per day	Haemoglobin adjustment (g/L)
Smoker, quantity unknown	3
<10	3
10-19	5
>20	6

Implausible values for all populations for haemoglobin (g/L): *< 40 and > 200*

Reference: Guideline on haemoglobin cutoffs to define anaemia in individuals and populations. Geneva: World Health Organization; 2024. Licence: CC BY-NC-SA 3.0 IGO. https://www.who.int/publications/i/item/9789240088542 *[Accessed 06 Aug 2024]*

Ferritin (µg/L)

The tool follows the analytical process below for Ferritin:

Cutoff points to define iron deficiency and risk of iron overload in apparently healthy and non-healthy individuals by age group

Population	Iron deficiency		Risk of iron overload	
	Apparently healthy individuals	Individuals with infection or inflammation	Apparently healthy individuals	Individuals with infection or inflammation
Infants and children (0–23 months)	<12 µg/L	<30 µg/L		
Children (24-59 months)	<12 µg/L	<30 µg/L		
Children (5–10 years)	<15 µg/L	<70 µg/L	≥150 females ≥200 males	≥500
Adolescents (10 to less than 20 years)	<15 µg/L	<70 µg/L	≥150 females ≥200 males	≥500
Adults (20-59 years)	<15 µg/L	<70 µg/L	≥150 females ≥200 males	≥500
Older populations (60+ years)	<15 µg/L	<70 µg/L	≥150 females ≥200 males	≥500
Pregnant women	<15 µg/L	<70 µg/L		

Note: When data from children 0 to 59 months is analyzed, ferritin concentration will only apply to iron deficiency cut offs (with/without infection).

Inflammation biomarker cutoffs

Inflammation biomarkers	Cutoff
CRP	≥5 mg/L
AGP	≥1 g/L

Adjustments for inflammation:

1. Consider cutoffs for infection or inflammation approach uses a higher ferritin concentration cut-off value for individuals with infection/inflammation, e.g. <30 µg/L.

2. Regression correction (BRINDA approach) uses linear regression to adjust ferritin concentrations by the CRP and AGP concentrations on a continuous scale, and malaria infection as a dichotomous variable. The adjusted ferritin equation is calculated by subtracting the influence of CRP, AGP and malaria as follows:

$$Ferritin_{adjusted} = ferritin_{unadjusted} - \beta 1(CRP_{obs} - CRP_{ref}) - \beta 2(AGP_{obs} - AGP_{ref}) - \beta 3\ malaria$$

where **β1** is the CRP regression coefficient, **β2** is the AGP regression coefficient, **β3** malaria is the malaria regression coefficient, **obs** is the observed value, and **ref** is the external reference value generated to define low inflammation.

3. Arithmetic correction factor (CF) approach applies an arithmetic correction factor by grouping inflammation into groups, e.g. (i) reference (both CRP concentration <5 mg/L and AGP concentration <1 g/L); (ii) incubation (CRP concentration >5 mg/L and AGP concentration <1 g/L); (iii) early convalescence (both CRP concentration >5 mg/L and AGP concentration >1 g/L); and (iv) late convalescence (CRP concentration <5 mg/L and AGP concentration >1 g/L)

4. Remove AGP ≥1 mg/L and/or CRP 5 ≥g/L and/or malaria approach uses the inflammation, malaria-biomarker information, or both, to exclude individuals with elevated inflammation (as defined by a CRP concentration >5 mg/L, AGP concentration >1 g/L, or both) or individuals with malaria infection.

Implausible values for all populations ferritin (µg/L): *<0.5 and >1000*

The tool does not consider any implausible values for CRP or AGP

References:

- WHO guideline on use of ferritin concentrations to assess iron status in individuals and populations. Geneva: World Health Organization; 2020. Licence: CC BY-NC-SA 3.0 IGO https://www.who.int/publications/i/item/9789240000124
- Namaste SM, Rohner F, Huang J, Bhushan NL, Flores-Ayala R, Kupka R, Mei Z, Rawat R, Williams AM, Raiten DJ, Northrop-Clewes CA, Suchdev PS. Adjusting ferritin concentrations for inflammation: Biomarkers Reflecting Inflammation and Nutritional Determinants of Anemia (BRINDA) project. Am J Clin Nutr. 2017 Jul;106(Suppl 1):359S-371S. doi: 10.3945/ajcn.116.141762.
- Thurnham DI, McCabe LD, Haldar S, Wieringa FT, Northrop-Clewes CA, McCabe GP. Adjusting plasma ferritin concentrations to remove the effects of subclinical inflammation in the assessment of iron deficiency: a meta-analysis. Am J Clin Nutr. 2010 Sep;92(3):546-55. doi: 10.3945/ajcn.2010.29284. Epub 2010 Jul 7. PMID: 20610634. https://pubmed.ncbi.nlm.nih.gov/20610634

Iron deficiency anaemia (IDA)

