Draft for review; methodology and results previously validated by NSA

Nutritional Status among Children Under Five Years of Age

Supplement to the 2015/16 Namibia Household Income Expenditure Survey

December 2019

Draft for review; methodology and results previously validated by NSA

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1. Introduction and Survey Methodology

The Namibia Household Income and Expenditure Survey (NHIES) is a household survey designed to measure living conditions that is conducted approximately every five years by the Namibia Statistics Agency (NSA). The 2015/16 NHIES was the fourth edition of the survey. The objectives of the 2015/16 NHIES were to measure patterns of consumption and income, and to measure other socio-economic indicators. The 2015/16 survey sampled 10,368 households from April 2015 to March 2016. The survey provided representative data for the national level and for each of the 14 regions in the country. In addition, the sampling strategy made national level data representative in each of the four quarters of data collection. The full survey methodology is available in the main survey report[1].

After consultations with numerous stakeholders, NSA designed the 2015/16 NHIES questionnaire to collect a wide range of variables to satisfy user needs. All variables could not be analyzed and included in the main survey report; and NSA made the survey data publicly available to facilitate secondary analysis and use of the data[2]. The survey questionnaire included food security elements and enumerators measured the weight and height of children under five years of age to allow for estimation of child nutritional status. This supplement analyzed child measurements to provide estimates of child nutritional status in 2015/16, and to analyze trends over time[3].

1.1. Anthropometry response rate, sample selection and data analysis

The 2015/16 NHIES individual dataset had a total of 41,581 people, including 6,205 children who were under 5 years of age, and thus eligible to be measured. Enumerators measured 5,741 children, giving an overall response rate of 92.5% for child anthropometry. Analysis for this supplement followed methodology used in Demographic and Health Surveys[4], which excludes children who do not have a valid measurement date and date of birth. After excluding children without a measurement date (n=0) and children without a date of birth (n=774), the total number of children remaining for analysis was 4,960. A detailed flow chart for sample selection is included in the appendix of this report.

To estimate child nutritional status, we compared the weight and height of children included in the sample to the 2006 World Health Organization (WHO) Child Growth Standards. The analysis of measurements used SPSS macros provided by WHO, with sampling errors calculated using SPSS *Complex Samples* to account for cluster sampling in the NHIES. For trend analysis, all estimates of nutritional status are based on the 2006 WHO Child Growth Standards.

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[1] NSA. Namibia Household Income and Expenditure Survey (NHIES) 2015/16 Report. Windhoek: NSA; 2018.
[2] Data available from the NSA Central Data Catalogue: https://nsa.org.na/page/central-data-catalogue/
[3] Data retrieved from DHS StatCompiler: https://www.statcompiler.com/en/
[4] Croft, Trevor N., Aileen M. J. Marshall, Courtney K. Allen, et al. 2018. Guide to DHS Statistics. Rockville, Maryland, USA: ICF.

The background characteristic variables used to disaggregate estimates of nutritional status followed definitions used in the 2015/16 NHIES. Categorization of wealth relied on Adjusted Per Capita Income (APCI), which is based on consumption. Detailed methods for all analyses are included in the appendix of this report.

2. Child nutritional status

2.1. 2015/16 nutritional status among children under five years of age

The 2015/16 NHIES collected anthropometric data on the height and weight of children under five years of age. Of the 4,960 children with analyzed measurements, WHO cutoffs for biological plausibility flagged 8.7% as implausible. In the 2013 Namibia Demographic and Health Survey (NDHS), WHO cutoffs flagged 12% of children for biologically implausible measurements[5]. After excluding children with flagged measurements, the final sample for the 2015/16 NHIES was 4,780 children for height-for-age; 4,637 children for weight-for-height; and 4,873 children for weight-for-age.

