Ministry of Health
of the Republic of Uzbekistan

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UZBEKISTAN NUTRITION SURVEY REPORT

Tashkent – 2019

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Ministry of Health of the Republic of Uzbekistan

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ABBREVIATIONS

AGP	α-1-acid glycoprotein
BMI	Body mass index
BRINDA	Biomarkers Reflecting Inflammation and Nutritional Determinants of Anaemia
CI	Confidence Interval
CRP	C-reactive protein
DHS	Demographic and Health Survey
ELISA	Enzyme linked immunosorbent assay
HAZ	Height-for-age z-score
HPLC	High-pressure liquid chromatography
IYCF	Infant and young child feeding
MICS	Multiple Indicator Cluster Survey
MoH	Ministry of Health
MUAC	Mid-upper arm circumference
NPW	Non-pregnant women (15-49 years)
ppm	Parts per million
U5 children	Children less than 5 years of age
PSU	Primary sampling unit
PW	Pregnant women
QC	Quality control
UNICEF	United Nation's Children Fund
UNS	Uzbekistan Nutrition Survey
US CDC	US Centers of Disease Control and Prevention
WAZ	Weight-for-age z-score
WHO	World Health Organization
WHZ	Weight-for-height z-score

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Introduction

In Uzbekistan, the overall nutrition situation among children less than 5 years of age, women of reproductive age (15-49 years of age) and pregnant women has steadily improved over the past two decades, as trend data from the World Bank indicate [1]. A 2008 national survey found that among women of reproductive age, just over 34 percent were anaemic. The same survey found that iron and folate deficiencies affected 48 percent and 29 per cent, respectively, of the adult women. National data on anaemia prevalence in children <5 years of age, last assessed in 2002, was almost 50 percent and indicated a severe public health problem according to WHO classification. Data on other micronutrient deficiencies in women of reproductive age and children less than 5 years of age are scarce and apply to only limited geographic areas. A survey in 2002 found that overnutrition, rather than undernutrition, has become an important public health challenge in recent years in women in Uzbekistan, with an estimated 43 percent of women overweight and 17 percent obese.

Currently, salt and wheat flour are the two principal fortified food vehicles in Uzbekistan. Salt iodization has been mandatory since 2011, with a legally mandated level of 40 ± 15 mg iodine/kg salt. Wheat flour fortification focuses on first grade flour (extraction rate 75 per cent) produced by mills in Uzbekistan. The micronutrient premix also contains folic acid and zinc. As of 2007, it was estimated that fortified wheat flour was consumed by 61 percent of the population nationally.

Objectives

The objective of the UNS 2017 was to obtain updated and reliable information on the nutrition and micronutrient status of children 0-59 months of age (blood biomarker 6-59 months of age), non-pregnant women 15-49 years of age, and pregnant women in Uzbekistan, and to formulate evidence-based recommendations to improve the nutritional status of vulnerable groups.

Key nutrition variables assessed included anaemia, iron deficiency, and vitamin A deficiency in children 6-59 months of age and non-pregnant women. Anaemia was also assessed in pregnant women. Deficiencies in folate and vitamin B12 in non-pregnant women were assessed, as was iodine status in non-pregnant and pregnant women. Lastly, children under 5 years of age were assessed for wasting, stunting, overweight, and obesity, and non-pregnant women were assessed for overweight and obesity.

The UNS 2017 also assessed other variables that may potentially influence or cause various types of micronutrient deficiencies, such as socio-economic status, household food security, individual food consumption patterns, infant and child feeding and breastfeeding practices, intake of micronutrient supplements, and the consumption and coverage of adequately fortified salt and wheat flour.

Design

The UNS 2017 was a cross-sectional stratified survey based on a probability sample to produce estimates that have acceptable precision for priority indicators of nutritional status in children 0-59 months of age and non-pregnant women in each of the 14 regions of the country which were defined as different strata. For pregnant women, the UNS 2017 was designed to produce national estimates only.

A two-stage sampling procedure was conducted to randomly select households. In the first stage, 25 makhallas within each of the 14 strata were randomly selected with probability proportional to population size. For the UNS 2017, each makhalla served as a primary sampling unit (PSU). For the second stage of sampling, simple random sampling was used to select households in each PSU. The UNS 2017 survey was nationwide in scope, and collected data from four target groups: 1) households, 2) children aged 0-59 months (6-59 months for blood biomarkers), 3) non-pregnant women of child-bearing age (15-49 years of age), and 4) pregnant women.

As there were more non-pregnant women than needed, non-pregnant women 15-49 years of age were recruited from a randomly selected subsample of one-half of selected households.

Results

In this executive summary, only national estimates are presented, and Table 1 refers the reader to the corresponding table in the report that contains more detailed results.

Table 1. **Summary results of the Uzbekistan Nutrition Survey 2017**

Target group	Indicator[a]	Result	Table[b]
Household			
	Salt iodine ≥15 ppm	36.4%	Table 7
	Flour iron ≥ 30 ppm	29.9%	Table 9
Children less than 5 years of age (unless otherwise indicated)			
	Early initiation of breastfeeding (<24 months)	91.0%	Table 12
	Exclusive breastfeeding (<6 months)	50.7%	
	Minimum dietary diversity (6-23 months)	30.3%	
	Minimum meal frequency (6-23 months)	22.6%	
	Minimum acceptable diet (6-23 months)	5.4%	
	Ate iron-rich or iron-fortified food (6-23 months)	74.4%	
	Age appropriate breast feeding	55.1%	
	Bottle feeding	23.0%	
	Stunting[c]	8.7%	Table 14
	Wasting[c]	1.9%	Table 15
	Overweight or obese[c]	4.6%	Table 16
	Underweight	2.6%	Table 17
	Anaemia (6-59 months)	14.7%	Table 18
	Iron deficiency (6-59 months)	54.7%	
	Iron deficiency anaemia (6-59 months)	10.8%	
	Vitamin A deficiency (6-59 months)	6.4%	Table 21
All women			
	Has heard of fortified flour	26.3%	Table 23
	Has heard of iodized salt	93.8%	
Non-pregnant women			
	Meets minimum dietary diversity	40.4%	Table 25
	Underweight (low BMI)	6.3%	Table 26
	Overweight	25.2%	
	Obese	15.5%	
	Overweight or obese (combined)	40.7%	
	Anaemia	20.3%	Table 27
	Iron deficiency	40.5%	
	Iron deficiency anaemia	15.5%	
	Vitamin A deficiency	2.6%	Table 30
	Folate deficiency	44.6%	Table 31
	Vitamin B_{12} deficiency	19.1%	Table 32
	Urinary iodine median (µg/L)	135.3 µg/L	Table 33
Pregnant women			
	Meets minimum dietary diversity	51.3%	Table 35
	Undernutrition (low MUAC)	2.5%	-
	Anaemia	32.7%	Table 36
	Urinary iodine median (µg/L)	117.3	Table 37

[a] See text of method section for case definitions.
[b] Refer to the table indicated for more detailed analysis of the outcome, including group-specific results by age, region, wealth quintiles and other analyses.
[c] Estimates of all anthropometric indicators (except underweight) for children less than 5 years of age exclude Bukhara region due to quality issues in this region.

Discussion

Discussion of findings:

Over 90 percent percent of respondents at the household level reported using iodized salt, and this information was also confirmed by the label on the salt packages (80 per cent). However, quantitative salt analyses revealed a quite different picture: only 40 percent of salt samples were adequately iodized and salt samples labelled as "iodized" were less often adequately iodized than those that did not claim this or where the salt was not in its original package.

Overall, just about one third of wheat flour was fortified. That said, the legislation does not require all flour to be fortified, e.g. imported flour and certain locally produced flours are exempt.

Child stunting, wasting and underweight are low in Uzbekistan, and although child overweight is not yet considered to be of great public health relevance, the situation should be monitored. Anaemia prevalence in children less than 5 years of age is 15 percent nationally, but iron deficiency affects over half of children and almost ¾ of anaemia is likely due to iron deficiency. This implies that reducing iron deficiency will most likely reduce the anaemia prevalence in these children. Vitamin A deficiency is low with about 6 percent nationally, although regional differences exist.

While undernutrion in non-pregnant women is not common in Uzbekistan, the prevalence of overweight and obesity is considerable. Further, there is an important age pattern showing increased overweight/obesity with older age in women. Because previous assessments used different age ranges, it is difficult to estimate whether the prevalence of overweight or obesity has increased in recent years, but the present situation merits attention. Anaemia affects a fifth of non-pregnant women and as in young children, iron deficiency is very high with 80 percent of anaemia related to iron deficiency. There are regional differences for both anaemia and iron deficiency. Vitamin A deficiency is not very common in non-pregnant women in Uzbekistan, while folate deficiency affects about 40 percent of women and vitamin B12 deficiency about 20 per cent. Although on a national level, non-pregnant women are iodine sufficient, there are regions where iodine deficiency poses a problem. And importantly, the UNS 2017 found that women living in households without iodized salt are iodine deficient, while those from households with some iodine or adequate iodine levels are iodine sufficient.

One third of all pregnant women are anaemic, and approximately 40 percent of those in their 3rd trimester are anaemic. Nationally, pregnant women are considered iodine deficient, however those living in households with adequately iodized salt are iodine sufficient.

Strengths and limitations:

The UNS 2017 was designed to produce representative results for each of the 14 oblasts, and oblast-specific estimates were achieved due to high response rates. Prior to data collection, the lack of up-to-date census data required the research team to undertake the tedious process of obtaining makhalla-level population estimates. Despite these efforts, it is not possible to assess if this approach yielded a true reflection of the actual population in Uzbekistan since there are no recent census data for Uzbekistan to compare against.

The UNS 2017 used the HemoCue 301 to measure haemoglobin concentration. This device has been reported to yield lower anaemia prevalence than other similar devices (e.g. HemoCue 201+), but the fact that all blood samples are from venous collection likely reduced the bias found in studies comparing the results from capillary samples. Thus, anaemia estimates in the UNS 2017 are potentially lower than what would have been produced with an alternate measurement device. Nonetheless, there seems to be a trend of decreasing anaemia prevalence compared to the 2008 survey using the same haemoglobin measurements.

Quantitative analysis of salt iodine content allowed for a more accurate estimation of household coverage with adequately iodized salt than previous estimations. Additionally, collection of urine samples from women from half of the included households enabled correlations to be run between salt iodine content and urinary iodine concentration.

Of note, due to budgetary limitations, only women from half of the households could be included. This approach did not compromise the representativeness nor precision of the UNS 2017, but limited the data analyses on the mother-child pairs. Furthermore, the UNS 2017 did not collect specific information on infectious diseases or helminths and thus, contributions of these factors to nutrition and health could not be taken into consideration.

Good data quality for child anthropometric measurements was found in all regions except Bukhara. For this region, the data quality was not found acceptable, and was excluded from estimates on child stunting, wasting, underweight, and overweight.

Recommendations

1. **Strengthen salt iodization law enforcement:** women living in households with non-iodized salt are iodine deficient; iodization information on the label does not reflect salt iodine content, despite the legislation in place. Thus, the legislation should be enforced at the level of production, importation and distribution.

2. **Strengthen wheat flour fortification:** household coverage with adequately fortified samples is rather low. This is in part due a large proportion of flour samples for which fortification is not mandatory, in particular imported flour. Thus, wheat flour fortification standards should be updated to include all wheat flour for human consumption (including imported and all locally produced flour), and law enforcement should be strengthened to ensure better adherence to legislation. The recently updated flour fortification standard mandates inclusion of vitamin B12, so this deficiency should be reduced once coverage with fortified flour increases.

3. **Reduce overweight and obesity in non-pregnant women:** with a high proportion of overweight or obese women, this aspects merits attention. As the prevalence increases with age and this has been associated with parity in similar contexts, antenatal and postnatal care providers may be a good entry point for behavior change communication.

4. **Monitor prevalence of overweight and obesity in children:** although overweight prevalence in children is low compared to non-pregnant women, relevant stakeholders should consider monitoring of overweight and obesity in children in future nutrition and health assessments. In addition, stakeholders could design behavior change communication campaigns to instill 'good behaviors' in early age in an effort to prevent overweight and obesity from increasing in this group.

5. **Strengthen other strategies to tackle micronutrient deficiencies:** infant and young child feeding practices and dietary diversity in non-pregnant women should be further improved. This can happen through caregiver education antenatal and postnatal visits, as well as through school programmes. Although iron and folic acid supplement consumption in pregnant women was around 50 per cent, this coverage should be further raised to bridge potential nutrient gaps during periods of need. In particular, the provision of multiple micronutrient supplements rather than iron and folic acid supplements should be explored as cost-effective alternatives for all women and not only for pregnant women in rural areas. Similarly, because food fortification of staples may not be the most appropriate approach to reach young children 6-23 months of age due to their limited food intake relative to their micronutrient need, programmes to provide micronutrient powder may be envisioned for this age group, in particular in more vulnerable regions.

INTRODUCTION

1. INTRODUCTION

1.1 Country overview

Uzbekistan, a land-locked country in Central Asia, has a total population of 32.1 million as of early 2017 [2]. The country is comprised of 12 provinces or oblasts, the Republic of Karakalpakstan, and the capital city Tashkent. Since its independence from the former Soviet Union in 1991, Uzbekistan has made economic progress; between 2000 and 2017, Uzbekistan's human development index (HDI) value increased from 0.595 to 0.710, an increase of 19.3 percent, positioning the country at 105 out of 189 countries and territories [3].

The topography of Uzbekistan is dominated by arid zones, including the Kyzyl Kum mountain range. Vast lowlands are located in the country's west. Mountains and foothills, encompassing about a third of the republic, are in the east and south-east (Figure 1).

Figure 1. **Oblast and elevation map of Uzbekistan**

1.2 Nutritional situation of young children and women in Uzbekistan

While data on anaemia and child growth have been collected by multiple surveys over the past 20 years, data documenting the micronutrient status of Uzbekistan's women and children are scarce. A national survey done in 2008 using lot-quality assurance sampling found that among women of reproductive age, just over 34 percent were anaemic [4]. The same survey found that iron and folate deficiencies affected 48 per centand 29 percent of adult women, respectively. A large proportion of the anaemia among these women could be explained by iron deficiency. The high prevalence of iron deficiency in the face of diets relatively high in iron was ascribed to the practice of drinking tea and/or coffee along with meals as both drinks are known to contain strong iron-absorption inhibitors. Data on other micronutrient deficiencies in Uzbek women of reproductive age are scarce and apply to only limited geographic areas.

The 2002 Health Examination Survey demonstrated that overweight and obesity in adults and their nutritional consequences have become an important public health challenge in recent years in Uzbekistan [5]. This survey found an estimated 43 percent of women were overweight and 17 percent were obese. This survey also found, not surprisingly, that hypertension and levels of cholesterol and triglycerides are strongly associated with overweight and obesity.

Nutritional data specifically for pregnant women in Uzbekistan are rare and consist mostly of estimates of anaemia prevalence. In view of the recently established regulation (Decree 156 [6]) to provide multivitamin supplements to pregnant women free of charge, an in-depth nutritional assessment of this population group is indicated.