Cutoff points for IDA

Population	Iron deficiency anaemia	
	Iron deficiency in apparently healthy individuals	**Iron deficiency in individuals with infection or inflammation**
Children (0–23 months)	<105 g/L haemoglobin and <12 µg/L ferritin	<105 g/L haemoglobin and <30 µg/L ferritin
Children (24-59 months)	<110 g/L haemoglobin and <12 µg/L ferritin	<110 g/L haemoglobin and <30 µg/L ferritin
Children (5–11 years)	<115 haemoglobin and <15 µg/L ferritin	<115 haemoglobin and <70 µg/L ferritin
Children (12–14 years non-pregnant girls)	<120 haemoglobin and <15 µg/L ferritin	<120 haemoglobin and <70 µg/L ferritin
Children (12–14 years boys)	<120 haemoglobin and <15 µg/L ferritin	<120 haemoglobin and <70 µg/L ferritin
Adults (15 and above non-pregnant women)	<120 haemoglobin and <15 µg/L ferritin	<120 haemoglobin and <70 µg/L ferritin
Adults (15 and above men)	<130 haemoglobin and <15 µg/L ferritin	<130 haemoglobin and <70 µg/L ferritin
Pregnancy	<110 haemoglobin and <15 µg/L ferritin	

Note: Iron deficiency anaemia is a composite indicator that includes both haemoglobin and ferritin concentrations

Median Urinary Iodine Concentration (UIC) (µg/L)

Notes:

- Median urinary iodine concentration is used to determine iodine status in the population.
- No implausible values were considered in urinary iodine concentrations.

Reference: WHO. Urinary iodine concentrations for determining iodine status deficiency in populations. Vitamin and Mineral Nutrition Information System. Geneva: World Health Organization; 2013 https://www.who.int/publications/i/item/WHO-NMH-NHD-EPG-13.1

4. Helpful resources for survey planning, implementation and reporting

- Centers for Disease Control and Prevention, World Health Organization, Nutrition International, UNICEF. Micronutrient survey manual. Geneva: World Health Organization; 2020. Licence: CC BY-NC-SA 3.0 IGO (available at https://www.who.int/publications/i/item/9789240012691)
- Centers for Disease Control and Prevention (CDC), World Health Organization (WHO), Nutrition International (NI), UNICEF. Micronutrient survey manual & toolkit [website]. Ottawa: Nutrition International; 2022 (available at https://mnsurvey.nutritionintl.org/)
- Recommendations for data collection, analysis and reporting on anthropometric indicators in children under 5 years old. Geneva: World Health Organization and the United Nations Children's Fund (UNICEF), 2019. Licence: CC BY-NC-SA 3.0 IGO (available at https://www.who.int/publications/i/item/9789241515559)

Annex 1. Data dictionary – Short format

Biomarker	Variable or Group	Description
All	Age_min	Minimum age in the sample
All	Age_max	Maximum age in the sample
All	Age_unit	Age unit
All	Gender	Female or male or both
All	Pregnancy_status	For yes ("1"), no ("2"), don't know ("3"); NA when non applicable (e.g., men, and age under 15)
All	Lactating_status	For yes ("1"), no ("2"), don't know ("3"); NA when non applicable (e.g., men, and age under 15)
All	Area of residence	Rural, Urban or Both
All	Wealth quintile	Q1(Poorest); Q2; Q3; Q4; Q5(Wealthiest)
All	Mother's education	No Education; Primary Education; Secondary Education; Higher Education
All	Geographical region	Text; geographical region name provided by the user
All	Other geographical region	Text; other geographical region name provided by the user
Haemoglobin	hgb_pop	Weighted sample size
Haemoglobin	hgb_unwpop	Unweighted sample size
Haemoglobin	hgb_mean	Mean of haemoglobin concentration
Haemoglobin	hgb_mean_sd	Standard deviatiodvin of the haemoglobin concentration mean
Haemoglobin	hgb_mean_ll	Lower 95% confidence limit of the haemoglobin concentration mean
Haemoglobin	hgb_mean_ul	Upper 95% confidence limit of the haemoglobin concentration mean
Haemoglobin	hgb_25percentile	Haemoglobin concentration 25 Percentile
Haemoglobin	hgb_50percentile	Haemoglobin concentration 50 Percentile
Haemoglobin	hgb_75percentile	Haemoglobin concentration 75 Percentile
Haemoglobin	totalanaemia_r	Prevalence of total anaemia according to cutoff depending of population group
Haemoglobin	totalanaemia_se	Standard error of total anaemia according to cutoff depending on population group
Haemoglobin	totalanaemia_ll	Lower 95% confidence limit of total anaemia according to cutoff depending on population group
Haemoglobin	totalanaemia_ul	Upper 95% confidence limit of total anaemia according to cutoff depending on population group
Haemoglobin	mildanaemia_r	Prevalence of mild anaemia according to cutoff depending on population group
Haemoglobin	mildanaemia_se	Standard error of mild anaemia according to cutoff depending on population group
Haemoglobin	mildanaemia_ll	Lower 95% confidence limit of mild anaemia according to cutoff depending on population group
Haemoglobin	mildanaemia_ul	Upper 95% confidence limit of mild anaemia according to cutoff depending on population group
Haemoglobin	moderateanaemia_r	Prevalence of moderate anaemia according to cutoff depending on population group
Haemoglobin	moderateanaemia_se	Standard error of moderate anaemia according to cutoff depending on population group