Table 1 shows child nutritional status (height-for-age, weight-for-height, and weight-for-age) by background characteristics. 30.3% of all children were stunted (height-for-age <-2 standard deviations (SD)), or too short for their age. Stunting is generally considered an indicator of chronic, or long-term, undernutrition. As expected, stunting prevalence increased with child age, and the younger age groups had the lowest prevalence. Rural areas had a greater proportion of stunted children than urban areas, at 34.4% and 25.4% respectively. There was large variation in stunting prevalence by region, ranging from a high of 42% in Omusati to a low of 18.5% in Erongo.

11.2% of all children were wasted (weight-for-height <-2 SD), or too thin for their height. Wasting is generally considered an indicator of acute, or short-term, undernutrition. Out of the 14 regions, 8 regions had a proportion of over 10% for wasting.

19.6% of all children were underweight (weight-for-age <-2 SD), or weighed too little for their age. Underweight is an indicator that captures both chronic and acute undernutrition. Zambezi Region had a notable low prevalence of underweight (9.1%), and it was the only region with underweight prevalence below 10%.

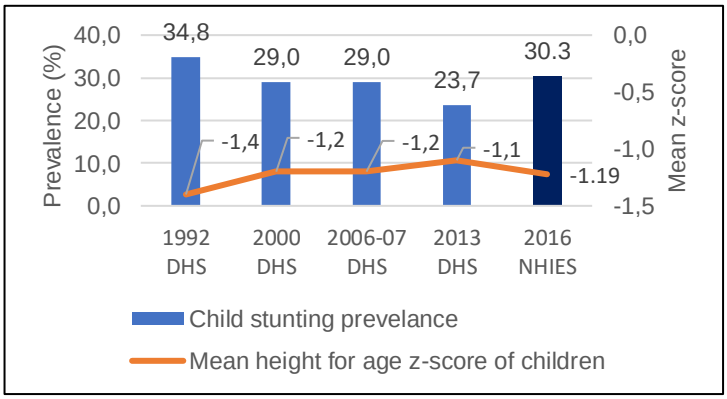
There were four categories of wealth: food poor, severely poor, poor, and non-poor. Food poor households were the most impoverished households, followed by severely poor and poor. For all indicators of undernutrition (stunting, wasting and underweight), prevalence was higher among children in impoverished households compared to children in non-poor households, showing a clear association between poverty and undernutrition. Prevalence of stunting, wasting and underweight among children in food poor households was close to 10 percentage points higher than prevalence among children in non-poor households (37% vs 28% for stunting, 17% vs 11% for wasting, and 29% vs 18% for underweight).

[5] The Nambia Ministry of Health and Social Services (MoHSS) and ICF International. 2014. *The Namibia Demographic and Health Survey 2013*. Windhoek, Namibia, and Rockville, Maryland, USA: MoHSS and ICF International.

2.2. 1992-2016 trends in nutritional status among children under age 5

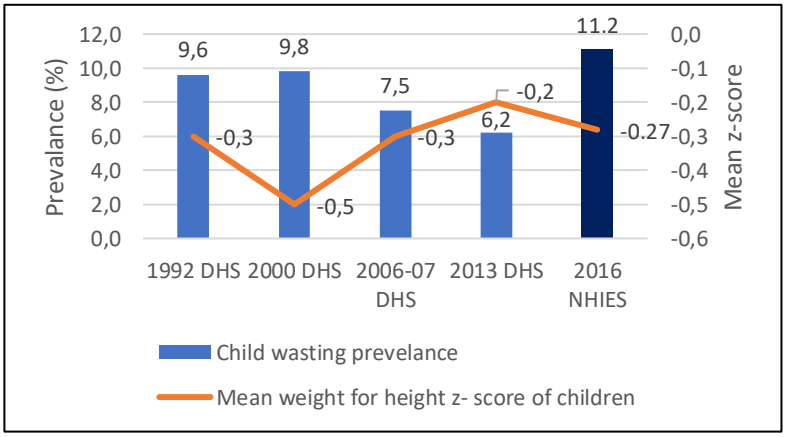
Over the last 30 years the main source of data used to estimate national prevalence of child malnutrition was the Namibia Demographic and Health Survey (NDHS). This section presents trends of child stunting, wasting, underweight, and mean z-score of anthropometric indices across two types of surveys: the NDHS (1992, 2000, 2006/07, 2013) and the NHIES (2015/2016). The NHIES was conducted by Namibia Statistics Agency while Ministry of Health and Social Services was the lead institution for NDHS. Methodological differences need to be considered when comparing estimates from the two survey types. For nutrition, one important difference in methodology was that NHIES collected data throughout the year, while NDHS collected data over a three- or four-month period that was outside of the lean season. Seasonality may have affected the trends presented in this report. Another important consideration when analyzing trends over time is that prevalence estimates for undernutrition indicators can be affected by data quality. Changes in the quality of measurement can influence prevalence trends. Mean z-score is not as sensitive as prevalence to changes in measurement quality, which is why it is important to consider mean z-score trends for correct interpretation of changes in child nutritional status over time.