Data on the nutritional status of children less than 5 years of age, particularly data on micronutrient status, are equally limited. While the prevalence of undernutrition and anaemia have steadily declined, anaemia prevalence remains relatively high [5,7]. Data on iron deficiency are available only for some geographically limited data for older, school-aged children from the Aral Sea region; these data indicate that just over 20 percent of such children are iron-deficient and that a third of the anaemia was due to iron deficiency [8]. Similarly, for vitamin A status, the only data available available was from Fergana Oblast in 2002, reporting that over 50 percent of children aged 6-59 months had vitamin A deficiency [8].

Previous international recommendations targeted school-age children for measurement of urinary iodine concentration. As a result, such assessments in Uzbekistan also targeted this age group. The national median urinary iodine concentration in 1998 showed very poor iodine status, with all urine specimens having a concentration less than 50 µg/L [9]. By 2005 the situation was much better with an overall median urinary iodine concentration slightly below 100 µg/L [9]. By 2014, the median iodine concentration in school-age children was substantially greater than 100 µg/L, implying iodine sufficiency of the general population. Successful salt iodization during this time period seems to have contributed to a substantial decline in goiter rates and rise in urinary iodine concentration.

There are no data on zinc deficiency for Uzbek children, but risk estimates for zinc deficiency based on intake and stunting prevalence classify Uzbekistan as a country at low risk of zinc deficiency [10]. The reported high intake of inhibitors of iron may, however, affect zinc absorption and therefore, zinc deficiency could potentially be more common than estimated. Vitamin D deficiency has been reported as extremely common in infants in the Samarkand region: almost 80% of infants aged 5-61 weeks were reported to have 25-OHD level below 30 nmol/L [11].

1.3 Programmes to combat micronutrient deficiencies in Uzbekistan

There are numerous programmes currently established in Uzbekistan to improve the micronutrient status of women and children and the population as a whole, including food fortification, in-home fortification, and supplementation with vitamins and minerals.

Regarding mass fortification, the two principal fortified food vehicles in Uzbekistan are salt and wheat flour. Uzbekistan began iodizing salt shortly after its independence in 1991, and substantial iodization support was provided to the salt manufacturing industry in Uzbekistan between 2002 and 2007 [12]. Since 1998, the coverage of iodized salt has steadily increased. The IDD Elimination Law of 2007 was passed to expand salt iodization and the production of iodized table salt became mandatory in 2011; this law mandates an iodization level of 40 ± 15 mg iodine/kg salt. Internationally established recommendations previously stated that salt should be iodized at levels of 20-40 ppm [13], but more recent guidelines recommend adjusting iodine levels by daily salt intake [14]. For Uzbekistan, the daily intake has been estimated in 2016 to be about 15 g/d [15] and thus, the recommended resulting target salt iodine level would be 14-15 ppm.

Wheat flour fortification efforts have focused on first grade wheat flour (extraction rate 75 per cent) produced by mills in Uzbekistan [16]. According to national law at the time of the survey, the iron fortificant was electrolytic iron and the micronutrient premix also contained folic acid and zinc. Starting from June 2019, the "Uzstandard" agency introduced new first grade flour fortification standards [17]. With this standard, together with a premix-standard released in 2017 [18], a new vitamin-mineral mixture was introduced, with the main difference to the previous standard being the inclusion of vitamin B12 and the use of sodium iron ethylenediaminetetraacetate (NaFeEDTA) instead of electrolytic iron. As of 2007, it was estimated that fortified wheat flour was consumed by 61 percent of the population nationally [12]. Since rural households purchase bread made from flour milled by numerous small-scale millers without the necessary equipment to fortify, fortification has focused on Uzbekistan's urban population. The Uzbekistan wheat flour fortification programme is implemented by the Uzbekistan Ministry of Health and UNICEF. From 2001 to 2004, the programme was supported by the Asian Development Bank, The Global Alliance for Improved Nutrition (GAIN), and the World Bank from 2004 to 2008. A national survey in 2008 found that while nearly 97 percent of household had some type of wheat flour in the household, only 42 percent of flour specimens spot-tested were fortified with iron [4].

The first vitamin A supplementation campaign took place in 2002 with UNICEF support and has been conducted twice a year since. According to official statistics, supplementation reached 98 percent of all children less than 5 years of age in the country during the last five years. According to the 2006 multiple indicator cluster survey (MICS), caretakers of children 6-59 months of age , reported that 72 percent of children received a vitamin A supplement in the prior 6 months [19]. Another 17.5 percent of caretakers reported receipt either more than 6 months prior or were not sure when the child received a vitamin A supplement. Vitamin A status in young children has not been assessed nationwide prior to the UNS 2017.

Regarding government policies, in 2010, the Uzbek parliament adopted a law and regulations named ‘On Prevention of Micronutrient Deficiency among the Population of Uzbekistan’. Accordingly, the Government provides pregnant women in rural areas with multivitamin supplements for five months free of charge under the Cabinet of Ministers Decree 156 [6].

1.4 Rationale for the survey

While some data related to nutrition and micronutrient status of women and children has been collected, Uzbekistan has not yet conducted a comprehensive assessment of nutritional status. Though the prevalence of anaemia and undernutrition have been measured as part of the Demographic and Health Survey (DHS) and MICS, information on micronutrient deficiencies is very scarce in Uzbekistan. There are no current representative data on the prevalence of deficiencies of iron, zinc, vitamin A, folic acid, vitamin B12 and iodine in the target groups of the survey.

Due to the lack of current data on micronutrient deficiencies and the implementation of national fortification and supplementation programmes, the Uzbekistan Nutrition Survey 2017 (UNS 2017) aimed to increase the understanding of the severity of micronutrient deficiencies and provide a baseline against which to measure the progress of various national nutrition programmes in the future. In addition, the UNS 2017 provides a key measurement of the coverage and fortification levels of fortified wheat flour and salt. Due to limited national laboratory capacity and funding constraints, analyses of zinc and vitamin D status and the assessment of genetic blood disorders were not included in the survey.

1.5 Primary objectives and indicators

The overall objective of this survey was to obtain updated and reliable information on the current micronutrient status of children 6-59 months of age and women 15-49 years of age in Uzbekistan. This information was deemed to be useful for developing evidence-based policies to improve the nutritional status of these target groups.

The UNS 2017 was nationwide in scope, and collected data from four target groups: 1) households, 2) children aged 0-59 months (6-59 months for blood biomarkers), 3) non-pregnant women of child-bearing age (15-49 years of age), and 4) pregnant women. The specific aims for the various target groups are:

1. To measure the prevalence and severity of anaemia in children 6-59 months of age, non-pregnant women of child-bearing age, and pregnant women based on blood haemoglobin concentrations.

2. To assess the prevalence and severity of iron deficiency in children 6-59 months of age and non-pregnant women of child-bearing age by measuring serum ferritin concentration (adjusted for the presence of inflammation) and to calculate what proportion of anaemia is associated with iron deficiency.

3. To assess the vitamin A status of children 6-59 months of age and non-pregnant women of child-bearing age by measuring serum retinol (adjusted for the presence of inflammation).

4. To estimate the current prevalence of deficiencies of folate and vitamin B_{12} in non-pregnant women.

5. To estimate population iodine status by measuring spot urinary iodine in non-pregnant women of child-bearing age and pregnant women.

6. To estimate the current prevalence and severity of acute malnutrition (wasting), chronic malnutrition (stunting), underweight and overweight in children less than 5 years of age using WHO-recommended anthropometric measurements and indices.
7. To estimate the current prevalence of chronic energy deficiency and overweight in non-pregnant women of child-bearing age using body mass index (BMI).
8. To estimate the current prevalence of acute malnutrition in pregnant women by measuring mid-upper arm circumference (MUAC).
9. To assess the household coverage of adequately fortified wheat flour (iron) and salt (iodine).

1.6 Secondary objectives and indicators

The UNS 2017 also investigated other variables that may influence various types of malnutrition or play a causative role. This questionnaire-based data included household socio-economic status, individual food consumption patterns, infant feeding and breastfeeding practices, and intake of micronutrient supplements (e.g. iron-folate supplementation in women of reproductive age).

METHODOLOGY

2. METHODOLOGY

2.1 Survey design and sampling procedure

The UNS was a cross-sectional stratified survey. Because the last complete census was more than 25 years ago, census data were outdated and could not be used; the more recent 2010 census update only counted 10 percent of the population. As a result, the survey did not use the census enumeration areas as primary sampling units (PSUs). Instead the survey used makhallas (administrative units) as PSUs, whose population was assessed in 2002 by the State Committee of Statistics.

The Ministry of Health (MoH) provided an updated list of makhallas with population data. From this national list of makhallas, 25 makhallas were selected in each of the 14 regional strata (total 350) with probability proportional to size. The selected makhallas and a map of their locations are shown in APPENDIX 4. Note that one initially-selected Makhalla from the Sukh district of the Ferghana Oblast had to be replaced due to inaccessibility to the field teams. To do so, a cluster was re-drawn from the list of all remaining PSU's, once the selected and inaccessible PSU's were excluded from the sampling frame.

In each of the 350 selected makhallas, a list of households was created using the MICS survey approach for household listing [20]. In case the selected makhalla had more than 200 households, local maps were used to segment the makhalla into segments of approximately 100 households each, and one segment was selected with probability proportional to size. An updated list of households in the selected segment was created by conducting a census of that segment. Twelve households were randomly selected from the list of households prior to the survey teams embarking on data collection. In each of the twelve selected households, all children less than 5 years of age and all pregnant women were recruited. As there were more non-pregnant women than needed to achieve the desired precision, non-pregnant women 15-49 years of age were recruited from a randomly selected subsample of one-half of selected households.

2.2 Sample size determination

An *a priori* sample size for the entire survey and each stratum was based on the estimated prevalence, the desired precision around the resulting estimate of prevalence, and the expected design effect for priority indicators of nutritional status in children 0-59 months of age and non-pregnant women (see APPENDIX 5). Calculations assumed an expected household response rate of 94 percent and an 80-90 percent individual response, depending on the target group and indicator measured. The sample size was determined based on the desired precision as well as the availability of resources.

Because the UNS 2017 may also function as a baseline against which to compare future surveys, consideration was also given to the minimum statistically significant difference between the UNS 2017 and some future survey.

The Fisher's formula for estimating the minimum sample size for prevalence descriptive studies was used as follows:

$$n = \frac{Z^2{}_{\alpha/2} P(1-P)}{d^2} * DEFF * \frac{100}{R}$$

Where:

n = minimum sample size, expressed as number of units of analysis,

$Z_{\alpha/2}$ = Z value corresponding to 95% confidence intervals

P = the assumed prevalence

d = the allowable sampling error, or ½ the desired confidence interval

DEFF = design effect

RR = response rate expressed as a decimal

To calculate the minimum sample size for comparison of UNS 2017 to a future survey, the following equation was used:

$$n = DEFF \times \frac{\left[Z_{\alpha} \sqrt{2\left(\frac{p_1 + p_2}{2}\right)\left(1 - \frac{p_1 + p_2}{2}\right)} + Z_{\beta} \sqrt{p_1 q_1 + p_2 q_2} \right]^2}{(p_1 - p_2)^2}$$

x factor to adjust non-response rate

Where:

n = required sample size for each survey, expressed as number of units of analysis,

DEFF =design effect

P_1 = Proportion in the pre-intervention (or baseline) survey,

P_2 =Proportion in post-intervention survey,

(P_2-P_1) =Expected difference between baseline and follow-up surveys,

Z_{α} = 1.96 at α=0.05

$Z_{1-\beta}$ = (-.842) for power of the test set at 0.80

The calculated number of children and women needed for the survey sample had to be converted to the number of households to select, which was done by accounting for the average household size and the proportion of the general population made up of the specific target group. The average household size in the 2002 DHS was 5.4 persons. Children less than 5 years of age make up 12.1 percent of the population, and women 15-49 years of age make up 25.3 percent of the population, resulting in 0.65 children less than 5 years of age and 1.4 women 15-49 years of age per household. Given a crude birth rate of 20 births per 1000 population and assuming that women know they are pregnant by the sixth week of gestation, about 1.3 percent of the general population at any point in time consists of pregnant women, resulting in an average of only 0.07 pregnant women per household. **In total, 4,200 households were selected** to ensure sufficient sample size of households, children, and women.

2.3 Study populations

Table 2 below lists the inclusion criteria for enrollment into the survey for each of the target groups. Note that for pregnant women, only one nationally representative estimate is generated for the prevalence of anaemia and underweight. For all groups, an individual was excluded if, for children less than 5 years of age, the parent or guardian refused; for girls 15-17, if the girl herself or a parent refused; and for an adult woman 18 years of age and older, if the individual herself did not give consent.

Table 2. **Inclusion criteria by targeted population group**

Target population	Inclusion criteria
Households	• Household head or spouse or other adult household member gives oral consent for survey data collection • Members currently reside in selected PSU
Children 0-59 months	• Age 0-59 months at the time of survey data collection (6-59 months for blood sampling) • Considered a household member by adults living in the household • Mother or caretaker provided written consent for questionnaire, anthropometric measurements, and collection of biologic specimens
Non-pregnant women	• Age 15-49 years at the time of survey data collection • Currently non-pregnant by self-report • Gives written consent for survey questionnaire, anthropometric measurements, and collection of biologic specimens • Considered a household member by other adults living in the household
Pregnant women	• Currently pregnant by self-report • Gives written consent for survey questionnaire, anthropometric measurements, and collection of biologic specimens • Considered a household member by other adults living in the household

2.4 Ethical considerations

Ethical approval for the survey was obtained from the Ethical Committee of Uzbekistan's Ministry of Health as well as from an external review board (see APPENDIX 6 for approval letter and appraisal).

For household interviews, oral consent was sought from the household head or in his/her absence, from another adult household member. The selected women and child caregivers were asked to provide written informed consent (see APPENDIX 7 for information sheet and consent form) for themselves and their participating children. If any consenting survey participants were unable to read and write, the consent form was read out loud to them and a thumbprint or fingerprint was taken as evidence of consent in lieu of a signature. Alternatively, the respondent could assign a witness to sign on their behalf. The respondents were also told that they were free to withdraw from participation in the survey at any time, even after written consent had been given.

2.5 Field work and data collection

2.5.1 Mapping and listing

Prior to data collection, all households located in the selected PSU were listed in order to create a complete and updated list of households for all selected makhallas. This list served as a sampling frame for the final selection of households included in the UNS 2017 sample. . local research agency was hired to provide teams of specialists for listing and mapping. The research agency, in consultation with an international expert, created 14 teams to work in the 14 regions of Uzbekistan. One team was responsible to conduct the household mapping and listing of those 25 makhallas in one region. The teams were trained by the international expert. The listing was conducted in July 2017. During the household listing operation, each selected makhalla was visited to:

a. Update the existing map of the makhalla or create the new map if one was not available. Both a location map of the makhalla as well as a sketch map of the dwellings in the makhalla were drawn.

b. Record on listing forms a description of every dwelling together with the names of the heads of the households found in the dwelling.