Biomarker	Variable or Group	Description
Haemoglobin	moderateanaemia_ll	Lower 95% confidence limit of moderate anaemia according to cutoff depending on population group
Haemoglobin	moderateanaemia_ul	Upper 95% confidence limit of moderate anaemia according to cutoff depending on population group
Haemoglobin	severeanaemia_r	Prevalence of severe anaemia according to cutoff depending on population group
Haemoglobin	severeanaemia_se	Standard error of severe anaemia according to cutoff depending on population group
Haemoglobin	severeanaemia_ll	Lower 95% confidence limit of severe anaemia according to cutoff depending on population group
Haemoglobin	severeanaemia_ul	Upper 95% confidence limit of moderate anaemia according to cutoff depending on population group
Ferritin	ferritin_unadj_pop	Weighted sample size (Unadjusted ferritin)
Ferritin	ferritin_unadj_unwpop	Unweighted sample size (Unadjusted ferritin)
Ferritin	ferritin_unadj_mean	Unadjusted ferritin concentration mean
Ferritin	ferritin_unadj_mean_sd	Unadjusted ferritin concentration standard deviation
Ferritin	ferritin_unadj_mean_ll	Unadjusted Lower 95% confidence limit of the ferritin concentration mean
Ferritin	ferritin_unadj_mean_ul	Unadjusted Upper 95% confidence limit of the ferritin concentration mean
Ferritin	ferritin_unadj_25percentile	Unadjusted ferritin concentration 25th Percentile
Ferritin	ferritin_unadj_50percentile	Unadjusted ferritin concentration 50th Percentile
Ferritin	ferritin_unadj_75percentile	Unadjusted ferritin concentration 75th Percentile
Ferritin	depletedironstores_unadj_r	Unadjusted prevalence of depleted iron stores according to cutoff depending on population group
Ferritin	depletedironstores_unadj_se	Unadjusted standard error of depleted iron stores according to cut-off depending of population group
Ferritin	depletedironstores_unadj_ll	Unadjusted Lower 95% confidence limit of prevalence of depleted iron stores according to cutoff depending on population group
Ferritin	depletedironstores_unadj_ul	Unadjusted Upper 95% confidence limit of prevalence of depleted iron stores according to cutoff depending on population group
Ferritin	riskofironoverload_unadj_r	Unadjusted prevalence of prevalence of risk of iron overload according to cutoff depending on population group
Ferritin	riskofironoverload_unadj_se	Unadjusted Standard error of risk of iron overload according to cut-off depending of population group
Ferritin	riskofironoverload_unadj_ll	Unadjusted Lower 95% confidence limit of prevalence of risk of iron overload according to cutoff depending on population group
Ferritin	riskofironoverload_unadj_ul	Unadjusted Upper 95% confidence limit of prevalence of risk of iron overload according to cutoff depending on population group
Ferritin	ferritin_adj_pop	Weighted sample size (Adjusted ferritin)
Ferritin	ferritin_adj_unwpop	Unweighted sample size (Adjusted ferritin)
Ferritin	ferritin_adj_mean	Adjusted ferritin concentration mean
Ferritin	ferritin_adj_mean_sd	Adjusted ferritin concentration standard deviation
Ferritin	ferritin_adj_mean_ll	Adjusted Lower 95% confidence limit of the ferritin concentration mean

Biomarker	Variable or Group	Description
Ferritin	ferritin_adj_mean_ul	AdjustedUpper 95% confidence limit of the ferritin concentration mean
Ferritin	ferritin_adj_25percentile	Adjusted ferritin concentration 25th Percentile
Ferritin	ferritin_adj_50percentile	Adjusted ferritin concentration 50th Percentile
Ferritin	ferritin_adj_75percentile	Adjusted ferritin concentration 75th Percentile
Ferritin	depletedironstores_adj_r	Adjusted prevalence of depleted iron stores according to cutoff depending on population group
Ferritin	depletedironstores_adj_se	Adjusted standard error of depleted iron stores according to cut-off depending of population group
Ferritin	depletedironstores_adj_ll	Adjusted Lower 95% confidence limit of prevalence of depleted iron stores according to cutoff depending on population group
Ferritin	depletedironstores_adj_ul	Adjusted Upper 95% confidence limit of prevalence of depleted iron stores according to cutoff depending on population group
Ferritin	riskofironoverload_adj_r	Adjusted prevalence of prevalence of risk of iron overload according to cutoff depending on population group
Ferritin	riskofironoverload_adj_se	Adjusted standard error of risk of iron overload according to cut-off depending of population group
Ferritin	riskofironoverload_adj_ll	Adjusted Lower 95% confidence limit of prevalence of risk of iron overload according to cutoff depending on population group
Ferritin	riskofironoverload_adj_ul	Adjusted Upper 95% confidence limit of prevalence of risk of iron overload according to cutoff depending on population group
Iron deficiency anaemia	IDA_unadj_pop	Weighted sample size (using unadjusted ferritin)
Iron deficiency anaemia	IDA_unadj_unwpop	Unweighted sample size (using unadjusted ferritin)
Iron deficiency anaemia	IDA_unadj_r	Prevalence of iron deficiency anaemia according to cutoff depending on population group (using unadjusted ferritin)
Iron deficiency anaemia	IDA_unadj_se	Standard error of prevalence of iron deficiency anaemia according to cutoff depending on population group (using unadjusted ferritin)
Iron deficiency anaemia	IDA_unadj_ll	Lower 95% confidence limit of prevalence of iron deficiency anaemia according to cutoff depending on population group (using unadjusted ferritin)
Iron deficiency anaemia	IDA_unadj_ul	Upper 95% confidence limit of prevalence of iron deficiency anaemia according to cutoff depending on population group (using unadjusted ferritin)
Iron deficiency anaemia	IDA_adj_pop	Weighted sample size (using adjusted ferritin)
Iron deficiency anaemia	IDA_adj_unwpop	Unweighted sample size (using adjusted ferritin)