Figure 1. National trends in child height.
Among children under 5 years of age; 1992-2013 Demographic and Health Surveys (DHS) and 2015-16 Namibia Household Income & Expenditure Survey (NHIES)



For child height, stunting prevalence and mean height-for-age z-score showed similar trends (**Fig 1**). There was moderate improvement from 1992 to 2000, followed by stagnation from 2000 to 2006/07, and slight improvement from 2006/07 to 2013. The stunting prevalence and mean height-for-age z-score from the 2015/16 NHIES were similar to the levels found in the 2000 and 2006/07 NDHS.

***Figure 2* National trends in child weight for height.**
Among children under 5 years of age; 1992-2013 Demographic and Health Surveys (DHS) and 2015-16 Namibia Household Income & Expenditure Survey (NHIES)



From 1992 to 2013, the mean weight-for-height z-score ranged from -0.5 to -0.2 according to the NDHS (**Fig 2**). The mean weight-for-height z-score from the 2015/16 NHIES, -0.28, was similar to the mean found in the 2006/07 NDHS. However, the wasting prevalence from the 2015/16 NHIES, 11%, was higher than all four survey rounds of the

NDHS. It is important to note that wasting prevalence, a measure of acute undernutrition, can be sensitive to both seasonal changes in food security and changes in data quality.

For child weight, mean weight-for-age z-score and underweight prevalence showed a similar trend: there was slow, steady improvement from 1992 to 2013 according to the NDHS (**Fig 3**). The mean weight-for-age z-score and underweight prevalence from the 2016 NHIES were similar to the levels found in the 2000 NDHS.

Figure 3. **National trends in child weight for age.**
Among children under 5 years of age; 1992-2013 Demographic and Health Surveys (DHS) and 2015-16 Namibia Household Income & Expenditure Survey (NHIES)

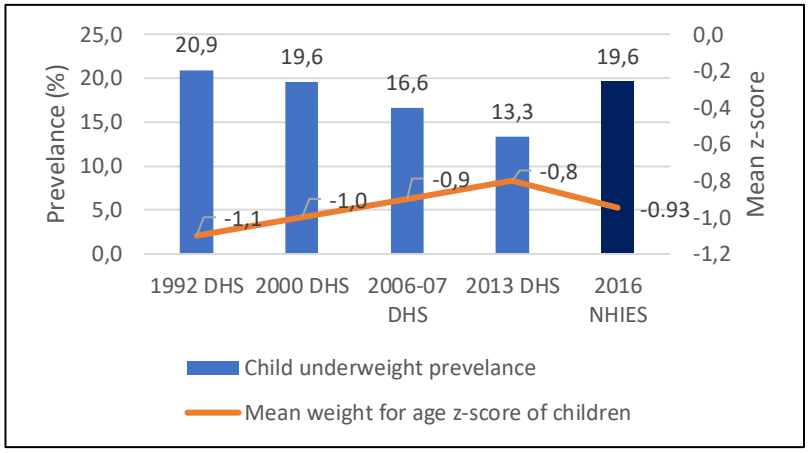


Table 1. Nutritional status of children

Percentage of children under 5 as malnourished according to three anthropometric indices of nutritional status: height-for age, weight-for-height, and weight-for-age, by background characteristics, Namibia 2016