2.5.2 Instrument pre-testing, training of survey teams and field testing

Prior to data collection, team members were thoroughly trained, and all survey instruments were pre-tested during the training. The training consisted of classroom instruction and practice, and of field testing of all survey procedures.

Deputy heads of regional health departments were nominated by MoH as regional coordinators to help with administrative issues and all of them were invited to a one day orientation workshop. During this workshop regional coordinators were informed about survey goals and objectives, on survey protocol and tasks to ensure support of field work data collection.

Survey staff also received extensive classroom training on each questionnaire, whereby interviewers and team leaders discussed each question, practiced reading the questions, and role-played interviews in local languages. In addition, instruction was provided on how to record, save, and upload data on the tablet computers (Galaxy, Samsung™) used in the UNS 2017 survey.

As part of classroom training, anthropometrists and phlebotomists were trained on anthropometric and blood collection techniques. A standardization exercise was conducted for the survey anthropometrists, whereby an anthropometrist, assisted by a phlebotomist,-measured and recorded the length or height of 10 children, and their results were checked for precision as well as for accuracy when compared with instructor's "gold standard" measurements. Blood collection procedures were practiced, including training on labeling of samples, processing of samples, labeling of aliquots, pipetting procedures, and maintenance of the cold chain when transporting blood and urine specimens.

Following classroom training, two days of field testing were undertaken in two PSUs in the vicinity of Tashkent that were not included in the survey sample. The teams conducted the community sensitization, interviewing anthropometry, and phlebotomy.

Specimens were transported to multiple laboratory facilities for processing depending on the sample type (i.e. blood, urine, flour). Wheat flour and salt samples were also collected.

Approximately 20 percent more field workers than required were enlisted for the training to ensure that all survey staff ultimately hired could implement the survey procedures. To assess their understanding of field procedures, a short examination containing questions about the various survey procedures was given to all survey staff. The results of this examination, the results of the anthropometry standardization exercise, and observations from the survey trainers were used to a) identify the best-performing team members and appoint a team leader for each team, and b) identify survey workers that could not adequately understand and implement the survey procedures. These individuals were released and were not included in the field work.

2.5.3 Community mobilization and sensitization

At the start of the fieldwork, each survey team was provided with a copy of an order (see APPENDIX 8). from the Ministry of Health. Before entering any PSU, teams met with the management of the local District Health Department to notify them that the UNS 2017 would be conducted in their area and requested them to ensure support from health care facilities providing services in the PSU. Shortly before the team's arrival in a given PSU, the team leader visited the area to inform and pre-sensitize local authorities on the upcoming survey activities. Upon the arrival of a team in a PSU, the team met with the relevant authorities to inform them again about the work and also seek their support.

2.5.4 Field work: Interviews

Data collection in the 350 PSUs was conducted between 2nd October and 5th November 2017.

Each of the 14 teams comprised one team leader, two interviewers, one phlebotomist, one anthropometrist and one driver. The members of each team are listed in APPENDIX 9. Each team was assigned to one of the 14 regions and was responsible for data collection in all randomly-selected households in 25 PSUs. All reasonable attempts were made to recruit selected households. At least two repeat visits were made before dismissing a household as non-responding.

For data collection at the household level, tablet computers were used for direct data entry. Skip patterns were built into the electronic questionnaires, which sped up interviewing as well as minimizing erroneous entries. Interviewers administered the household questionnaire first, followed by the child and women questionnaires if the household had eligible children and/or women (as prompted by the tablet computer). During the household interview, a household roster was completed. Household and individual questionnaires were available in English, Uzbek, Russian and Karakalpak. Interviews were conducted in the interviewee's preferred language. All questionnaires are provided in APPENDIX 10.

Where available, standard questionnaire modules were used, e.g. for all infant and young child feeding questions, including the 24-hour recall module [21]. To help the respondents to recall food products, interviewers used a picture catalogue containing commonly used food products, e.g. infant cereals, fortified foods, vitamin A supplements, etc. Similarly, for the women's questionnaire, the 24-hour recall module was adapted from existing tools [22] and a picture catalogue was used to help respondents recall the right food group.

Flour and salt specimens were collected in each recruited households by the interviewers after completion of the household interview. For selected women and children, interviewers prepared and labeled a biological form (see APPENDIX 10). and directed those participants (or their mothers) to a central location in the PSU where the anthropometrist and phlebotomist were stationed.

2.5.5 Field work: Anthropometry and phlebotomy

First, weight measurements from selected children and non-pregnant women were taken using standard methods [23] on a SECA scale (UNICEF, # S0141021). For children who could not stand by themselves, the mother or caregiver was first measured alone, then together with the child, so that the child's weight was obtained by automatic subtraction using the scale's tare function. Children's height or length was measured by using a standard wooden height board (UNICEF, #S0114540). The feet of children were examined for edema, and edema was only considered present if it was bilateral. For non-pregnant women, height was measured using the same standard wooden height board as used for the children. For pregnant women, only their mid upper arm circumference (MUAC) was measured to assess their nutritional status, since weight measurements do not provide useful anthropometric information during pregnancy.

For children (6-59 months of age) as well as non-pregnant women, blood was collected via venipuncture into 6 ml serum tubes (Becton Dickinson). Using a DIFF-Safe device (Becton Dickinson), a small amount of blood was extracted from the tubes onto a weighing boat to assess haemoglobin concentration using a portable haemoglobinometer (HemoCue® 301). Remaining whole blood was placed in a cool box containing cold packs to ensure that it was stored cold but not frozen at ~4°C and kept in the dark until further processing later the same day. For pregnant women, blood was collected from a fingerstick for haemoglobin measurement only.. urine sample was collected from each selected woman. A labeled urine beaker was given to the woman, and she was instructed to bring the urine specimen with her to the phlebotomy site. Urine sample were aliquoted in the field and placed into cold boxes.

Participants found to have severe acute malnutrition or severe anaemia were referred for treatment at the nearest health hospital or clinic (see APPENDIX 11 for referral form). No efforts were made to collect blood in a fasting state as this was unnecessary since no biomarkers sensitive to fasting state were measured.

At the end of each day, the team leader reviewed and collated the biological forms and consent forms, and reviewed data collected in an Open Data Kit[1] (ODK). Interviewers were notified of any errors and/or omissions, whereupon they were instructed to make the necessary corrections, when possible. A salt sample (20 g) was collected from each selected household if available. Further, interviewers were instructed to

1 https://opendatakit.org/

collect a wheat flour sample (50g) of the most frequently used wheat flour from each selected household.

2.5.6 Cold chain and processing of blood samples

Following collection, all blood samples were placed on cold packs (at 4°C to 8°C) until processing. Phlebotomists recorded the temperature inside ice chests containing the cold packs every two hours.

Every evening, when the field teams stopped their daily work, the blood, urine, salt and flour samples were transported to the regional blood transfusion centers. Blood samples were processed upon arrival and urine samples stored at ~4°C until transport to the Republican Specialized Scientific Practical Medical Centre of Endocrinilogy in Tashkent. In the same transport, salt samples were collected and stored in the Center for the Scientific and Clinical Study of Endocrinology at room temperature until analysis.

Upon arrival at the regional blood transfusion center, the Vacutainers™ containing venous blood from children and non-pregnant women were centrifuged at 3,000 rpm for 7 min to separate the serum from the erythrocytes, platelets, and leukocytes. Subsequently, serum was pipetted from the Vacutainers™ and aliquoted into cryovials appropriately labeled with the respondents' ID numbers. Aliquots destined for different laboratories were sorted into their corresponding storage boxes and stored frozen at around-20°C. Upon completion of field work in all regions the serum samples were collected and transported frozen to the laboratory at Tashkent Institute of Postgraduate Medical Education and stored at-80°C until analyses. In the same transport, flour samples were shuttled to Tashkent, to the 'Donmahsulotlari IIChM' laboratory.

2.5.7 Supervision of fieldwork

Supervision was provided consistently. During the first week of field work, intense supervision was conducted to identify and address any flaws, as well as initial quality assurance. In addition to team leaders, a roaming supervisor was assigned to each stratum, who ensured that the correct survey procedures were followed, i.e. a follow-up quality assurance measures. Furthermore, targeted visits to teams were conducted by the Survey Coordinator to ensure protocol adherence.

2.6 Definitions of indicators and specimen analysis

2.6.1 Anthropometric indicators

Children less than 5 years of age

In children, undernutrition (including wasting, stunting, and underweight) and overnutrition were defined using WHO Child Growth Standards [24]. Children with z-scores less than -2.0 for weight-for-height, height-for-age, or weight-for-age were defined as wasted, stunted, or underweight, respectively. Moderate wasting, stunting, and underweight were defined as a z-score less than -2.0 but greater than or equal to -3.0 Z-scores. Z-scores less than -3.0 define severe wasting, severe stunting, or severe underweight. Children with bilateral pitting edema in the feet and/or lower legs were automatically considered to have severe wasting, regardless of their weight-for-height z-score.

Overnutrition was defined as a weight-for-height z-score greater than +2.0. Overweight was defined as a weight-for-height z-score of greater than +2.0 but less than or equal to +3.0 and obesity as a weight-for-height z-score greater than +3.0.

During interviews with the mother or caretaker of a selected child, questions were asked to derive all 15 of the standard infant and young child feeding indicators recommended by WHO and UNICEF. These indicators are measured in different age groups; the age group for each indicator is shown in each table presenting infant and young child feeding results. The WHO/UNICEF recommendations [21] contains a detailed description of each indicator.

Non-pregnant women

Chronic energy deficiency and overnutrition in non-pregnant women were assessed by using BMI. We used the following most commonly used cut-off points for BMI to define levels of malnutrition in non-pregnant women (19): <16.0 severe undernutrition, 16.0-16.9 moderate undernutrition, 17.0-18.4 at risk of undernutrition, 18.5-24.9 normal, 25.0-29.9 overweight and >30 obese.

Pregnant women

Because body weight in pregnancy is increased by the products of conception and extra body fluid, BMI is not a valid indicator of nutritional status. Thus, MUAC was used instead to measure the nutritional status of pregnant women. A MUAC of less than 23.0 cm was used to define a pregnant woman as undernourished [25].

2.6.2 Blood and urine specimens

Anaemia

Blood haemoglobin concentration was measured using a HemoCue™ portable haemoglobinometer (Hb301, HemoCue, Ängelholm, Sweden). Quality control of the Hemocue devices was done daily using low and medium concentration liquid control blood commercially available from the device supplier. Control blood was kept in cold boxes (2-8°C) for the duration of the field work to prevent degradation.

Iron (serum ferritin), acute phase proteins (CRP, AGP)

Serum ferritin was used to assess iron status of all young children and non-pregnant women. Ferritin concentration has been recommended by the World Health Organization (WHO) as the marker of first choice for iron deficiency in population based surveys [26]. Because serum ferritin levels can be elevated in the presence of infection or other causes of inflammation, the acute phase proteins AGP and CRP were used to detect the presence of inflammation in survey subjects and to correct the ferritin values using the correction algorithm developed by the Biomarkers Reflecting Inflammation and Nutritional Determinants of Anaemia working group (BRINDA) [27]. Ferritin was measured on the Siemens Immulite 2000 Xpi, while CRP and AGP were run on the Siemens Dimension Xpand plus. These biomarkers were analyzed at the Vitamed laboratories in Tashkent. Prior to analyzing survey samples, the laboratory underwent a series of external quality control (QC) rounds conducted by the US CDC, followed by capacity building, until laboratory performance was satisfactory. During the analyses of the survey samples, the laboratory conducted a rigorous QC that was externally reviewed twice a week.

Serum retinol

Serum retinol was used to assess the vitamin A status of all young children and non-pregnant women. Serum retinol concentration is currently being recommended by the World Health Organization (WHO) as the marker of first choice for vitamin A deficiency assessment in population based surveys [28]. Because serum retinol levels can be depressed during an inflammatory response, the acute phase proteins AGP and CRP were used to detect the presence of inflammation in survey subjects and to correct the retinol values using the correction algorithm developed by the Biomarkers Reflecting Inflammation and Nutritional Determinants of Anaemia working group (BRINDA) [29]. Serum retinol was analyzed using reverse-phase High Performance Liquid Chromatography (HPLC; LC-20 Prominence with Auto Sampler, Shimadzu, USA) at «MEDSTANDART» laboratories in Tashkent.

Retinol was extracted into acetonitrile, centrifuged and the supernatant was injected into the system using a Hypersil GOLD aQ Analytical HPLC Column, 3µm, 4.6 x 100mm, (1202Y28, Thermo Scientific, USA) with a mobile phase of 83 percent acetonitrile, 0.1 percent trimethylamine, and 17 percent water by volume. Retinol was detected at 325nm using a photo-diode array detector. Retinyl acetate was added as an internal standard before extraction (1716002, United States Pharmacopeia [USP] Reference Standard, Sigma-Aldrich [MERCK], USA). Purified retinol was used to construct the external standard curves (95144, BioXtra, ≥97.5% HPLC, Sigma-Aldrich [MERCK], USA).

Prior to analyzing survey samples, the laboratory underwent a series of external QC rounds conducted by the US CDC; all rounds were satisfactory prior to starting the analyses. During the analyses of the survey samples, the laboratory conducted a rigorous QC, which was externally reviewed twice a week.

Serum folate and vitamin B_{12}

Serum folate and vitamin B_{12} concentrations were measured on the Siemens Immulite 2000 Xpi. These biomarkers were analyzed at the Vitamed laboratories in Tashkent. Prior to analyzing survey samples, the laboratory underwent a series of external QC rounds conducted by the US CDC, followed by capacity building, until laboratory performance was satisfactory. During the analyses of the survey samples, the laboratory conducted a rigorous QC, which was externally reviewed twice a week.

Urinary iodine

The WHO recommends measuring iodine in urine for population-based surveys [30]. Urinary iodine results serve as an approximate reflection of recent iodine intake, but substantial variation in individuals from specimen to specimen is a major limitation of this biomarker.

Urinary iodine concentration was determined using the Sandell-Kolthoff reaction method. Specimens were analyzed by the 'Scientific epidemiological laboratory for the determination of iodine in urine and salt under The Republican Specialized Scientific Practical Medical Centre of Endocrinology' in Tashkent, which in the past has participated in the laboratory validation rounds for urinary iodine concentrations (EQUIP) organized by the U.S. Centers for Disease Control and Prevention, Atlanta, Georgia, USA. Additionally, for the analysis of urine samples from the UNS 2017, external QC samples with known iodine concentrations were run every 30^{th} sample roughly. Of note, the concentration of these samples was unknown to the performing laboratory and the laboratory was given green light to continue analysis only if the QC results were within a preset range. The external QC urine samples were provided by the laboratory of Human Nutrition Laboratory, Institute of Food, Nutrition and Health, ETH Zurich, Switzerland.