Biomarker	Variable or Group	Description
Iron deficiency anaemia	IDA_adj_r	Prevalence of iron deficiency anaemia according to cutoff depending on population group (using adjusted ferritin)
Iron deficiency anaemia	IDA_adj_se	Standard error of prevalence of iron deficiency anaemia according to cutoff depending on population group (using adjusted ferritin)
Iron deficiency anaemia	IDA_adj_ll	Lower 95% confidence limit of prevalence of iron deficiency anaemia according to cutoff depending on population group (using adjusted ferritin)
Iron deficiency anaemia	IDA_adj_ul	Upper 95% confidence limit of prevalence of iron deficiency anaemia according to cutoff depending on population group (using adjusted ferritin)
Iodine	iodine_pop	Weighted sample size
Iodine	iodine_unwpop	Unweighted sample size
Iodine	iodine_median_r	Median of urinary iodine concentration
Iodine	iodine_25percentile	Urinary iodine concentration 25 Percentile
Iodine	iodine_75percentile	Urinary iodine concentration 75 Percentile

Annex 2. Data dictionary - Long format

Biomarker	Group or Variable	Description or variable values
All	age_min	Minimum age in the sample
All	age_max	Maximum age in the sample
All	age_unit	Age unit
All	Gender	Female or male or both
All	Pregnancy_status	For yes ("1"), no ("2"), don't know ("3"); NA when non applicable (e.g., men, and age under 15)
All	Lactating_status	For yes ("1"), no ("2"), don't know ("3"); NA when non applicable (e.g., men, and age under 15)
All	Area of residence	Rural, Urban or Both
All	Wealth quintile	Q1(Poorest); Q2; Q3; Q4; Q5(Wealthiest)
All	Mother's education	No Education; Primary Education; Secondary Education; Higher Education
All	Geographical region	Text; geographical region name provided by the user
All	Other geographical region	Text; other geographical region name provided by the user
Haemoglobin	hgb_pop	Weighted sample size
Haemoglobin	hgb_unwpop	Unweighted sample size
Haemoglobin	hgb_mean	Haemoglobin concentration mean
Haemoglobin	hgb_mean_sd	Haemoglobin concentration standard deviation
Haemoglobin	hgb_mean_ll	Lower 95% confidence limit of the haemoglobin concentration mean
Haemoglobin	hgb_mean_ul	Upper 95% confidence limit of the haemoglobin concentration mean
Haemoglobin	hgb_geomean	Haemoglobin concentration geometric mean
Haemoglobin	hgb_geomean_ll	Lower 95% confidence limit of the haemoglobin concentration geometric mean
Haemoglobin	hgb_geomean_ul	Upper 95% confidence limit of the haemoglobin concentration geometric mean
Haemoglobin	hgb_10percentile	Haemoglobin concentration 10th Percentile
Haemoglobin	hgb_25percentile	Haemoglobin concentration 25th Percentile
Haemoglobin	hgb_50percentile	Haemoglobin concentration 50th Percentile
Haemoglobin	hgb_75percentile	Haemoglobin concentration 75th Percentile
Haemoglobin	hgb_90percentile	Haemoglobin concentration 90th Percentile
Haemoglobin	hgb_p180_r	Haemoglobin concentration prevalence <180 g/L
Haemoglobin	hgb_p180_se	Standard error of haemoglobin concentration prevalence <180 g/L
Haemoglobin	hgb_p180_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <180 g/L
Haemoglobin	hgb_p180_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <180 g/L
Haemoglobin	hgb_p175_r	Haemoglobin concentration prevalence <175 g/L

Biomarker	Group or Variable	Description or variable values
Haemoglobin	hgb_p175_se	Standard error of haemoglobin concentration prevalence <175 g/L
Haemoglobin	hgb_p175_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <175 g/L
Haemoglobin	hgb_p175_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <175 g/L
Haemoglobin	hgb_p170_r	Haemoglobin concentration prevalence <170 g/L
Haemoglobin	hgb_p170_se	Standard error of haemoglobin concentration prevalence <170 g/L
Haemoglobin	hgb_p170_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <170 g/L
Haemoglobin	hgb_p170_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <170 g/L
Haemoglobin	hgb_p165_r	Haemoglobin concentration prevalence <165 g/L
Haemoglobin	hgb_p165_se	Standard error of haemoglobin concentration prevalence <165 g/L
Haemoglobin	hgb_p165_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <165 g/L
Haemoglobin	hgb_p165_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <165 g/L
Haemoglobin	hgb_p160_r	Haemoglobin concentration prevalence <160 g/L
Haemoglobin	hgb_p160_se	Standard error of haemoglobin concentration prevalence <160 g/L
Haemoglobin	hgb_p160_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <160 g/L
Haemoglobin	hgb_p160_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <160 g/L
Haemoglobin	hgb_p155_r	Haemoglobin concentration prevalence <155 g/L
Haemoglobin	hgb_p155_se	Standard error of haemoglobin concentration prevalence <155 g/L
Haemoglobin	hgb_p155_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <155 g/L
Haemoglobin	hgb_p155_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <155 g/L
Haemoglobin	hgb_p150_r	Haemoglobin concentration prevalence <150 g/L
Haemoglobin	hgb_p150_se	Standard error of haemoglobin concentration prevalence <150 g/L
Haemoglobin	hgb_p150_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <150 g/L
Haemoglobin	hgb_p150_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <150 g/L
Haemoglobin	hgb_p145_r	Haemoglobin concentration prevalence <145 g/L
Haemoglobin	hgb_p145_se	Standard error of haemoglobin concentration prevalence <145 g/L
Haemoglobin	hgb_p145_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <145 g/L
Haemoglobin	hgb_p145_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <145 g/L
Haemoglobin	hgb_p140_r	Haemoglobin concentration prevalence <140 g/L
Haemoglobin	hgb_p140_se	Standard error of haemoglobin concentration prevalence <140 g/L
Haemoglobin	hgb_p140_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <140 g/L
Haemoglobin	hgb_p140_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <140 g/L
Haemoglobin	hgb_p135_r	Haemoglobin concentration prevalence <135 g/L
Haemoglobin	hgb_p135_se	Standard error of haemoglobin concentration prevalence <135 g/L