	Height-for-age[1]				Weight-for-height				Weight-for age				
Background characteristic	Percent - age below -3 SD	Percent - age below -2 SD[2]	Mean Z-score (SD)	Number of children	Percent - age below -3 SD	Percent - age below -2 SD[2]	Percent - age above +2 SD	Mean Z-score (SD)	Number of children	Percent - age below -3 SD	Percent - age below -2 SD[2]	Mean Z-score (SD)	Number of children
Age in months													
<6	10.1	21.8	-0.32	491	7.2	16.5	12.8	-0.16	459	7.5	17.1	-0.56	522
6-8	8.0	15.3	-0.14	252	5.6	14.2	8.2	-0.37	249	10.7	19.9	-0.79	274
9-11	10.7	25.3	-0.74	254	4.4	13.0	9.6	-0.13	254	3.6	18.7	-0.54	268
12-17	18.3	33.6	-1.29	526	6.3	13.7	8.0	-0.27	504	8.6	19.4	-0.81	525
18-23	16.8	38.1	-1.47	465	4.1	9.9	8.9	-0.03	460	10.8	21.7	-0.93	478
24-35	16.4	37.3	-1.59	896	3.5	8.9	6.3	-0.16	887	6.8	20.1	-1.01	914
36-47	10.9	31.3	-1.42	906	2.9	9.6	4.2	-0.31	872	7.3	19.0	-1.07	897
48-59	8.6	27.2	-1.25	990	2.4	10.0	3.8	-0.50	952	5.7	20.1	-1.14	992
Sex													
Male	14.0	32.2	-1.28	2,464	3.7	10.7	7.4	-0.22	2,381	7.3	19.2	-0.93	2,509
Female	11.0	28.4	-1.09	2,316	4.3	11.6	6.1	-0.32	2,256	7.5	20.0	-0.93	2,363
Residence													
Urban	10.0	25.4	-0.93	2,161	4.7	11.8	8.2	-0.16	2,041	6.6	17.6	-0.70	2,198
Rural	14.8	34.4	-1.40	2,619	3.5	10.6	5.6	-0.35	2,596	8.0	21.2	-1.12	2,674
Region													
Erongo	5.6	18.5	-0.77	284	3.8	7.5	6.8	0.16	267	6.5	14.9	-0.44	288
Hardap	17.2	30.1	-1.21	185	5.4	13.7	5.5	-0.28	167	5.7	21.1	-0.75	187
//Karas	10.3	25.4	-0.86	169	7.1	21.4	11.3	-0.36	160	7.9	19.5	-0.67	173
Kavango East	13.7	31.6	-1.14	353	8.7	14.6	5.2	-0.42	342	8.0	18.8	-1.02	359
Kavango West	8.6	28.2	-1.00	252	3.9	10.4	3.0	-0.46	248	3.6	16.5	-0.95	253
Khomas	10.9	26.7	-0.98	738	5.2	14.1	10.1	-0.21	689	8.0	18.7	-0.78	754