2.6.3 Food samples

Analysis of salt samples

The concentration of iodine was measured quantitatively using iodometric titration according to standard guidelines [30]. Quantitative analyses were conducted by the 'Scientific epidemiological laboratory for the determination of iodine in urine and salt under The Republican Specialized Scientific Practical Medical Centre of Endocrinology' in Tashkent. The laboratory has an established internal quality control scheme. Additionally, for the analysis of samples from the UNS, the laboratory was provided a high quality salt sample with known iodine content and was run roughly every thirtieth sample. This external quality control sample was prepared by Südwestdeutsche Salzwerke AG, Heilbronn, Germany.

Analysis of flour samples

Iron content in flour was assessed in a two-staged approach: first, all samples underwent qualitative testing using the so-called iron spot test (AACC method 40-40). For samples containing iron, a semi-quantitative test was conducted (INCAP Method IV).

In selected flour samples, presence of iron was detected by a quantitative atomic absorption spectrophotometric method as an additional QC measure. The quantitative results are not shown in this report, but they confirmed that the semi-quantitative assessment adequately discerned the different categories of 40, 60, and 90 ppm.

2.7 Data management and analysis

2.7.1 Data entry

Direct electronic data entry was done using the ODK during the household, child, and women interviews. For the parts of the individual questionnaires (biological form) that were completed by the anthropmetrist/phlebotomist using a paper form, the interviewers entered the data into the ODK on the same or the following day on the additional data entry forms (biological form for children and women) pre-programmemed in the ODK.

2.7.2 Data monitoring

Interview data uploaded from the tablets to the cloud were monitored continuously. In case of systematic and sporadic errors made by one or several teams, all team leaders were immediately informed about the problem, so the problem was not repeated. For errors that the teams could address, they were requested to do so immediately, while still in a given PSU. For some variables, data quality checks could not be done immediately (e.g. composite anthropometric indicators) and thus, during data analysis, quality checks were conducted to assess the quality of the data collected. Some of these quality checks are presented in APPENDIX 13.

2.7.3 Data analysis

Data analysis was done using SPSS version 21. Data analysis included calculation of proportions to derive the prevalence of dichotomous outcomes and calculation of mean and median averages for continuous outcomes. Nationwide prevalences were calculated by using weighted analysis to account for the unequal probability of selection in the 14 strata. The statistical precision of all estimates was assessed using 95 percent confidence. All measures of precision, including confidence limits and chi square p values for differences, were calculated accounting for the complex cluster and stratified sampling used by the UNS 2017.

Descriptive statistics were calculated for all children together and all women together (i.e. across all strata), for each stratum separately, and by sex (for children). Results are also presented by specific age sub-groups for non-pregnant women (15-19 years, 20-29 years, 30-39 years, and 40-49 years) and children (0-5 months, 6-11 months, 12-23 months, 24-35 months, 36-47 months, and 48-59 months of age). For pregnant women, only select sub-group analyses were conducted due to the limited sample size.

2.7.4 Case definitions of deficiency

The cut-off values for each biomarker indicator used to determine nutritional status for each participant are presented in Table 3. For haemoglobin concentration multiple cut-offs were used to classify the severity of anaemia. For other indicators, a single cut-off is used to identify deficiency or abnormality.

Table 3. **Clinical cut-off points and classifications for biomarker indicators**

Indicator	Cut-offs defining deficiency or abnormality		
Haemoglobin* [31]	Severe	Moderate	Mild
Children 6-59 & pregnant women	<70 g/L	70-99 g/L	100-109 g/L
Non-pregnant women	<80 g/L	80-109 g/L	110-119 g/L
Ferritin † [26]			
Children 6-59 months of age (U5 children)		12 μg/L	
Non-pregnant women (NPW)		15 μg/L	
α1-acid-glycoprotein (AGP) [32]			
U5 children and NPW		>1 g/L	
C-reactive protein (CRP) [32]			
U5 children and NPW		>5 mg/L	
Retinol† [28]			
U5 children and NPW		<0.7 μmol/L	
Folate [33]			
NPW		<10 nmol/L (<4.4 ng/mL)	
Vitamin B_{12} [33]			
NPW		<150 pmol/L (<203 ng/L)	
Urinary iodine concentration [34]			
NPW		100 μg/L	
PW		<150 μg/L	

*The cut-off defining normal haemoglobin concentrations was adjusted for the number of cigarettes smoked per day as follows : <10 no adjustment, 10-19 +30 g/L, 20-39 +50 g/L, 40+ per day +70 g/L, smoker but amount not known +30 g/L. Adjustment for altitude was also made according to [35].

†Ferritin and retinol values were adjusted for inflammation using appropriate algorithms [27,29]

2.7.5 Calculation of wealth index and socio-economic status

Using data on each household's dwelling, water and sanitation conditions and facilities, and ownership of durable goods, a wealth index was calculated using the World Bank method [36]. Calculation of wealth index quintiles categorizes the continuous wealth index and permits the cross-tabulation and the subsequent presentation of key indicators by wealth quintile.

RESULTS

3. RESULTS

3.1 Study participation of households, children, and women

Figure 2 below provides an overview of the number of respondents at the different survey stages. Only about 5 percent of households were absent or refused to participate in the survey. Among women residing in the participating households, 2269 women agreed to participate and completed the individual interview. Anthropometric measurements and blood were collected from 2217 and 2207 non- pregnant women, respectively. Overall, 2277 children 0-59 months old participated in the survey, of which 2179 completed anthropometry measurements. Because only children 6-59 months old were eligible and due to a higher refusal rate, blood samples were obtained from only 1937 children 6-59 months old. Additional information about household and individual response rates are provided in APPENDIX 1.

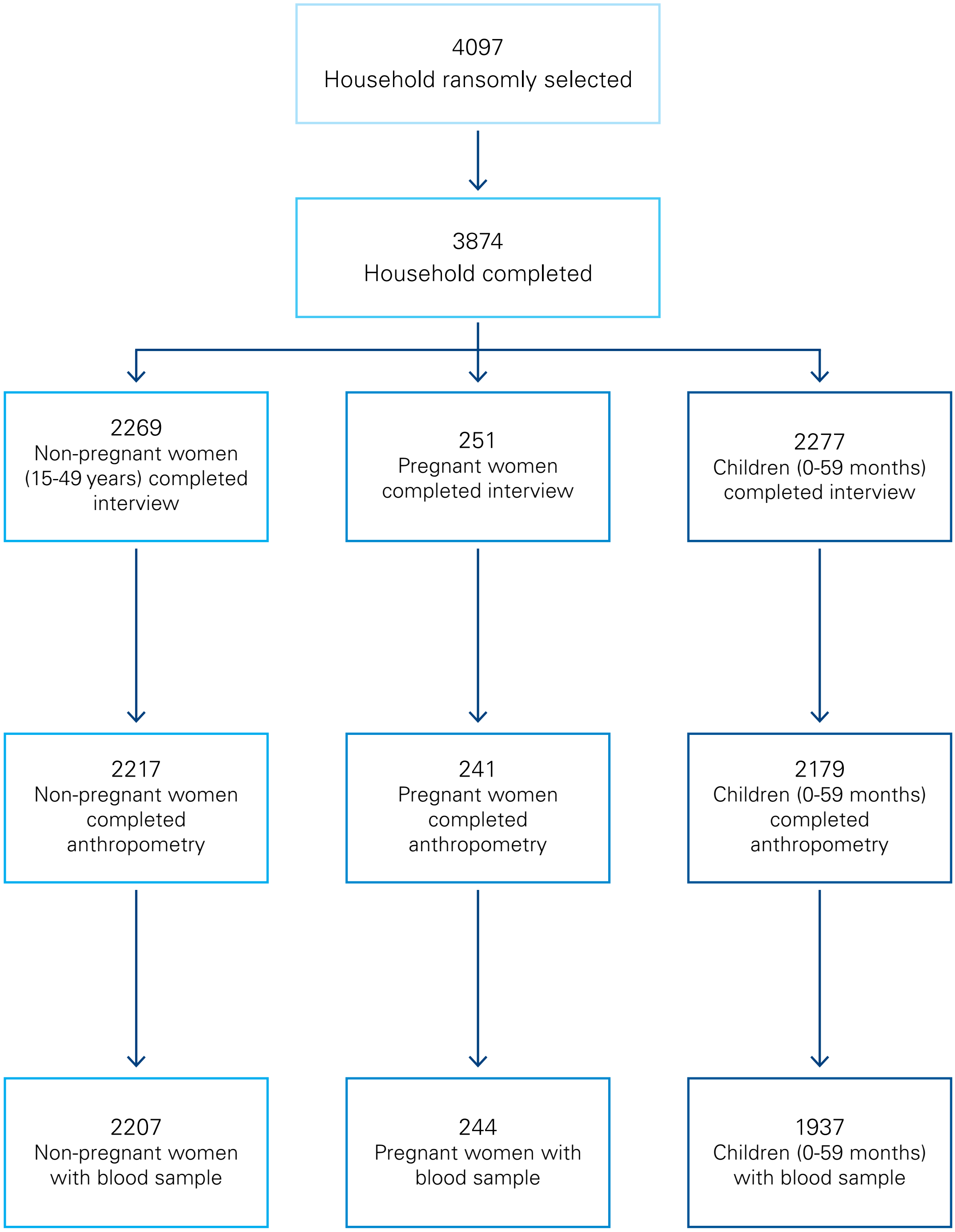

Figure 2. **Participation flow diagram for households, women, and children, Uzbekistan 2017**

3.2 Household characteristics

3.2.1 Demographic characteristics

The characteristics of participating households in the UNS 2017 are summarized in Table 4 below. In total 3874 households were included, about 70 percent in rural areas. On average, households had about 5.2 members. A large majority of households in Uzbekistan have household heads who are of Uzbek ethnicity, followed by Tajik and Russian.

Table 4. **Demographic characteristics of households, Uzbekistan 2017**

Characteristic	Total number of households per sub-group	%[a] or mean
TOTAL	3874	100.0%
Urban/rural		
Urban	1185	31.0%
Rural	2689	69.0%
Region		
Karakalpakstan	279	7.2%
Andijon	274	7.1%
Bukhara	267	6.9%
Jizzakh	283	7.3%
Kashqadarya	263	6.8%
Namangan	279	7.2%
Navoiy	273	7.0%
Samarkand	277	7.2%
Surkhandarya	271	7.0%
Sirdarya	294	7.6%
Ferghana	279	7.2%
Khorazm	285	7.4%
Tashkent oblast	270	7.0%
Tashkent city	280	7.2%
Number of HH members (mean)	3874	5.2
Number of HH with given number of women 15-49 years of age		
0	572	15.4%
1	2027	51.2%
2	951	25.1%
3+	324	8.2%
Number of HH with given number of children 0-59 months of age		
0	2194	56.9%
1	1114	28.5%
2+	566	14.6%

Characteristic	Total number of households per sub-group	%[a] or mean
Ethnicity of household head		
Uzbek	3229	83.9%
Tajik	182	4.5%
Russian	97	2.9%
Karakalpak	103	2.1%
Kazakh	86	2.0%
Turkmen	51	1.2%
Tatar	38	1.0%
Kyrgyz	35	0.8%
Other	53	1.6%
Sex of household head		
Male	3024	77.1%
Female	850	22.9%

Note: The N's are un-weighted numbers for each subgroup; the sum of subgroups may not equal the total because of missing data.
[a] All percentages except region-specific estimates are weighted for unequal probability of selection.

3.2.2 Water and sanitation

As shown in Table 5, almost all surveyed households had an improved source of water for drinking. The majority of households with an unimproved source of water reported treating their water to make it safe to drink. As a result, the proportion of households drinking water either from an improved source or after adequate treatment at home was almost 100 per cent. Also very high, with nine out of ten households, was the proportion of households which had improved sanitation facilities.

Table 5. **Indicators of household water and sanitation**

Characteristic	Total number of households per sub-group	% [a]	(95% CI)[b]
Drinking water source			
Piped in dwelling/yard (public water)	1810	46.7%	(42.7, 50.8)
Piped in dwelling/yard (private water)	698	16.2%	(14.0, 18.8)
Tube well or borehole	541	16.8%	(14.0, 20.0)
Protected well	221	5.1%	(3.9, 6.7)
Unprotected well	37	0.7%	(0.4, 1.0)
Protected spring	18	0.5%	(0.2, 1.2)
Unprotected spring	30	0.7%	(0.3, 1.6)
Rainwater collection	2	0.1%	(0.0, 0.2)
Tanker-truck	378	9.7%	(7.7, 12.3)
Surface water (damn, pond, falaj)	81	2.1%	(1.3, 3.3)
Bottled water	47	1.2%	(0.8, 1.7)

Characteristic	Total number of households per sub-group	% [a]	(95% CI)[b]
Has safe water source[c]			
No	148	3.4%	(2.5, 4.8)
Yes	3715	96.6%	(95.2, 97.5)
Drink safe water[d]			
Yes	3862	99.8%	(99.5, 99.9)
No	8	0.2%	(0.1, 0.5)
Improved sanitation[e]			
Yes	3449	89.2%	(87.8, 90.5)
No	417	10.8%	(9.5, 12.2)

Note: The N's are un-weighted numbers for each subgroup; the sum of subgroups may not equal the total because of missing data. Total sample size = 3874

[a] Percentages weighted for unequal probability of selection between regions.

[b] CI=confidence interval calculated taking into account the complex sampling design.

[c] Safe drinking water when from improved source; improved source = water from piped system, tube well or borehole,protected well, protected spring, rainwater collection, bottled water, tanker truck or cart or sachet water. Unimproved source = water from unprotected well, unprotected spring, surface water or other [37].

[d] Composite variable of main source of drinking water and treating water to make safe for drinking [37].

[e] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation= open pit, bucket latrine, hanging toilet/latrine, no facility, bush, field [37].

3.2.3 Salt iodization

Almost all participating households had salt in the household at the time of the survey. A very high propotion (96.2 per cent) of households believed that the salt they used was iodized; note that this is based on the respondents' responses and reflecting their perception about whether or not salt is iodized. Almost 80 percent of surved households had salt in its original package stating that it was iodized, whereas about 17 percent of the available salt was not in the original package (see Table 6).

Table 6. **Household salt availability and packaging, Uzbekistan 2017**

Characteristic	Total number of households per sub-group	% [a]	(95% CI)[b]
Have salt in house[c]			
Yes	3791	98.0%	(97.5, 98.4)
No	81	1.9%	(1.5, 2.4)
Reports salt is iodized[c,d]			
Yes	3662	96.2%	(95.4, 96.8)
No	28	0.7%	(0.5, 1.1)

Characteristic	Total number of households per sub-group	% [a]	(95% CI)[b]
Packaging of salt			
Original packaging stating salt is iodized	2910	79.2%	(77.8, 80.5)
Original packaging without mention of iodization	101	2.7%	(2.1, 3.5)
Undetermined, not in original package	760	17.6%	(16.4, 18.8)
Undetermined for other reasons	20	0.5%	(0.3, 0.8)

Note: The N's are un-weighted numbers for each subgroup; the sum of subgroups may not equal the total because of missing data.
[a] Percentages and means are weighted for unequal probability of selection between regions.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] The percentages do not add up to 100% because the small proportion of the respondents that reported 'don't know' is not shown: 0.1% for 'have salt in house' and 3.1% for 'reports salt is iodized.
[d] This variable was calculated based on respondents' perceptions about whether or not salt was iodized.