Biomarker	Group or Variable	Description or variable values
Haemoglobin	hgb_p135_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <135 g/L
Haemoglobin	hgb_p135_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <135 g/L
Haemoglobin	hgb_p130_r	Haemoglobin concentration prevalence <130 g/L
Haemoglobin	hgb_p130_se	Standard error of haemoglobin concentration prevalence <130 g/L
Haemoglobin	hgb_p130_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <130 g/L
Haemoglobin	hgb_p130_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <130 g/L
Haemoglobin	hgb_p125_r	Haemoglobin concentration prevalence <125 g/L
Haemoglobin	hgb_p125_se	Standard error of haemoglobin concentration prevalence <125 g/L
Haemoglobin	hgb_p125_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <125 g/L
Haemoglobin	hgb_p125_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <125 g/L
Haemoglobin	hgb_p120_r	Haemoglobin concentration prevalence <120 g/L
Haemoglobin	hgb_p120_se	Standard error of haemoglobin concentration prevalence <120 g/L
Haemoglobin	hgb_p120_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <120 g/L
Haemoglobin	hgb_p120_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <120 g/L
Haemoglobin	hgb_p115_r	Haemoglobin concentration prevalence <115 g/L
Haemoglobin	hgb_p115_se	Standard error of haemoglobin concentration prevalence <115 g/L
Haemoglobin	hgb_p115_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <115 g/L
Haemoglobin	hgb_p115_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <115 g/L
Haemoglobin	hgb_p110_r	Haemoglobin concentration prevalence <110 g/L
Haemoglobin	hgb_p110_se	Standard error of haemoglobin concentration prevalence <110 g/L
Haemoglobin	hgb_p110_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <110 g/L
Haemoglobin	hgb_p110_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <110 g/L
Haemoglobin	hgb_p105_r	Haemoglobin concentration prevalence <105 g/L
Haemoglobin	hgb_p105_se	Standard error of haemoglobin concentration prevalence <105 g/L
Haemoglobin	hgb_p105_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <105 g/L
Haemoglobin	hgb_p105_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <105 g/L
Haemoglobin	hgb_p100_r	Haemoglobin concentration prevalence <100 g/L
Haemoglobin	hgb_p100_se	Standard error of haemoglobin concentration prevalence <100 g/L
Haemoglobin	hgb_p100_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <100 g/L
Haemoglobin	hgb_p100_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <100 g/L
Haemoglobin	hgb_p95_r	Haemoglobin concentration prevalence <95 g/L
Haemoglobin	hgb_p95_se	Standard error of haemoglobin concentration prevalence <95 g/L
Haemoglobin	hgb_p95_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <95 g/L

Biomarker	Group or Variable	Description or variable values
Haemoglobin	hgb_p95_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <95 g/L
Haemoglobin	hgb_p90_r	Haemoglobin concentration prevalence <90 g/L
Haemoglobin	hgb_p90_se	Standard error of haemoglobin concentration prevalence <90 g/L
Haemoglobin	hgb_p90_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <90 g/L
Haemoglobin	hgb_p90_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <90 g/L
Haemoglobin	hgb_p85_r	Haemoglobin concentration prevalence <85 g/L
Haemoglobin	hgb_p85_se	Standard error of haemoglobin concentration prevalence <85 g/L
Haemoglobin	hgb_p85_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <85 g/L
Haemoglobin	hgb_p85_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <85 g/L
Haemoglobin	hgb_p80_r	Haemoglobin concentration prevalence <80 g/L
Haemoglobin	hgb_p80_se	Standard error of haemoglobin concentration prevalence <80 g/L
Haemoglobin	hgb_p80_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <80 g/L
Haemoglobin	hgb_p80_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <80 g/L
Haemoglobin	hgb_p75_r	Haemoglobin concentration prevalence <75 g/L
Haemoglobin	hgb_p75_se	Standard error of haemoglobin concentration prevalence <75 g/L
Haemoglobin	hgb_p75_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <75 g/L
Haemoglobin	hgb_p75_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <75 g/L
Haemoglobin	hgb_p70_r	Haemoglobin concentration prevalence <70 g/L
Haemoglobin	hgb_p70_se	Standard error of haemoglobin concentration prevalence <70 g/L
Haemoglobin	hgb_p70_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <70 g/L
Haemoglobin	hgb_p70_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <70 g/L
Haemoglobin	hgb_p65_r	Haemoglobin concentration prevalence <65 g/L
Haemoglobin	hgb_p65_se	Standard error of haemoglobin concentration prevalence <65 g/L
Haemoglobin	hgb_p65_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <65 g/L
Haemoglobin	hgb_p65_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <65 g/L
Haemoglobin	hgb_p60_r	Haemoglobin concentration prevalence <60 g/L
Haemoglobin	hgb_p60_se	Standard error of haemoglobin concentration prevalence <60 g/L
Haemoglobin	hgb_p60_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <60 g/L
Haemoglobin	hgb_p60_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <60 g/L
Haemoglobin	hgb_p55_r	Haemoglobin concentration prevalence <55 g/L
Haemoglobin	hgb_p55_se	Standard error of haemoglobin concentration prevalence <55 g/L
Haemoglobin	hgb_p55_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <55 g/L
Haemoglobin	hgb_p55_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <55 g/L