Kunene	8.6	27.9	-1.13	206	5.4	8.6	7.2	-0.26	202	6.5	15.1	-0.84	205
Ohangwena	17.0	37.6	-1.51	623	2.5	7.7	5.6	-0.31	622	8.1	21.6	-1.13	640
Omaheke	8.7	30.4	-1.14	163	1.8	8.4	5.4	-0.20	158	5.3	20.2	-0.67	164
Omusati	19.8	42.0	-1.73	532	1.4	9.2	6.7	-0.25	533	5.9	24.5	-1.2	540
Oshana	9.9	24.5	-1.12	380	1.7	6.2	5.6	-0.27	369	5.7	16.4	-0.91	386
Oshikoto	12.3	29.7	-1.26	386	4.4	15.0	4.5	-0.52	380	12.9	24.9	-1.32	402
Otjozondjupa	13.1	31.5	-1.14	315	4.5	13.0	7.7	-0.22	312	8.4	22.2	-0.93	322
Zambezi	8.3	24.6	-0.87	193	3.9	10.1	9.6	-0.02	187	5.6	9.1	-0.55	197
Main languages spoken													
Khoisan	40.7	68.2	-2.61	79	5.2	19.0	3.1	-0.85	81	26.3	58.4	-2.22	83
Zambezi languages	5.9	21.6	-0.71	192	5.3	13.0	11.1	-0.03	188	6.6	10.1	-0.51	196
Otjiherero	8.5	27.4	-0.92	446	4.9	11.1	9.2	-0.12	421	5.5	15.1	-0.61	446
Rukavango	11.9	28.3	-1.08	702	6.5	13.4	4.4	-0.41	681	6.5	16.8	-0.95	711
Nama/Damara	10.4	30.9	-1.24	553	4.9	10.5	5.4	-0.31	525	7.3	20.5	-0.95	553
Oshiwambo	13.9	32.2	-1.31	2,369	3.0	10.6	5.9	-0.32	2,323	8.2	22.0	-1.08	2,436
Afrikaans	12.2	25.8	-0.97	271	4.9	10.3	12.9	0.17	251	3.1	10.9	-0.31	276
Other	9.9	18.6	-0.71	167	0.9	7.6	13.3	0.23	166	2.1	10.7	-0.29	171
Wealth													
Food-poor	16.8	37.0	-1.47	289	5.6	17.3	4.2	-0.59	277	13.1	28.7	-1.41	290
Severely-poor[3]	18.2	41.2	-1.55	566	5.2	15.0	3.6	-0.50	545	10.9	27.0	-1.36	565
Poor[4]	18.1	39.0	-1.52	926	4.3	12.7	4.3	-0.43	906	8.9	24.7	-1.25	936
Non-poor	11.3	28.3	-1.11	3,854	4.0	10.8	7.3	-0.23	3,731	7.0	18.4	-0.85	3,936
Total	12.6	30.3	-1.19	4,780	4.0	11.2	6.7	-0.27	4,637	7.4	19.6	-0.93	4,872

Notes: Table is based on children who stayed in the household on the night before the interview. Table is based on children with valid dates on birth (month and year) and valid measurement of both height and weight. Each of the indices is expressed in standard deviation units (SD) from the median of the WHO Child Growth Standards. Wealth is classified by poverty cutoffs (current ND/adult/year): food-poor <N$3,517.20, severely-poor <N$4,671.60, poor <N$6,249.60, and non-poor >N$6,249.60.

[1]Recumbent length was measured for children under age 2 and in the few cases when the age of the child was unknown and the child was less than 85 cm; standing height was measured for all other children.

[2]Includes children who are below -3 standard deviations.

[3]Includes children who are food-poor.

[4]Includes children who are severely-poor and food-poor.

Appendix

1. Data quality and sampling errors

Table 2. Z-score standard deviation of anthropometric indices by age group

Age group (months)		Anthropometric Index		
		Length/height-for-age z-score	Weight-for-length/height z-score	Weight-for-age z-score
0-11	Mean	-0.38	-0.21	-0.61
	N	997	962	1064
	Std. Deviation	2.09	1.80	1.63
12-23	Mean	-1.37	-0.15	-0.86
	N	991	964	1003
	Std. Deviation	1.78	1.65	1.59
24-35	Mean	-1.59	-0.16	-1.01
	N	896	887	914
	Std. Deviation	1.56	1.45	1.40
36-59	Mean	-1.33	-0.41	-1.11
	N	1896	1824	1890
	Std. Deviation	1.44	1.34	1.27
0-59	Mean	-1.19	-0.27	-0.93
	N	4780	4637	4872
	Std. Deviation	1.74	1.54	1.46