Salt was collected from participating households for subsequent quantitative testing for iodine content at the central laboratory (see Table 7). The median iodine concentration was 6.9 mg/ kg salt. As shown in Figure 3 in total, almost one-half of participating households had non- iodized salt (iodine concentration <5ppm), about one-fifth had insufficiently iodized salt (iodine concentration 5-14.9ppm) and only just over one third had adequately iodized salt (iodine concentration ≥ 15ppm).

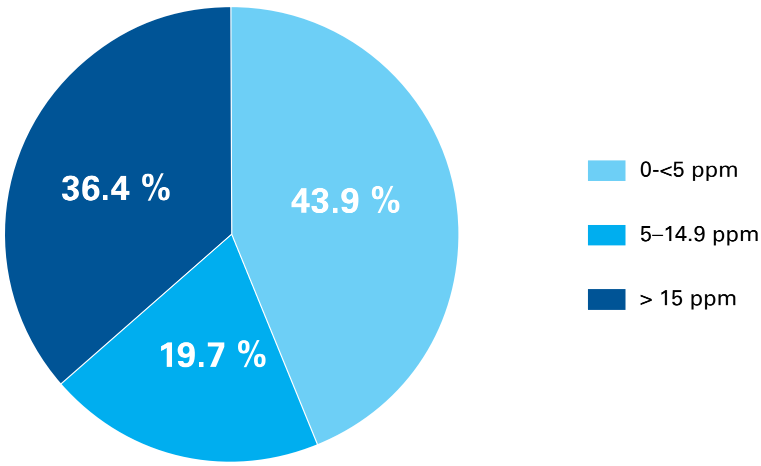

Figure 3. **Salt iodine concentration by categories not iodized (0-<5 ppm), inadequately iodized (5-14.9 ppm) and adequately iodized (≥ 15 ppm), Uzbekistan 2017**

Figure 4 presents the distribution of household salt iodine concentration, corroborating that a large proportion contains less than 5 ppm iodine. Further, a negligible proportion of salt is over-iodized.

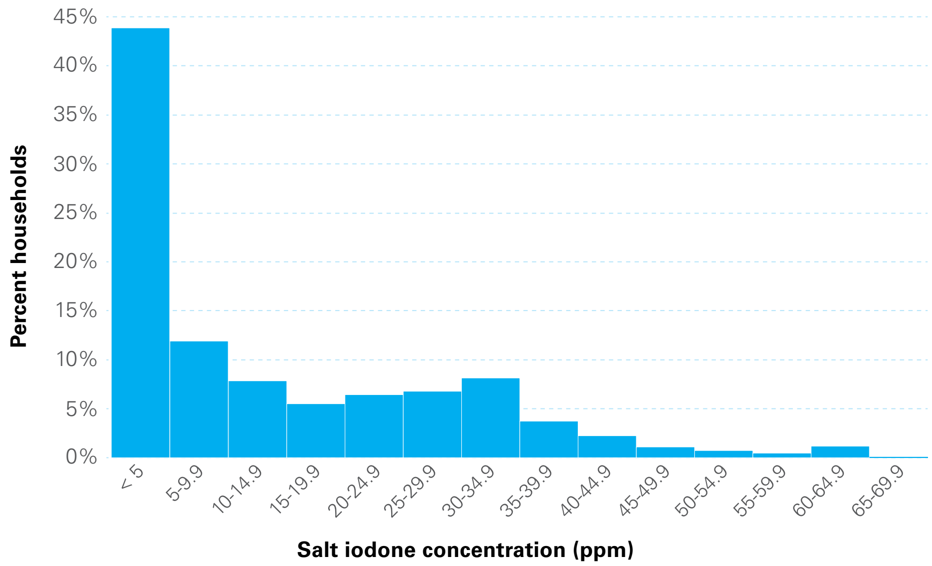

Figure 4. **Weighted distribution of household salt iodine concentrations, Uzbekistan 2017**

The proportion of adequately iodized salt was higher in urban households compared to rural, and large differences were detected between regions (see Table 7). The highest median iodine concentration and the largest proportion of households using iodized salt were found in Khorazm. The lowest median iodine concentration was detected in Namangan where the median iodine concentration and proportion of households using adequately iodized salt were more than six-fold lower. Both ethnicity of the household head as well as wealth of the household had a significant impact on salt iodine concentration. The lowest proportion of households with adequately iodized salt was found in the poorest households, whereas highest proportion was found in households in the fourth and highest wealth quintile where adequately iodized salt was more than twice as common (see Table 7). Interestingly, salt from households where the salt package was labelled as "iodized" did not contain more iodine than non-labelled samples. In fact, the proportion of salt samples that were adequately iodized was lower amoung salt samples labelled as “iodized” compared to samples with no iodization logo or samples that were not in the original package.

Table 7. **Proportion of households in which salt was adequately iodized (iodine concentration is ≥ 15 ppm), Uzbekistan 2017**

Characteristic	Median iodine concentration (ppm)	Total number of households per sub-group	%[a]	(95% CI)[b]	P value [c]
Total	6.9	3413	36.4%	(34.1, 38.7)	
Residence					
Urban	13.8	1025	47.8%	(42.6, 53.0)	<0.001
Rural	5.8	2388	31.4%	(28.6, 34.3)	
Region					
Karakalpakstan	3.7	243	19.5%	(12.0, 30.0)	<0.001
Andijon	4.2	238	15.5%	(10.8, 21.8)	
Bukhara	11.1	244	41.8%	(31.0, 53.4)	
Jizzakh	4.8	243	32.9%	(23.1, 44.5)	
Kashqadarya	5.8	173	24.3%	(15.8, 35.4)	
Namangan	3.7	268	13.8%	(9.5, 19.6)	
Navoiy	16.7	234	55.6%	(45.3, 65.4)	
Samarkand	3.7	245	15.1%	(10.2, 21.7)	
Surkhandarya	4.2	238	16.0%	(11.3, 22.1)	
Sirdarya	4.2	245	27.8%	(19.9, 37.3)	
Tashkent oblast	9.0	257	43.6%	(35.8, 51.7)	
Ferghana	5.6	258	38.0%	(30.5, 46.1)	
Khorazm	27.0	271	88.2%	(83.0, 92.0)	
Tashkent city	24.9	237	73.0%	(63.7, 80.6)	
Wealth Quintile					
Lowest	4.2	661	20.7%	(17.5, 24.4)	<0.001
Second	5.6	682	29.8%	(25.9, 34.1)	
Middle	8.5	675	39.3%	(35.2, 43.5)	
Fourth	12.2	686	45.7%	(41.6, 50.0)	
Highest	11.6	689	45.5%	(40.4, 50.7)	
Packaging of salt					
Original packaging stating salt is iodized	6.3	2626	33.2%	(30.8, 35.7)	<0.001
Original packaging without mention of iodization	6.9	96	36.5%	(24.9, 49.8)	
Undetermined, not in original package	15.3	674	50.1%	(45.1, 55.0)	

Note: The N’s are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data.
[a] All percentages except region-specific estimates are weighted for unequal probability of selection.
[b] CI=confidence interval, calculated taking into account the complex sampling design.
[c] Chi-square p-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups.

Figure 5 shows the geographic distribution of coverage with adequately iodized salt, and it reveals vast variability in coverage by oblast. The map shows the proportion of households that had adequately iodized salt at the time of the survey. As such, this map is a visual representation of the regional findings presented in Table 7.

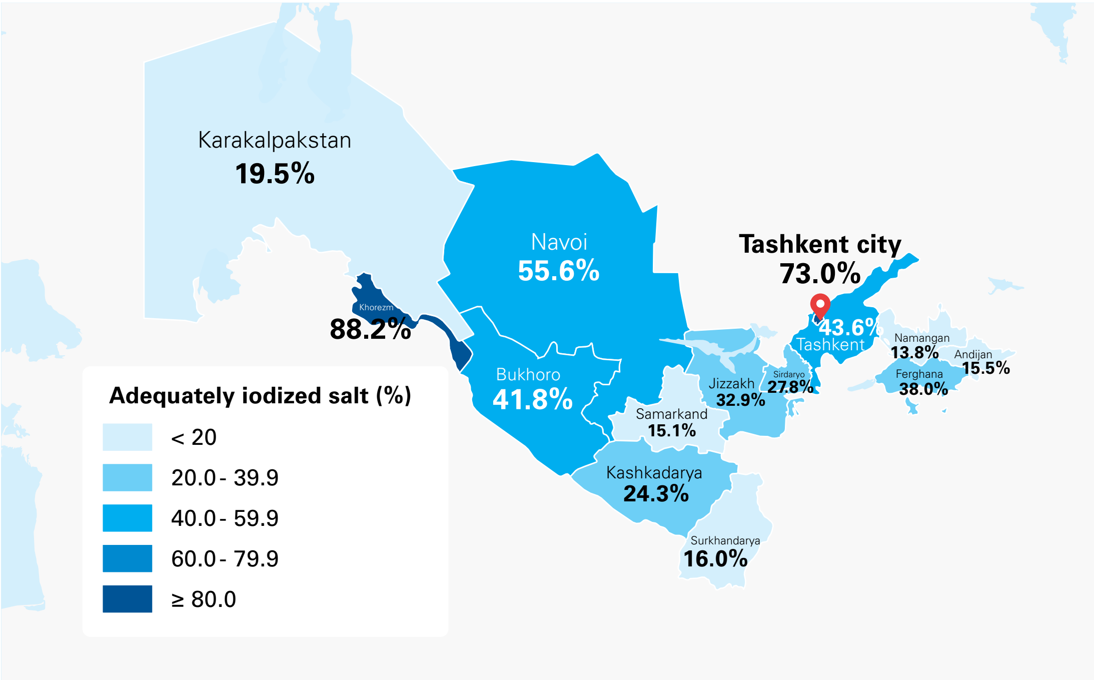

Figure 5. **Proportion of households with adequate salt iodization (≥15 ppm), by oblast, Uzbekistan 2017**

3.2.4 Bread and flour types and iron fortification

The majority of surveyed households commonly consumed home-made bread. About one half of households consumed Uzdonmahsulot or other flour milled in Uzbek milling plants. About 45 percent of households used flour made in Kazakhstan (see Table 8). Of commonly purchased bread, only 'grey loaf' is supposed to be made with fortified flour.

Table 8. **Proportion of households with bread and flour types, Uzbekistan 2017**

Characteristic	Total number of households per sub-group	% [a]	(95% CI)[b]
Type of bread most commonly consumed			
White loaf	88	1.9%	(1.4, 2.6)
Grey loaf	289	8.5%	(7.3, 9.8)
Black loaf	15	0.5%	(0.3, 0.8)
Batons	3	0.1%	(0.0, 0.3)
Lepeshka	891	25.1%	(22.5, 27.9)
Patyr	20	0.5%	(0.3, 1.0)
Home-made bread	2527	62.4%	(59.2, 65.6)
Other	10	0.2%	(0.1, 0.8)
Unknown	3	0.1%	(0.0, 0.3)
Does not have any bread	28	0.6%	(0.4, 0.9)
Type of flour most commonly consumed			
Uzdonmahsulot or from private milling plant in Uzbekistan	1876	49.7%	(46.5, 52.8)
Flour made in Kazakhstan	1565	45.2%	(41.9, 48.5)
Flour from water or household mills, or other locally produced	200	5.1%	(4.0, 6.6)

Note: The N's are un-weighted numbers for each subgroup; the sum of subgroups may not equal the total because of missing data. Total sample size with valid responses = 3874.
[a] Percentages are weighted for unequal probability of selection between regions.
[b] CI=confidence interval calculated taking into account the complex sampling design.

Just about one third of households had fortified flour at home at the time of the survey. In contrast to adequately iodized salt results, a significantly higher proportion of households residing in rural areas consumed flour with iron concentrations ≥ 30 ppm, compared to urban households. The oblast of Navoiy and Sirdarya have over 40 percent household coverage with fortified flour, whereas Tashkent city and oblast have coverage of less than 10 per cent. Significant differences were also found by household wealth: fewer of the wealthiest households used flour with an iron concentration of ≥ 30 ppm compared to households in other wealth quintile categories.

Table 9. **Proportion of households in which flour iron concentration was ≥ 30 ppm, Uzbekistan 2017**

Characteristic	Total number of households per sub-group	% [a]	(95% CI)[b]	P value [c]
Total	3366	29.9%	(25.8, 29.9)	
Residence				
Urban	888	20.1%	(16.7, 24.1)	<0.001
Rural	2478	30.6%	(28.1, 33.2)	
Region				
Karakalpakstan	259	35.5%	(27.4, 44.5)	<0.001
Andijon	236	27.1%	(21.4, 33.7)	
Bukhara	232	32.3%	(25.2, 40.3)	
Jizzakh	255	24.3%	(17.2, 33.2)	
Kashqadarya	238	29.0%	(24.3, 34.2)	
Namangan	241	27.8%	(20.3, 36.8)	
Navoiy	252	45.2%	(36.3, 54.5)	
Samarkand	231	22.9%	(17.1, 30.0)	
Surkhandarya	254	38.6%	(31.6, 46.0)	
Sirdarya	229	41.0%	(33.3, 49.2)	
Tashkent oblast	222	8.6%	(4.8, 14.9)	
Ferghana	240	33.3%	(24.4, 43.6)	
Khorazm	277	35.7%	(29.7, 42.3)	
Tashkent city	200	6.0%	(3.7, 9.6)	
Wealth Quintile				
Lowest	688	34.9%	(30.6, 39.5)	<0.001
Second	674	32.7%	(29.0, 36.7)	
Middle	674	31.7%	(27.7, 36.0)	
Fourth	659	22.0%	(22.0, 18.8)	
Highest	650	16.9%	(13.9, 20.3)	

Note: The N's are un-weighted numbers (denominator) for each subgroup; the sum of subgroups may not equal the total because of missing data.
[a] All percentages except region-specific estimates are are weighted for unequal probability of selection between regions.
[b] CI=confidence interval calculated taking into account the complex sampling design
[c] Chi-square p-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups.

Figure 6 shows the geographic distribution of coverage with fortified wheat flour, and it reveals great variability in coverage by oblast. The map shows the proportion of households that had fortified flour at the time of the survey. As such, this map is a visual representation of the regional findings presented in Table 9.