Biomarker	Group or Variable	Description or variable values
Haemoglobin	hgb_p50_r	Haemoglobin concentration prevalence <50 g/L
Haemoglobin	hgb_p50_se	Standard error of haemoglobin concentration prevalence <50 g/L
Haemoglobin	hgb_p50_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <50 g/L
Haemoglobin	hgb_p50_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <50 g/L
Haemoglobin	hgb_p45_r	Haemoglobin concentration prevalence <45 g/L
Haemoglobin	hgb_p45_se	Standard error of haemoglobin concentration prevalence <45 g/L
Haemoglobin	hgb_p45_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <45 g/L
Haemoglobin	hgb_p45_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <45 g/L
Haemoglobin	hgb_p40_r	Haemoglobin concentration prevalence <40 g/L
Haemoglobin	hgb_p40_se	Standard error of haemoglobin concentration prevalence <40 g/L
Haemoglobin	hgb_p40_ll	Lower 95% confidence limit of haemoglobin concentration prevalence <40 g/L
Haemoglobin	hgb_p40_ul	Upper 95% confidence limit of haemoglobin concentration prevalence <40 g/L
Ferritin	ferritin_unadj_pop	Weighted sample size (Unadjusted ferritin)
Ferritin	ferritin_unadj_unwpop	Unweighted sample size (Unadjusted ferritin)
Ferritin	ferritin_unadj_mean	Unadjusted ferritin concentration mean
Ferritin	ferritin_unadj_mean_sd	Unadjusted ferritin concentration mean standard deviation
Ferritin	ferritin_unadj_mean_ll	Unadjusted Lower 95% confidence limit of the ferritin concentration mean
Ferritin	ferritin_unadj_mean_ul	Unadjusted Upper 95% confidence limit of the ferritin concentration mean
Ferritin	ferritin_unadj_geomean	Unadjusted ferritin concentration geometric mean
Ferritin	ferritin_unadj_geomean_ll	Unadjusted Lower 95% confidence limit of the ferritin concentration geometric mean
Ferritin	ferritin_unadj_geomean_ul	Unadjusted Upper 95% confidence limit of the ferritin concentration geometric mean
Ferritin	ferritin_unadj_10percentile	Unadjusted ferritin concentration 10th Percentile
Ferritin	ferritin_unadj_25percentile	Unadjusted ferritin concentration 25th Percentile
Ferritin	ferritin_unadj_50percentile	Unadjusted ferritin concentration 50th Percentile
Ferritin	ferritin_unadj_75percentile	Unadjusted ferritin concentration 75th Percentile
Ferritin	ferritin_unadj_90percentile	Unadjusted ferritin concentration 90th Percentile
Ferritin	ferritin_unadj_p5_r	Unadjusted ferritin concentration prevalence <5 µg/L
Ferritin	ferritin_unadj_p5_se	Unadjusted standard error of ferritin concentration prevalence <5 µg/L
Ferritin	ferritin_unadj_p5_ll	Unadjusted Lower 95% confidence limit of ferritin concentration prevalence <5 µg/L
Ferritin	ferritin_unadj_p5_ul	Unadjusted Upper 95% confidence limit of ferritin concentration prevalence <5 µg/L
Ferritin	ferritin_unadj_p10_r	Unadjusted ferritin concentration prevalence <10 µg/L
Ferritin	ferritin_unadj_p10_se	Unadjustd standard error of ferritin concentration prevalence <10µg/L
Ferritin	ferritin_unadj_p10_ll	Unadjusted Lower 95% confidence limit of ferritin concentration prevalence <10 µg/L