Table 3. National level sample error for anthropometric indices and indicators

	Estimate	Standard Error	95% Confidence Interval		Coefficient of Variation	Population Size	Unweighted Count
			Lower	Upper			
Length/height-for-age z-score	-1.189	0.038	-1.263	-1.115	-0.032	4780	4793
Stunted (<-2SD)	30.340	0.933	28.507	32.174	0.031	4780	4793
Severely stunted (<-3SD)	12.589	0.699	11.217	13.961	0.055	4780	4793
Weight-for-length/height z-score	-0.267	0.035	-0.335	-0.199	-0.130	4637	4683
Wasted (<-2SD)	11.153	0.618	9.939	12.367	0.055	4637	4683
Severely wasted (<-3SD)	4.038	0.384	3.284	4.792	0.095	4637	4683
Weight-for-age z-score	-0.929	0.032	-0.993	-0.866	-0.035	4872	4890
Underweight (<-2SD)	19.583	0.840	17.933	21.232	0.043	4872	4890
Severely underweight (<-3SD)	7.372	0.516	6.359	8.385	0.070	4872	4890

2. Detailed Methods

2.1 Nutritional status indicator guidelines

To the extent possible, analysis for the creation of nutrition indicators followed the methodology used in Demographic and Health Surveys. However, the 2015/16 NHIES did not include a variable for whether or not the child slept in the household the night before the survey. In DHS methodology, only children who slept in the household are included in the sample for analysis of nutritional status. For this supplement, we did not consider whether or not the child slept in the household the night before the survey. In addition, common practice for measuring height and length is to measure to the nearest 1/10th of a centimeter; the 2015/16 NHIES rounded height and length measurements to the nearest centimeter.

The remainder of this section specifies how nutrition indicators were calculated for this supplement, including percentage of children stunted, wasted, and underweight, and mean z-scores for anthropometric indices[6].

Definition of indicators

1) Percentage of children under 5 years of age, by nutritional status:
    a. Stunted
    b. Wasted and overweight
    c. Underweight for age
2) Mean z-score for height-for-age, weight-for-height, and weight-for-age.

Composition of indicators

Population base: Living children born 0-59 months (individual file)

Time period: Current status at time of survey

Numerators:

Stunting:

1) Severely stunted: Number of children whose height-for-age z-score is below minus 3 (-3.0) standard deviations (SD) below the mean on the WHO Child Growth Standards (hcw5 < -300)
2) Moderately or severely stunted: Number of children whose height-for-age z-score is below minus 2 (-2.0) standard deviations (SD) below the mean on the WHO Child Growth Standards (hcw5 < -200)
3) Mean z-score for height-for-age: Sum of the z-scores of children with a non-flagged height for age score (Σ hcw5/100, if hcw5 < 999.99)

Wasting:

[6] Adapted from: Croft, Trevor N., Aileen M. J. Marshall, Courtney K. Allen, et al. 2018. Guide to DHS Statistics. Rockville, Maryland, USA: ICF

4) Severely wasted: Number of children whose weight-for-height z-score is below minus 3 (-3.0) standard deviations (SD) below the mean on the WHO Child Growth Standards (hcw11 < -300)
5) Moderately or severely wasted: Number of children whose weight-for-height z-score is below minus 2 (-2.0) standard deviations (SD) below the mean on the WHO Child Growth Standards (hcw11 < -200)
6) Overweight: Number of children whose weight-for-height z-score is above plus 2 (+2.0) standard deviations (SD) above the mean on the WHO Child Growth Standards (hcw11 > 200 & hcw11 < 999.99)
7) Mean z-score for weight for height: Sum of the z-scores of children with a non-flagged weight for height score (Σ hcw11/100, if hcw11 < 999.99)

Underweight and overweight for age:

8) Severely underweight: Number of children whose weight-for-age z-score is below minus 3 (-3.0) standard deviations (SD) below the mean on the WHO Child Growth Standards (hcw8 < -300)
9) Moderately underweight: Number of children whose weight-for-age z-score is below minus 2 (-2.0) standard deviations (SD) below the mean on the WHO Child Growth Standards (hcw8 < -200)
10) Overweight for age: Number of children whose weight-for-age z-score is above plus 2 (+2.0) standard deviations (SD) above the mean on the WHO Child Growth Standards (hcw8 > 200 & hcw8 < 999.99)
11) Mean z-score for weight for age: Sum of the z-scores of children with a non-flagged weight for age score (Σ hcw8/100, if hcw8 < 999.99)