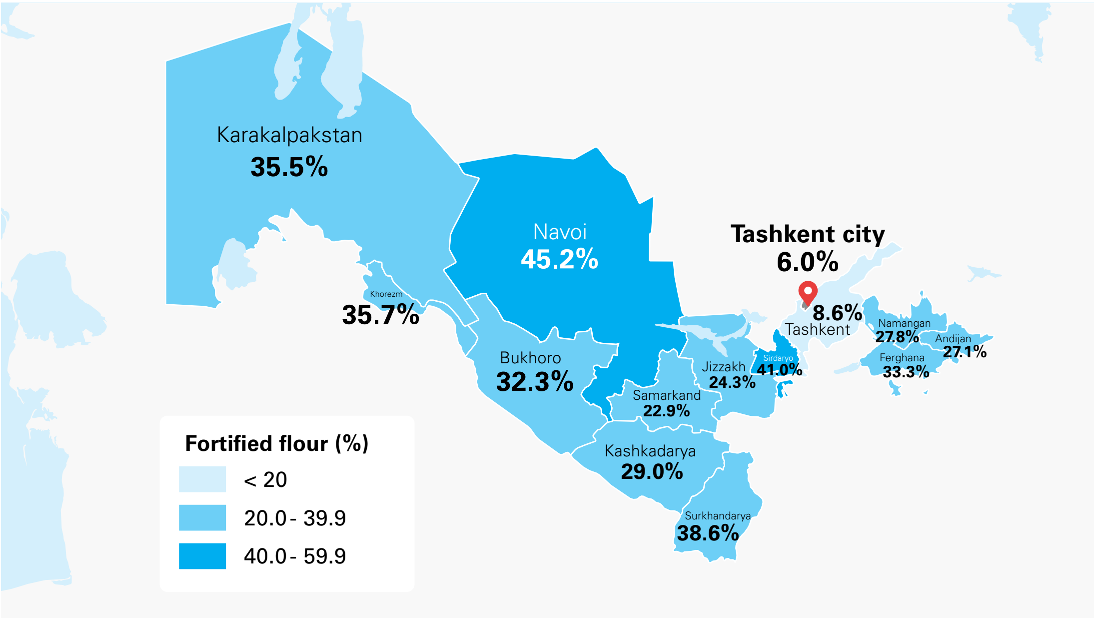

Figure 6. **Proportion of households with fortified wheat flour (≥ 30 ppm), by oblast, Uzbekistan 2017**

3.3 Children less than 5 years of age

3.3.1 Characteristics

Table 10 describes the demographic characteristics of children participating in the UNS 2017. One quarter the children resided in urban and three quarter in rural areas. Surveyed children were almost equally distributed among the different age groups.

Table 10. **Description of children less than 5 years of age, Uzbekistan 2017**

Characteristic	Total number of children per sub-group	% [a]	(95% CI) [b]
TOTAL	2277	100%	-
Urban/rural			
Urban	548	24.7%	(20.7, 29.3)
Rural	1726	75.3%	(70.7, 79.3)
Age (in months)			
<6	250	11.1%	(9.7, 12.5)
6-11	220	9.6%	(8.4, 10.9)
12-17	250	11.5%	(10.2, 13.0)

Characteristic	Total number of children per sub-group	% [a]	(95% CI)[b]
18-23	244	11.0%	(9.8, 12.4)
24-29	250	10.9%	(9.5, 12.3)
30-35	195	8.2%	(7.1, 9.4)
36-41	255	11.4%	(10.1, 12.8)
42-47	201	9.1%	(7.9, 10.5)
48-53	231	10.1%	(8.9, 11.4)
54-59	163	7.2%	(6.0, 8.6)
Sex			
Male	1215	53.3%	(51.2, 55.5)
Female	1044	46.7%	(44.5, 48.8)
Region			
Karakalpakstan	166	7.3%	(4.9, 10.9)
Andijon	182	8.0%	(5.2, 12.1)
Bukhara	161	7.1%	(4.5, 11.1)
Jizzakh	175	7.7%	(5.1, 11.4)
Kashqadarya	173	7.6%	(5.0, 11.4)
Namangan	140	6.2%	(4.1, 9.2)
Navoiy	139	6.1%	(4.0, 9.2)
Samarkand	161	7.1%	(4.6, 10.7)
Surkhandarya	214	9.4%	(6.2, 13.9)
Sirdarya	169	7.4%	(4.8, 11.2)
Tashkent oblast	144	6.3%	(4.0, 9.8)
Ferghana	153	6.7%	(4.3, 10.3)
Khorazm	181	8.0%	(5.3, 11.9)
Tashkent city	116	5.1%	(3.3, 7.8)
Mother's educational level			
Secondary or less	904	39.0%	(35.1, 42.2)
Special secondary or more	1356	61.0%	(57.6, 64.3)

Note: The N's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.
[b] CI=confidence interval calculated taking into account the complex sampling design.

3.3.2 Recent illness and health indicators

Almost all children participating in the survey had been weighed at birth. Low birthweight was not common. The proportion of children suffering from respiratory infection, fever or diarrhea was below 10 percent and medical advice had been sought for more than 50 percent of those children (see Table 11). The low morbidity burden is corroborated by the low proportion of children with elevated inflammation markers.

Table 11. **Health indicators in children less than 5 years of age, Uzbekistan 2017**

Characteristic	Total number of children per sub-group	% [a]	(95% CI)[b]
Child weighed at birth			
Yes	2222	98.5%	(97.6, 99.0)
No	13	0.6%	(0.2, 1.4)
Don't know	24	1.0%	(0.6, 1.6)
Birthweight in kilograms (mean)	2183	3.39	(3.36, 3.42)
Low birthweight			
<2500 grams	109	5.3%	(4.3; 6.4)
2500+ grams	2074	94.7%	(93.6; 95.7)
Had lower acute respiratory infection in past 2 weeks[c]			
Yes	86	3.8%	(3.0; 4.7)
No	2144	96.2%	(95.3; 97.0)
Seek advice or treatment for respiratory infection			
Yes	51	54.9%	(43.1, 66.1)
No	35	45.1%	(33.9, 56.9)
Had diarrhea in past 2 weeks			
Yes	140	6.3%	(5.2; 7.5)
No	2110	93.7%	(92.5; 94.8)
Seek advice or treatment for diarrhea			
Yes	66	50.7%	(42.1, 59.2)
No	74	49.3%	(40.8, 57.9)
Had fever in past 2 weeks			
Yes	158	6.4%	(5.3; 7.8)
No	2091	93.6%	(92.2; 94.7)
Seek advice or treatment for fever			
Yes	93	60.3%	(50.5, 69.4)
No	65	39.7%	(30.6, 49.5)
Inflammation[d]			
None	1218	69.5%	(67.0, 71.8)
Early (High CRP, Normal AGP)	46	2.7%	(2.0, 3.6)
Acute (High CRP, High AGP)	175	9.8%	(8.4, 11.4)
Convalescent (Normal CRP, High AGP)	308	18.1%	(16.1, 20.3)

Note: The N's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages and means weighted for unequal probability of selection among regions.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] Questions on recent illness were phrased according to the MICS manual [38]
[d] For thresholds of inflammatory markers, refer to Table 3.

3.3.3 Infant and young child feeding indicators

Table 12 presents several of the standard infant and young child feeding indicators recommended by WHO and UNICEF [39]. Almost 90 percent of children less than 6 months old were predominantely breastfed, more than half of the children received age-appropriate breastfeeding and less than one-quarter of children had received food from a bottle in the prior 24 hours. More than 95 percent of the surveyed children had ever been breastfed.

Table 12. **IYCF indicators in children less than 24 months of age (unless stated otherwise), Uzbekistan 2017**

Characteristic	Total number of children per sub-group	% [a]	(95% CI)[b]
Early initiation of breastfeeding (WHO/UNICEF IYCF indicator #1)[c]			
Yes	836	91.0%	(88.6, 93.0)
No	90	9.0%	(7.0, 11.4)
Exclusive breastfeeding (<6 months of age; WHO/UNICEF IYCF indicator #2)			
Yes	118	50.7%	(43.0, 58.3)
No	120	49.3%	(41.7, 57.0)
Continued breastfeeding at 1 year (12-15 months of age; WHO/UNICEF IYCF indicator #3)			
Yes	141	87.1%	(81.5, 91.2)
No	25	12.9%	(8.8, 18.5)
Introduction of solid foods (6-8 months; WHO/UNICEF IYCF indicator #4)			
Yes	48	52.9%	(42.5, 63.1)
No	41	47.1%	(36.9, 57.5)
Minimum dietary diversity (6-23 months of age; WHO/UNICEF IYCF indicator #5)			
Yes	203	30.3%	(26.4, 34.6)
No	436	69.7%	(65.4, 73.6)
Minimum meal frequency (6-23 months of age; WHO/UNICEF IYCF indicator #6)			
Yes	163	22.6%	(19.4, 26.2)
No	487	77.4%	(73.8, 80.6)
Minimum acceptable diet (6-23 months of age; WHO/UNICEF IYCF indicator #7)			
Yes	43	5.4%	(3.9, 7.4)
No	597	94.6%	(92.6, 96.1)
Ate iron-rich or iron- fortified food in past 24 hours (6-23 months of age) (WHO/UNICEF IYCF indicator #8)			
Yes	523	74.4%	(70.7, 77.9)
No	181	25.6%	(22.1, 29.3)

Characteristic	Total number of children per sub-group	% [a]	(95% CI)[b]
Ever breastfed (WHO/UNICEF IYCF indicator #9)			
Yes	928	95.6%	(93.8, 96.9)
No	36	4.4%	(3.1, 6.2)
Continued breastfeeding at 2 years (20-23 months of age) (WHO/UNICEF IYCF indicator #10)			
Yes	59	38.5%	(30.3, 47.5)
No	97	61.5%	(52.5, 69.7)
Age appropriate breastfeeding (WHO/UNICEF IYCF indicator #11)			
Yes	508	55.1%	(51.5, 58.6)
No	407	44.9%	(41.4, 48.5)
Predominant breastfeeding (<6 months of age; WHO/UNICEF IYCF indicator #12)			
Yes	195	87.9%	(82.2, 92.0)
No	30	12.1%	(8.0, 17.8)
Bottle fed in past 24 hours (WHO/UNICEF IYCF indicator #14)			
Yes	213	23.0%	(20.1, 26.2)
No	722	77.0%	(73.8, 79.9)
Received 2+ milk feedings in past 24 hours (non-breast feeding children 6-23 months of age; WHO/UNICEF IYCF indicator #15)			
Yes	11	7.3%	(4.0, 12.9)
No	148	92.7%	(87.1, 96.0)

Note: The N's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection among regions.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] The IYCF indicators are described in detail in [21].

Although early breastfeeding initiation was highly prevalent (91 per cent), only about 50 percent of children below 6 months of age were exclusively breastfed. Almost nine out of ten children were continuously breastfed up to one year of age, and about 40 percent were still breastfed at the age of two years. Interestingly, only about one-third of the children received foods from 4 or more food groups per day and only very few received the minimum acceptable diet. Despite this finding, a large majority of children had eaten iron-enriched foods or taken iron supplements in the 24 hours prior to data collection.

Figure 7 below provides age-dependent breastfeeding patterns for children less than 2 years old. It also provides information on the WHO/UNICEF IYCF indicator #13 (median duration of breastfeeding): 50 percent of children are continuing to be breastfed up to 21 months of age.

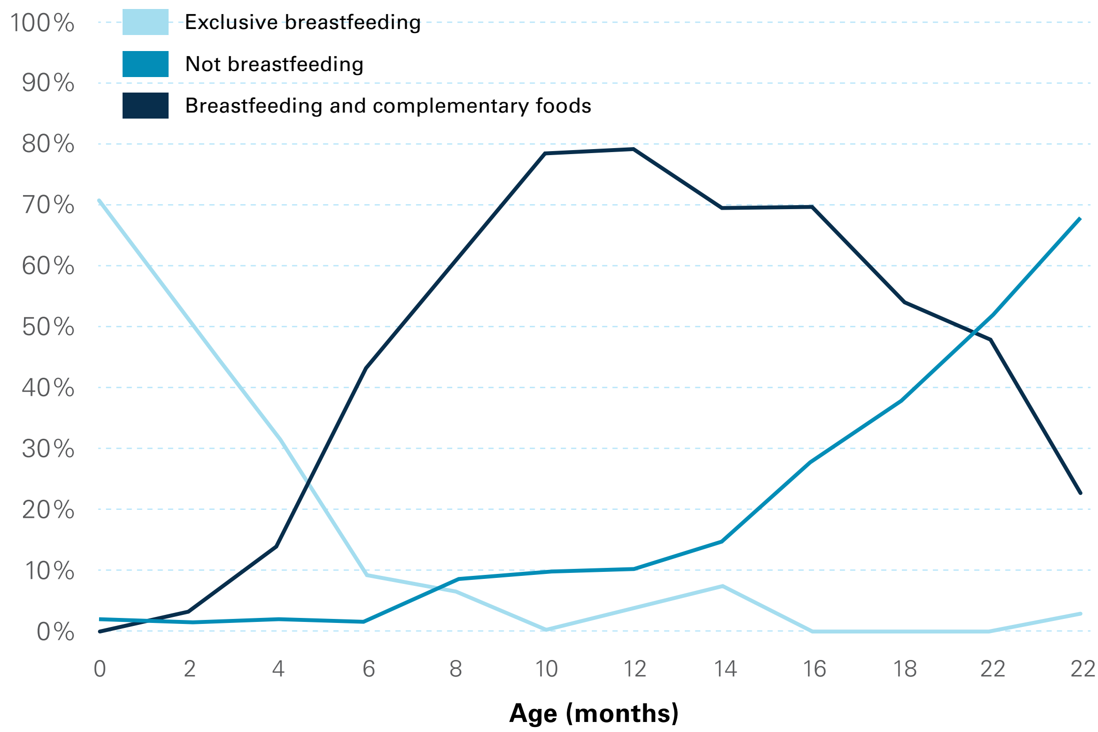

Figure 7. **Breastfeeding practices by age group, Uzbekistan 2017**

3.3.4 Consumption of vitamins and supplements

Less than 6 per cent, a relatively small proportion of children less than 5 years of age, consumed infant formula with added iron or fortified baby cereal in the 24 hours prior to the survey. More than two-thirds of participating caregivers reported their child having consumed iron-fortified bread in the past 24 hours prior to the survey. About 42 percent of the surveyed children took vitamin A supplements in the past 6 months prior to the survey. The most cited benefit of vitamin A supplementation was protection from night blindness, followed by support of health and growth; however, only a minority of mothers knew either of these two benefits. The majority of the caregivers obtained this information either from the patronage nurse or the doctor.