Biomarker	Group or Variable	Description or variable values
Ferritin	ferritin_unadj_p10_ul	Unadjusted Upper 95% confidence limit of ferritin concentration prevalence <10 µg/L
Ferritin	ferritin_unadj_p12_r	Unadjusted ferritin concentration prevalence <12 µg/L
Ferritin	ferritin_unadj_p12_se	Unadjustd standard error of ferritin concentration prevalence <12 µg/L
Ferritin	ferritin_unadj_p12_ll	Unadjusted Lower 95% confidence limit of ferritin concentration prevalence <12 µg/L
Ferritin	ferritin_unadj_p12_ul	Unadjusted Upper 95% confidence limit of ferritin concentration prevalence <12 µg/L
Ferritin	ferritin_unadj_p15_r	Unadjusted ferritin concentration prevalence <15 µg/L
Ferritin	ferritin_unadj_p15_se	Unadjustd standard error of ferritin concentration prevalence <15 µg/L
Ferritin	ferritin_unadj_p15_ll	Unadjusted Lower 95% confidence limit of ferritin concentration prevalence <15 µg/L
Ferritin	ferritin_unadj_p15_ul	Unadjusted Upper 95% confidence limit of ferritin concentration prevalence <15 µg/L
Ferritin	ferritin_unadj_p30_r	Unadjusted ferritin concentration prevalence <30 µg/L
Ferritin	ferritin_unadj_p30_se	Unadjustd standard error of ferritin concentration prevalence <30 µg/L
Ferritin	ferritin_unadj_p30_ll	Unadjusted Lower 95% confidence limit of ferritin concentration prevalence <30 µg/L
Ferritin	ferritin_unadj_p30_ul	Unadjusted Upper 95% confidence limit of ferritin concentration prevalence <30 µg/L
Ferritin	ferritin_unadj_p70_r	Unadjusted ferritin concentration prevalence <70 µg/L
Ferritin	ferritin_unadj_p70_se	Unadjustd standard error of ferritin concentration prevalence <70 µg/L
Ferritin	ferritin_unadj_p70_ll	Unadjusted Lower 95% confidence limit of ferritin concentration prevalence <70 µg/L
Ferritin	ferritin_unadj_p70_ul	Unadjusted Upper 95% confidence limit of ferritin concentration prevalence <70 µg/L
Ferritin	ferritin_unadj_p100_r	Unadjusted ferritin concentration prevalence <100 µg/L
Ferritin	ferritin_unadj_p100_se	Unadjustd standard error of ferritin concentration prevalence <100 µg/L
Ferritin	ferritin_unadj_p100_ll	Unadjusted Lower 95% confidence limit of ferritin concentration prevalence <100 µg/L
Ferritin	ferritin_unadj_p100_ul	Unadjusted Upper 95% confidence limit of ferritin concentration prevalence <100 µg/L
Ferritin	ferritin_unadj_p150_r	Unadjusted ferritin concentration prevalence <150 µg/L
Ferritin	ferritin_unadj_p150_se	Unadjustd standard error of ferritin concentration prevalence <150 µg/L
Ferritin	ferritin_unadj_p150_ll	Unadjusted Lower 95% confidence limit of ferritin concentration prevalence <150 µg/L
Ferritin	ferritin_unadj_p150_ul	Unadjusted Upper 95% confidence limit of ferritin concentration prevalence <150 µg/L
Ferritin	ferritin_unadj_p200_r	Unadjusted Unadjusted ferritin concentration prevalence <200 µg/L
Ferritin	ferritin_unadj_p200_se	Unadjustd standard error of ferritin concentration prevalence <200 µg/L
Ferritin	ferritin_unadj_p200_ll	Unadjusted Lower 95% confidence limit of ferritin concentration prevalence <200 µg/L
Ferritin	ferritin_unadj_p200_ul	Unadjusted Upper 95% confidence limit of ferritin concentration prevalence <200 µg/L
Ferritin	ferritin_unadj_p500_r	Unadjusted ferritin concentration prevalence <500 µg/L
Ferritin	ferritin_unadj_p500_se	Unadjustd standard error of ferritin concentration prevalence <500 µg/L
Ferritin	ferritin_unadj_p500_ll	Unadjusted Lower 95% confidence limit of ferritin concentration prevalence <500 µg/L
Ferritin	ferritin_unadj_p500_ul	Unadjusted Upper 95% confidence limit of ferritin concentration prevalence <500 µg/L