Denominators:

Number of living children between ages 0 and 59 months (hcw1 in 0:59) who have:

1) Stunting: valid non-flagged height for age z-scores (hcw5< 999.99)
2) Wasting and overweight: valid non-flagged weight for height z-scores (hcw11< 999.99)
3) Underweight and overweight for age: valid non-flagged weight for age z-scores (hcw8 < 999.99)

Variables: KR file.

agemonth	Child's age in months
htagesd	Height/Age standard deviation (new WHO)
wtagesd	Weight/Age standard deviation (new WHO)
wthtsd	Weight/Height standard deviation (new WHO)

Calculation of indicators

The assignment of anthropometric z-scores based on the WHO Child Growth Standards is done through a complicated interpolation function that takes into account sex, age (measured by difference in date of birth and date of interview, both precise to day of month), height in

centimeters, and weight in kilograms (precise to 100 grams). As part of the creation of a recode file, variables with the z-scores are calculated and included in that file. The z-scores are calculated using software based on the WHO Anthro program and the macros for statistical packages at http://www.who.int/childgrowth/software/en/.

In the process of assigning the z-scores, checks are made on their plausibility. Z-scores for height-for-age and weight-for-age are assigned special values to children with incomplete date of birth (month or year missing or "don't know") as the z-scores are sensitive to changes in age. Children with height-for-age z-scores below -6 SD or above +6 SD, with weight-for-age z-scores below -6 SD or above +5 SD, or with weight for height z-scores below -5 SD or above +5 SD are flagged as having invalid data.

The percentage of children stunted, wasted, and underweight are equal to the specific numerators divided by the appropriate denominators and multiplied by 100.

Handling of Missing Values

Children who were not weighed and measured and children whose values for weight and height were not recorded are excluded from both the denominators and the numerators. Children whose month or year of birth are missing or unknown are flagged and excluded from both the denominators and the numerators. Children who are flagged for out-of-range z-scores or invalid z-scores are excluded from both the denominator and the numerators.

Notes and Considerations

Stunting, based on a child's height and age, is a measure of chronic nutritional deficiency. Wasting, based on a child's weight and height, is a measure of acute nutritional deficiency. Underweight, based on weight and age, is a composite measure of both acute and chronic statuses. Overweight, based on weight and height, is a measure of excess weight than is optimally healthy.

From the total population, all children under 5 years of age were selected. From the children aged 0 to 59 months, all children who were measured and weighed were selected. Those who had recorded measurement dates and a date of birth were selected. The children with out-of-range age in months were excluded.