Table 13. **Consumption of iron-fortified food and vitamin A supplements in children less than 5 years of age, Uzbekistan 2017**

Characteristic	Total number of children per sub-group	% [a]	(95% CI)[b]
Consumed infant formula with added iron			
Yes	122	5.7%	(4.7, 7.0)
No	2130	94.3%	(93.0, 95.3)
Consumed commercially fortified baby cereal (age > 6 months)			
Yes	98	5.3%	(4.2, 6.6)
No	1903	94.7%	(93.4, 95.8)
Consumed iron-fortified bread (age > 6 months; self-report)			
Yes	1290	64.9%	(62.0, 67.7)
No	631	30.4%	(27.7, 33.2)
Took vitamin A supplement in past 6 months			
Yes	930	42.1%	(38.9, 45.5)
No	1015	45.0%	(41.9, 48.2)
Don't know	309	12.9%	(10.6, 15.5)
Benefits of vitamin A supplementation cited			
Protect from night blindness	831	37.2%	(34.4, 40.1)
Protect from illness and death	111	5.9%	(4.5, 7.6)
Support health and growth	434	21.9%	(19.5, 24.5)
Other	41	1.5%	(1.0, 2.2)
Don't know	111	3.5%	(2.7, 4.7)
Source of information on benefits			
Doctor	757	59.1%	(55.4, 62.7)
Nurse or midwife	219	15.9%	(13.3, 18.9)
Patronage nurse	892	62.7%	(59.0, 66.3)
Mother-in-law	32	2.5%	(1.7, 3.7)
Friend	8	0.7%	(0.3, 1.3)
Mass media	86	6.8%	(5.3, 8.6)
Other	28	1.7%	(1.1, 2.6)

Note: The N's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection among regions.
[b] CI=confidence interval calculated taking into account the complex sampling design.

3.3.5 Anthropometry

The anthropometry results for children, including national estimates, do not include Bukhara region. Despite all anthropometrists undergoing the same training, the adequate performance of the Bukhara anthropometrists during the training, and continuous supervision, child height measurements in Bukhara were incorrectly taken. This is illustrated by the consistently higher height measurements despite a comparable mean age of the children measured:

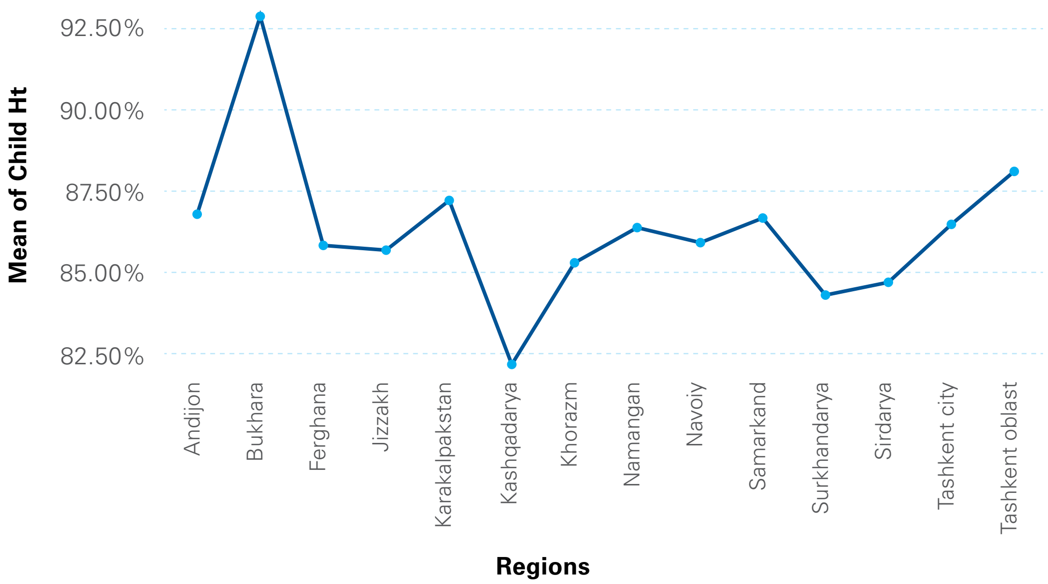

Figure 8. **Mean child height, by region, Uzbekistan 2017**

For this reason, it was decided to exclude anthropometric results from Bukhara in this report, with the exception of underweight data, since this assessment does not require height measurements. Additional data quality checks are presented in APPENDIX 13.

Stunting

Overall, stunting in children less than 5 years of age is not common in Uzbekistan (Table 14). Thus, according to WHO classification, the prevalence of stunting is classified as low in Uzbekistan [40]. The prevalence of stunting significantly differed by region, age, and wealth quintile, but not by rural/ urban residence, child's sex, or mother's educational level. Children living in poor households were more likely to be stunted than those living in wealthier households, and a considerably higher proportion of children residing in Namangan and Surkhandarya were stunted compared to Tashkent city and oblast.

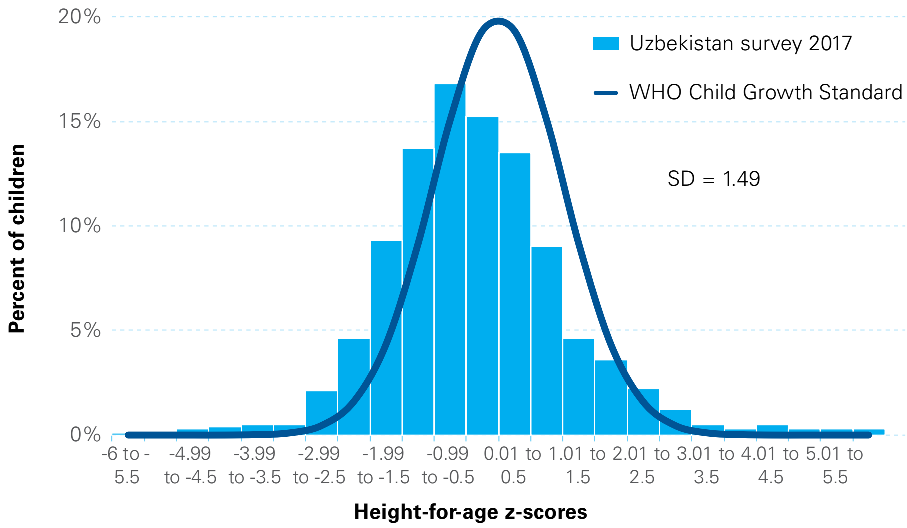

Figure 9. **Distribution of height-for-age z-scores in children less than 5 years of age, Uzbekistan 2017**

Figure 9 shows the distribution of the height-for-age z-score in the surveyed population of children 0-59 months of age. It demonstrates that the distribution is shifted somewhat towards the left of the standard growth curve. Figure 10 shows the geographic distribution of child stunting prevalence.

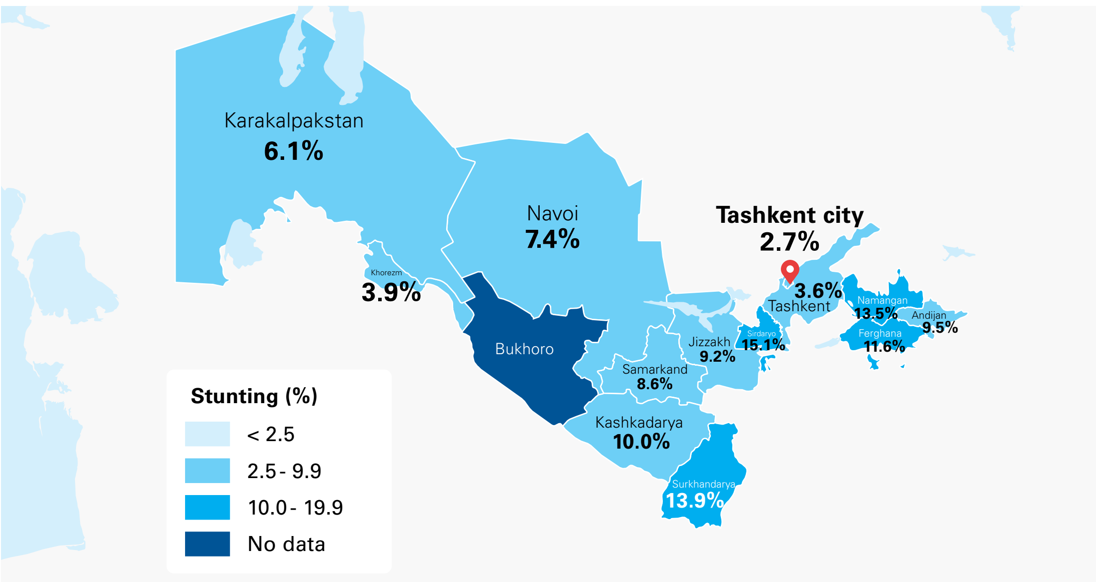

Figure 10. **Prevalence of stunting by region, children 0-59 months, Uzbekistan 2017**

Wasting

Only 1.9 percent of children 0-59 months of age in Uzbekistan were wasted. This prevalence is classified as very low [40]. Most of the wasted children suffered from moderate acute malnutrition; severe acute malnutrition was rare (Table 15). The survey found significant differences in wasting for the different age groups, with highest prevalence in the youngest children.

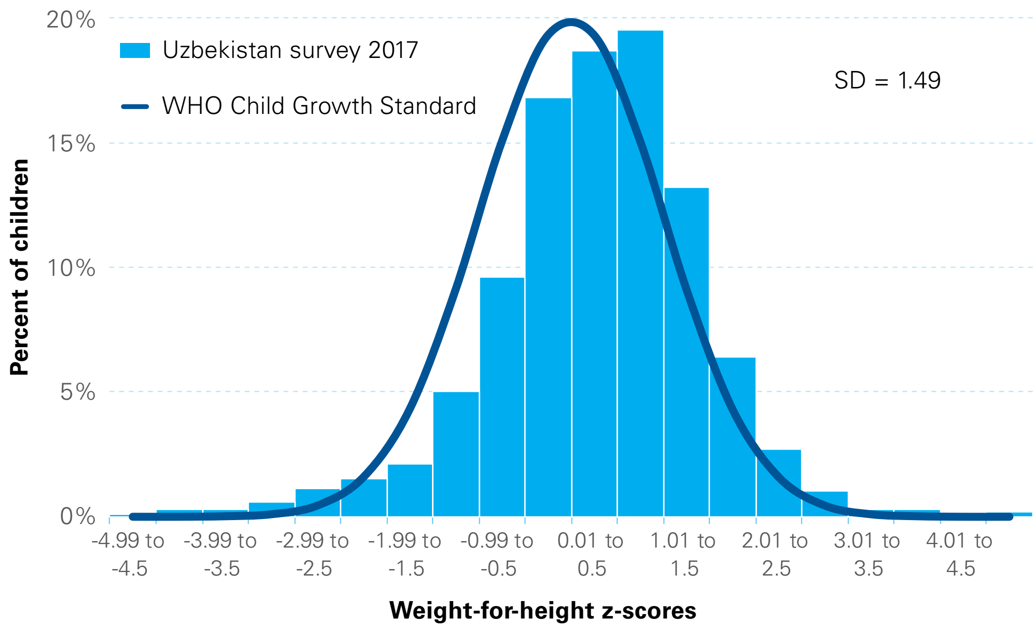

Figure 11. **Distribution of weight-for-height z-scores in children less than 5 years of age, Uzbekistan 2017**

Figure 11 shows the distribution of the height-for-age z-score in the surveyed population of children 0-59 months of age. It shows that the distribution is slightly shifted towards the right of the standard growth curve, indicating that weight-for-height z-scores were on average higher than those in the WHO Growth Standard population.

Overnutrition

Overnutrition (overweight and obesity) is not very common in Uzbekistan children. Significant differences were found between the age groups, with the highest prevalence of overnutrition in the youngest age group and declining with increasing age. No significant differences were detected by household wealth, urban vs. rural residency and region. Although not reaching significance, male sex children tended to have a higher prevalence of overweight and obesity.

Underweight

Underweight was not very common in Uzbekistan (Table 17). Significant differences were detected between wealth quintiles, with higher prevalence of underweight in the poorest households. No significant differences were found by age group, child's sex, urban vs. rural residency and region.

Table 14. **Prevalence of stunting in children 0-59 months, by various demographic characteristics, Uzbekistan 2017**

Characteristic	N	Severely stunted [c]		Moderately stunted [c]		Any stunted [d]		
		% [a]	(95% CI)[b]	%	(95% CI)[b]	%	(95% CI)[b]	Chi-Square p-value [e]
TOTAL	2039	2.0%	(1.4, 2.8)	6.8%	(5.6, 8.1)	8.7%	(7.4, 10.2)	
Urban/rural								
Urban	488	2.0%	(1.0, 4.0)	6.5%	(4.0, 10.2)	8.5%	(5.9, 12.1)	0.87
Rural	1551	1.9%	(1.3, 2.9)	6.9%	(5.6, 8.3)	8.8%	(7.4, 10.5)	
Sex								
Male	1097	2.0%	(1.3, 3.1)	7.2%	(5.7, 9.1)	9.2%	(7.5, 11.3)	0.406
Female	942	1.9%	(1.1, 3.0)	6.3%	(4.8, 8.2)	8.2%	(6.5, 10.2)	
Region								
Karakalpakstan	163	--	--	6.1%	(3.2, 11.5)	6.1%	(3.2, 11.5)	<0.001
Andijon	168	3.6%	(1.5, 8.2)	6.0%	(3.5, 10.0)	9.5%	(5.9, 15.1)	
Bukhara[f]								
Jizzakh	173	1.7%	(0.6, 5.0)	7.5%	(4.6, 12.1)	9.2%	(6.3, 13.5)	
Kashqadarya	170	2.4%	(0.7, 7.2)	7.6%	(4.0, 14.2)	10.0%	(5.3, 17.9)	
Namangan	133	3.8%	(1.7, 8.1)	9.8%	(5.9, 15.7)	13.5%	(8.6, 20.7)	
Navoiy	135	0.7%	(0.1, 4.9)	6.7%	(3.8, 11.4)	7.4%	(4.2, 12.9)	
Samarkand	152	2.0%	(0.5, 7.6)	6.6%	(3.4, 12.2)	8.6%	(5.0, 14.2)	
Surkhandarya	209	4.3%	(2.5, 7.4)	9.6%	(6.6, 13.7)	13.9%	(10.8, 17.7)	
Sirdarya	159	5.0%	(2.0, 12.1)	10.1%	(6.1, 16.1)	15.1%	(9.9, 22.4)	
Tashkent oblast	140	--	--	3.6%	(1.8, 7.0)	3.6%	(1.8, 7.0)	
Ferghana	146	0.7%	(0.1, 4.6)	11.0%	(6.4, 18.1)	11.6%	(7.1, 18.5)	
Khorazm	180	0.6%	(0.1, 3.7)	3.3%	(1.4, 7.9)	3.9%	(1.8, 8.4)	
Tashkent city	111	1.8%	(0.5, 6.6)	0.9%	(0.1, 5.7)	2.7%	(1.0, 7.3)	
Age (in months)								
0-11	412	1.6%	(0.7, 3.3)	1.0%	(0.4, 2.5)	2.5%	(1.4, 4.5)	<0.001
12-23	445	1.7%	(0.8, 3.5)	6.8%	(4.7, 9.8)	8.5%	(6.2, 11.7)	
24-35	404	2.7%	(1.4, 5.5)	11.1%	(7.9, 15.2)	13.8%	(10.2, 18.5)	
36-47	421	2.6%	(1.4, 4.8)	8.2%	(5.8, 11.6)	10.8%	(7.9, 14.5)	
48-59	324	1.2%	(0.4, 3.7)	7.5%	(5.0, 11.1)	8.7%	(5.9, 12.5)	
Wealth quintile								
Poorest	490	3.5%	(2.1, 5.8)	9.2%	(6.9, 12.0)	12.7%	(9.8, 16.2)	<0.005
Second	419	1.7%	(0.8, 3.7)	6.9%	(4.7, 9.9)	8.6%	(6.1, 11.9)	
Middle	434	1.5%	(0.7, 3.4)	5.8%	(3.8, 8.6)	7.3%	(5.1, 10.2)	
Fourth	369	1.1%	(0.4, 3.0)	8.1%	(5.2, 12.5)	9.2%	(6.0, 13.9)	
Wealthiest	313	1.1%	(0.4, 3.1)	4.1%	(2.2, 7.4)	4.1%	(2.2, 7.4)	

Characteristic	N	Severely stunted [c]		Moderately stunted[c]		Any stunted [d]		
		% [a]	(95% CI)[b]	%	(95% CI)[b]	%	(95% CI)[b]	Chi-Square p-value [e]
Mother's educational level								
Secondary or less	781	1.3%	(0.7, 2.5)	7.5%	(5.7, 9.8)	8.8%	(6.8, 11.3)	0.92
Special secondary or more	1258	2.3%	(1.5, 3.5)	6.4%	(5.0, 8.1)	8.7%	(7.0, 10.7)	
Child's weight at birth								
<2500 g	98	4.7%	(1.9, 11.5)	20.9%	(13.4, 31.1)	25.6%	(17.1, 36.5)	<0.001
2500 + grams	1871	1.8%	(1.2, 2.6)	6.2%	(5.1, 7.5)	8.0%	(6.1, 9.4)	

Note: The N's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] Severe stunting is defined as having a height-for-age z-score below-3 standard deviations from the WHO Child Growth Standards population median; moderate stunting is defined as having a height-for-age z score equal to or above-3 standard deviations and less than-2 SD from the WHO Child Growth Standards population median.
[d] Any stunting includes both severely and moderately stunted children.
[e] P value <0.05 indicates that at least one subgroup is significantly different from the others. Chi-square results are based on any stunting.
[f] Valid results not available for Bukhara.