Biomarker	Group or Variable	Description or variable values
Ferritin	ferritin_adj_pop	Weighted sample size (Adjusted ferritin)
Ferritin	ferritin_adj_unwpop	weighted sample size (Adjusted ferritin)
Ferritin	ferritin_adj_mean	Adjusted ferritin concentration mean
Ferritin	ferritin_adj_mean_sd	Adjusted ferritin concentration standard deviation
Ferritin	ferritin_adj_mean_ll	Adjusted Lower 95% confidence limit of the ferritin concentration mean
Ferritin	ferritin_adj_mean_ul	Adjusted Upper 95% confidence limit of the ferritin concentration mean
Ferritin	ferritin_adj_geomean	Adjusted ferritin concentration geometric mean
Ferritin	ferritin_adj_geomean_ll	Adjusted Lower 95% confidence limit of the ferritin concentration geometric mean
Ferritin	ferritin_adj_geomean_ul	Adjusted Upper 95% confidence limit of the ferritin concentration geometric mean
Ferritin	ferritin_adj_10percentile	Adjusted ferritin concentration 10th Percentile
Ferritin	ferritin_adj_25percentile	Adjusted ferritin concentration 25th Percentile
Ferritin	ferritin_adj_50percentile	Adjusted ferritin concentration 50th Percentile
Ferritin	ferritin_adj_75percentile	Adjusted ferritin concentration 75th Percentile
Ferritin	ferritin_adj_90percentile	Adjusted ferritin concentration 90th Percentile
Ferritin	ferritin_adj_p5_r	Adjusted ferritin concentration prevalence <5 µg/L
Ferritin	ferritin_adj_p5_se	Adjusted standard error of ferritin concentration prevalence <5 µg/L
Ferritin	ferritin_adj_p5_ll	Adjusted Lower 95% confidence limit of ferritin concentration prevalence <5 µg/L
Ferritin	ferritin_adj_p5_ul	Adjusted Upper 95% confidence limit of ferritin concentration prevalence <5 µg/L
Ferritin	ferritin_adj_p10_r	Adjusted ferritin concentration prevalence <10 µg/L
Ferritin	ferritin_adj_p10_se	Adjusted standard error of ferritin concentration prevalence <10µg/L
Ferritin	ferritin_adj_p10_ll	Adjusted Lower 95% confidence limit of ferritin concentration prevalence <10 µg/L
Ferritin	ferritin_adj_p10_ul	Adjusted Upper 95% confidence limit of ferritin concentration prevalence <10 µg/L
Ferritin	ferritin_adj_p12_r	Adjusted ferritin concentration prevalence <12 µg/L
Ferritin	ferritin_adj_p12_se	Adjustd standard error of ferritin concentration prevalence <12 µg/L
Ferritin	ferritin_adj_p12_ll	Adjusted Lower 95% confidence limit of ferritin concentration prevalence <12 µg/L
Ferritin	ferritin_adj_p12_ul	Adjusted Upper 95% confidence limit of ferritin concentration prevalence <12 µg/L
Ferritin	ferritin_adj_p15_r	Adjusted ferritin concentration prevalence <15 µg/L
Ferritin	ferritin_adj_p15_se	Adjusted standard error of ferritin concentration prevalence <15 µg/L
Ferritin	ferritin_adj_p15_ll	Adjusted Lower 95% confidence limit of ferritin concentration prevalence <15 µg/L
Ferritin	ferritin_adj_p15_ul	Adjusted Upper 95% confidence limit of ferritin concentration prevalence <15 µg/L
Ferritin	ferritin_adj_p30_r	Adjusted ferritin concentration prevalence <30 µg/L
Ferritin	ferritin_adj_p30_se	Adjusted standard error of ferritin concentration prevalence <30 µg/L
Ferritin	ferritin_adj_p30_ll	Adjusted Lower 95% confidence limit of ferritin concentration prevalence <30 µg/L

Biomarker	Group or Variable	Description or variable values
Ferritin	ferritin_adj_p30_ul	Adjusted Upper 95% confidence limit of ferritin concentration prevalence <30 µg/L
Ferritin	ferritin_adj_p70_r	Adjusted ferritin concentration prevalence <70 µg/L
Ferritin	ferritin_adj_p70_se	Adjustedstandard error of ferritin concentration prevalence <70 µg/L
Ferritin	ferritin_adj_p70_ll	Adjusted Lower 95% confidence limit of ferritin concentration prevalence <70 µg/L
Ferritin	ferritin_adj_p70_ul	Adjusted Upper 95% confidence limit of ferritin concentration prevalence <70 µg/L
Ferritin	ferritin_adj_p100_r	Adjusted ferritin concentration prevalence <100 µg/L
Ferritin	ferritin_adj_p100_se	Adjusted standard error of ferritin concentration prevalence <100 µg/L
Ferritin	ferritin_adj_p100_ll	Adjusted Lower 95% confidence limit of ferritin concentration prevalence <100 µg/L
Ferritin	ferritin_adj_p100_ul	Adjusted Upper 95% confidence limit of ferritin concentration prevalence <100 µg/L
Ferritin	ferritin_adj_p150_r	Adjusted ferritin concentration prevalence <150 µg/L
Ferritin	ferritin_adj_p150_se	Adjusted standard error of ferritin concentration prevalence <150 µg/L
Ferritin	ferritin_adj_p150_ll	Adjusted Lower 95% confidence limit of ferritin concentration prevalence <150 µg/L
Ferritin	ferritin_adj_p150_ul	Adjusted Upper 95% confidence limit of ferritin concentration prevalence <150 µg/L
Ferritin	ferritin_adj_p200_r	Adjusted ferritin concentration prevalence <200 µg/L
Ferritin	ferritin_adj_p200_se	Adjusted standard error of ferritin concentration prevalence <200 µg/L
Ferritin	ferritin_adj_p200_ll	Adjusted Lower 95% confidence limit of ferritin concentration prevalence <200 µg/L
Ferritin	ferritin_adj_p200_ul	Adjusted Upper 95% confidence limit of ferritin concentration prevalence <200 µg/L
Ferritin	ferritin_adj_p500_r	Adjusted ferritin concentration prevalence <500 µg/L
Ferritin	ferritin_adj_p500_se	Adjusted standard error of ferritin concentration prevalence <500 µg/L
Ferritin	ferritin_adj_p500_ll	Adjusted Lower 95% confidence limit of ferritin concentration prevalence <500 µg/L
Ferritin	ferritin_adj_p500_ul	Adjusted Upper 95% confidence limit of ferritin concentration prevalence <500 µg/L