2.2 Background characteristics indicator guidelines

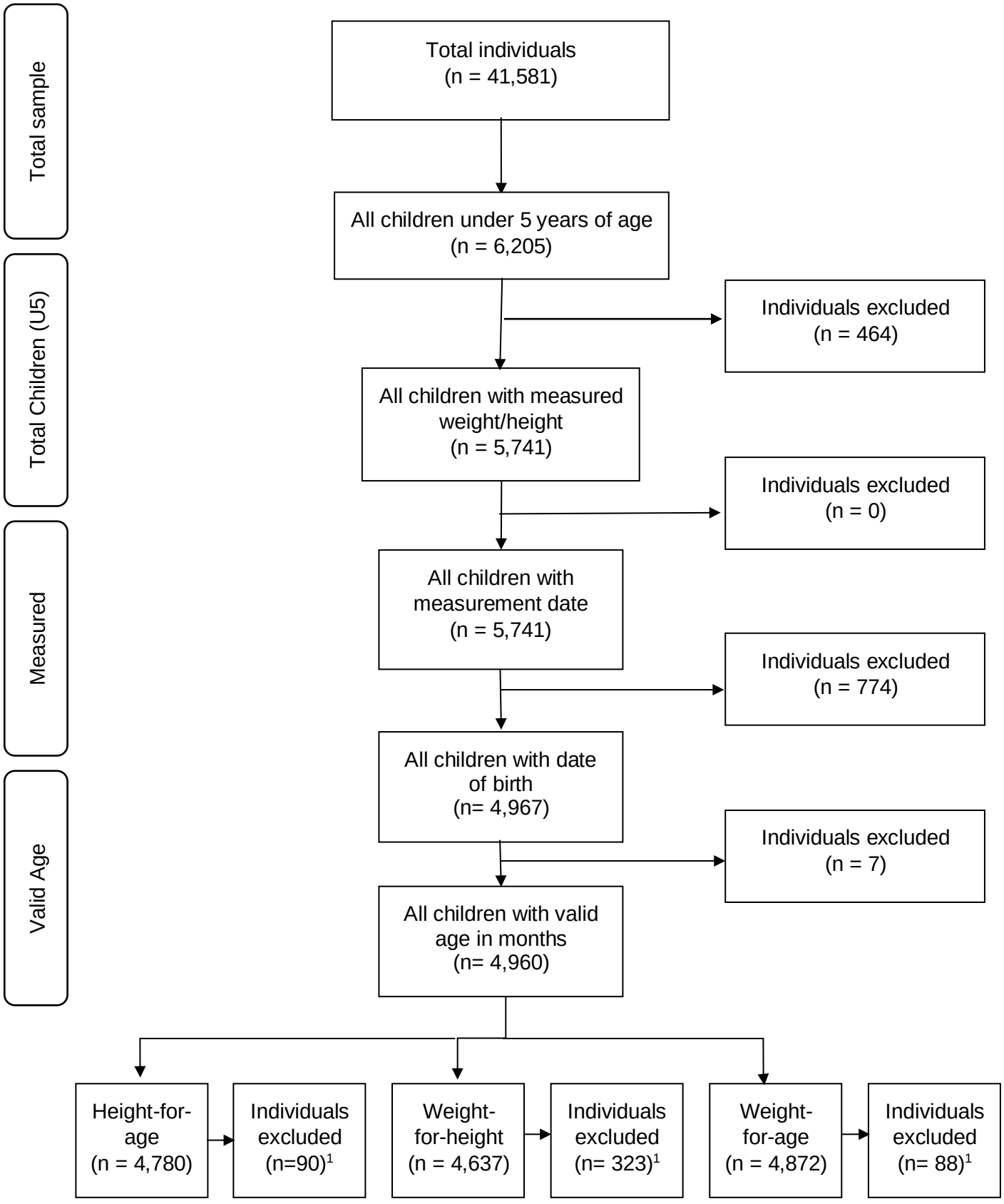
To the extent possible, this supplement included the same background characteristics as the previous Namibia Demographic and Health Surveys. Two notable differences were that for NHIES analysis we added a variable for "main language spoken," and the wealth categories in the two surveys were different. Wealth in the NDHS was based on household assets, while in the NHIES wealth was based on consumption. The background characteristic variables for this supplement that differ from NDHS are:

main_languages_collapsed	Main languages spoken
food_poor	Annual income expenditure of N$3517.20
severely_poor	Annual income expenditure of N$4671.60
poor	Annual income expenditure of N$6249.60

Households reported more than 10 languages as the main language spoken. To ensure sufficient sample size, languages were collapsed into 8 categories. The “other” category included Setswana, German, English, Other European, Other African and Other.

This supplement used the same indicators of wealth that were included in the main 2015/16 NHIES report. The wealth indicator was calculated using categories “food poor”, “severely poor”, and “poor”. These categories are based on adjusted per capita income (APCI), which is calculated from consumption reported at the household level. “Food-Poor” households were those with annual APCI below $3517.20. “Severely-Poor” was defined by the lower bound poverty line, which was an annual APCI below $4671.60. “Poor” was defined by the upper bound poverty line of $6249.60 per year, while “Non-Poor” was an income above the upper bound poverty line.

3. Sample selection flow chart



[1] Excluded due to flags, or out-of-range measurements