Table 15. Prevalence of wasting in children 0-59 months, by various demographic characteristics, Uzbekistan 2017

Characteristic	N	Severely wasted [c]		Moderately wasted[c]		Any wasted [d]		
		% [a]	(95% CI)[b]	%	(95% CI)[b]	%	(95% CI)[b]	Chi-Square p-value [e]
TOTAL	2036	0.3%	(0.1, 0.8)	1.6%	(1.1, 2.3)	1.9%	(1.3, 2.7)	
Urban/rural								
Urban	490	0.7%	(0.2, 2.2)	1.5%	(0.7, 3.2)	2.3%	(1.2, 4.0)	0.52
Rural	1546	0.2%	(0.1, 0.7)	1.6%	(1.0, 2.5)	1.8%	(1.2, 2.7)	
Sex								
Male	1094	0.2%	(0.1, 1.0)	1.8%	(1.1, 2.7)	2.0%	(1.3, 3.1)	0.749
Female	942	0.4%	(0.2, 1.2)	1.3%	(0.7, 2.6)	1.8%	(1.0, 3.1)	
Region								
Karakalpakstan	163	0.6%	(0.1, 4.2)	1.8%	(0.6, 5.1)	2.5%	(1.0, 5.9)	0.61
Andijon	166	0.6%	(0.1, 4.2)	1.8%	(0.6, 5.2)	2.4%	(0.9, 6.0)	
Bukhara[f]								
Jizzakh	173	--	--	1.2%	(0.3, 4.3)	1.2%	(0.3, 4.3)	
Kashqadarya	170	--	--	2.4%	(0.8, 7.1)	2.4%	(0.8, 7.1)	
Namangan	136	--	--	--	--	--	--	

Characteristic	N	Severely wasted [c]		Moderately wasted [c]		Any wasted [d]		
		% [a]	(95% CI) [b]	%	(95% CI) [b]	%	(95% CI) [b]	Chi-Square p-value [e]
Navoiy	136	–	–	3.7%	(1.6, 8.2)	3.7%	(1.6, 8.2)	
Samarkand	151	0.7%	(0.1, 4.7)	2.0%	(0.5, 7.6)	2.6%	(0.8, 8.0)	
Surkhandarya	206	0.5%	(0.1, 3.2)	2.4%	(1.0, 5.5)	2.9%	(1.4, 6.0)	
Sirdarya	159	–	–	2.5%	(0.8, 7.7)	2.5%	(0.8, 7.7)	
Tashkent oblast	112	0.9%	(0.1, 5.4)	1.8%	(0.5, 6.6)	2.7%	(1.0, 7.2)	
Ferghana	145	–	–	1.4%	(0.4, 4.9)	1.4%	(0.4, 4.9)	
Khorazm	180	–	–	0.6%	(0.1, 3.7)	0.6%	(0.1, 3.7)	
Tashkent city	139	0.7%	(0.1, 4.7)	–	–	0.7%	(0.1, 4.7)	
Age (in months)								
0-11	410	0.4%	(0.1, 2.6)	4.1%	(2.4, 6.8)	4.5%	(2.7, 7.3)	<0.005
12-23	447	0.2%	(0.0, 1.4)	0.7%	(0.3, 2.1)	0.9%	(0.4, 2.4)	
24-35	404	0.5%	(0.1, 2.1)	0.8%	(0.2, 2.7)	1.3%	(0.5, 3.3)	
36-47	421	0.3%	(0.0, 2.0)	0.3%	(0.0, 2.2)	0.6%	(0.1, 2.3)	
48-59	322	0.4%	(0.1, 2.9)	–	–	2.7%	(1.2, 5.7)	
Wealth quintile								
Poorest	486	0.2%	(0.0, 1.3)	2.4%	(1.3, 4.3)	2.6%	(1.5, 4.5)	0.12
Second	423	–	–	1.5%	(0.7, 3.4)	1.5%	(0.7, 3.4)	
Middle	432	0.3%	(0.0, 1.9)	1.4%	(0.6, 3.2)	1.7%	(0.8, 3.6)	
Fourth	366	0.3%	(0.0, 2.2)	0.3%	(0.1, 1.2)	0.6%	(0.2, 2.1)	
Wealthiest	315	1.1%	(0.4, 3.4)	2.0%	(0.9, 4.4)	3.1%	(1.7, 5.7)	
Mother's educational level								
Secondary or less	783	0.3%	(0.1, 1.3)	1.6%	(0.8, 3.0)	1.9%	(1.1, 3.3)	0.99
Special secondary or more	1253	0.3%	(0.1, 1.0)	1.5%	(0.9, 2.6)	1.9%	(1.2, 3.1)	

Note: The N's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.

[b] CI=confidence interval calculated taking into account the complex sampling design.

[c] Severe wasting is defined as having a weight-for-height z-score below-3 standard deviations from the WHO Child Growth Standards population median; moderate wasting is defined as having a weight-for-height z-score equal to or above-3 standard deviations and less than-2 SD from the WHO Child Growth Standards population median.

[d] Any wasting includes both severely and moderately wasted children.

[e] P value <0.05 indicates that one at least subgroup is significantly different from the others. Chi-square results are based on any stunting.

[f] Valid results not available for Bukhara.

Table 16. **Prevalence of overweight and obesity in children 0-59 months, by various demographic characteristics, Uzbekistan 2017**

Characteristic	N	Obese [c] % [a]	Obese [c] (95% CI)[b]	Overweight[c] %	Overweight[c] (95% CI)[b]	Overnutrition (overweight or obesity)[c] %	Overnutrition (overweight or obesity)[c] (95% CI)[b]	Chi-Square p-value [d]
TOTAL	2036	0.8%	(0.5, 1.3)	3.8%	(3.0, 4.7)	4.6%	(3.7, 5.6)	
Urban/rural								
Urban	490	0.5%	(0.2, 1.7)	3.9%	(2.5, 6.2)	4.5%	(2.9, 6.7)	0.92
Rural	1546	0.9%	(0.5, 1.6)	3.7%	(2.9, 4.8)	4.6%	(3.6, 5.8)	
Sex								
Male	1094	1.1%	(0.6, 2.0)	4.3%	(3.2, 5.7)	5.4%	(4.2, 6.9)	0.075
Female	942	0.4%	(0.2, 1.1)	3.2%	(2.2, 4.6)	3.6%	(2.6, 5.1)	
Region								
Karakalpakstan	163	--	--	1.2%	(0.3, 4.6)	1.2%	(0.3, 4.6)	0.21
Andijon	166	1.2%	(0.3, 4.7)	6.0%	(3.2, 10.9)	7.2%	(4.2, 12.1)	
Bukhara[e]								
Jizzakh	173	0.6%	(0.1, 3.9)	2.3%	(1.0, 5.4)	2.9%	(1.4, 6.0)	
Kashqadarya	170	1.2%	(0.3, 4.4)	2.4%	(0.9, 6.1)	3.5%	(1.6, 7.5)	
Namangan	136	1.5%	(0.4, 5.4)	2.9%	(1.2, 7.0)	4.4%	(2.2, 8.6)	
Navoiy	136	--	--	3.7%	(1.4, 9.5)	3.7%	(1.4, 9.5)	
Samarkand	151	--	--	5.3%	(3.0, 9.3)	5.3%	(3.0, 9.3)	
Surkhandarya	206	3.4%	(1.5, 7.7)	3.9%	(2.0, 7.2)	7.3%	(4.4, 11.7)	
Sirdarya	159	5.0%	(1.6, 15.0)	2.5%	(1.0, 6.0)	7.5%	(3.0, 17.8)	
Tashkent city	112	--	--	3.6%	(1.6, 7.7)	3.6%	(1.6, 7.7)	
Ferghana	145	--	--	4.1%	(2.1, 8.1)	4.1%	(2.1, 8.1)	
Khorazm	180	--	--	4.4%	(2.1, 9.1)	4.4%	(2.1, 9.1)	
Tashkent oblast	139	--	--	3.6%	(1.8, 7.0)	3.6%	(1.8, 7.0)	
Age (in months)								
0-11	410	1.4%	(0.6, 3.1)	6.8%	(4.5, 10.0)	8.1%	(5.6, 11.5)	<0.01
12-23	447	0.6%	(0.2, 1.6)	3.7%	(2.3, 6.1)	4.3%	(2.7, 6.8)	
24-35	404	0.5%	(0.2, 1.9)	3.0%	(1.7, 5.3)	3.5%	(2.1, 5.9)	
36-47	421	1.0%	(0.4, 2.6)	2.9%	(1.6, 5.3)	4.0%	(2.4, 6.5)	
48-59	322	0.4%	(0.1, 2.9)	1.8%	(0.7, 4.3)	2.2%	(1.0, 4.9)	
Wealth quintile								
Poorest	486	2.4%	(1.3, 4.4)	3.7%	(2.3, 5.9)	6.1%	(4.2, 8.7)	0.33
Second	423	0.3%	(0.1, 1.8)	3.8%	(2.3, 6.4)	4.2%	(2.5, 6.8)	
Middle	432	0.1%	(0.0, 0.4)	3.7%	(2.2, 6.1)	3.8%	(2.3, 6.2)	
Fourth	366	0.2%	(0.0, 0.8)	3.0%	(1.7, 5.4)	3.2%	(1.8, 5.6)	
Wealthiest	315	0.5%	(0.1, 2.1)	4.4%	(2.6, 7.4)	4.9%	(2.9, 8.0)	
Mother's educational level								
Secondary or less	783	0.8%	(0.3, 1.9)	2.9%	(1.8, 4.6)	3.7%	(2.5, 5.5)	0.19
Special secondary or more	1253	0.8%	(0.4, 1.6)	4.3%	(3.3, 5.5)	5.1%	(4.0, 6.4)	

Note: The N's are un-weighted numbers (denominator) for each subgroup, subgroups that do not sum to the total have missing data.
[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.
[b] CI=confidence interval calculated taking into account the complex sampling design .
[c] Overweight is defined as having a weight-for-height z-score greater than +2 but less than or equal to +3 standard deviations from the WHO Child Growth Standards population median, obesity is defined as having a weight-for-height z-score greater than +3 standard deviations from the WHO Child Growth Standards population median.
[d] P value <0.05 indicates that one at least subgroup is significantly different from the others. Chi-square results are based on overweight or obese.
[e] Valid results not available for Bukhara.

Table 17. **Prevalence of underweight in children 0-59 months, by various demographic characteristics, Uzbekistan 2017**

		Severe underweight [c]		Moderate underweight [c]		Any underweight [c]		
Characteristic	**N**	**% [a]**	**(95% CI) [b]**	**%**	**(95% CI) [b]**	**%**	**(95% CI) [b]**	**Chi-Square p-value [d]**
TOTAL	2207	0.7%	(0.4, 1.2)	1.9%	(1.3, 2.6)	2.6%	(1.9, 3.5)	
Urban/rural								
Urban	523	0.7%	(0.2, 2.0)	2.3%	(1.3, 4.1)	3.0%	(1.8, 5.0)	0.56
Rural	1684	0.7%	(0.4, 1.3)	1.7%	(1.1, 2.6)	2.5%	(1.7, 3.6)	
Sex								
Male	1187	0.7%	(0.3, 1.5)	2.0%	(1.3, 3.0)	2.6%	(1.8, 3.9)	0.853
Female	1020	0.8%	(0.4, 1.6)	1.8%	(1.1, 2.9)	2.5%	(1.7, 3.8)	
Region								
Karakalpakstan	163	--	--	1.2%	(0.3, 4.6)	1.2%	(0.3, 4.6)	0.56
Andijon	168	1.8%	(0.6, 5.1)	2.4%	(1.0, 5.5)	4.2%	(1.8, 9.2)	
Bukhara [e]	157	1.3%	(0.4, 4.4)	1.9%	(0.5, 7.1)	3.2%	(0.9, 11.0)	
Jizzakh	173	--	--	2.3%	(0.9, 5.6)	2.3%	(0.9, 5.6)	
Kashqadarya	170	0.6%	(0.1, 4.1)	3.5%	(1.4, 8.6)	4.1%	(1.6, 9.9)	
Namangan	136	1.5%	(0.4, 5.3)	0.7%	(0.1, 5.0)	2.2%	(0.5, 8.6)	
Navoiy	136	0.7%	(0.1, 4.9)	1.5%	(0.2, 9.4)	2.2%	(0.5, 8.6)	
Samarkand	154	0.6%	(0.1, 4.3)	1.9%	(0.7, 5.5)	2.6%	(1.1, 6.2)	
Surkhandarya	209	0.5%	(0.1, 3.1)	3.8%	(1.6, 8.7)	4.3%	(2.0, 9.0)	
Sirdarya	163	0.6%	(0.1, 4.1)	3.1%	(1.1, 8.1)	3.7%	(1.5, 8.6)	
Tashkent city	112	0.9%	(0.1, 5.8)	2.7%	(1.0, 7.3)	3.6%	(1.5, 8.2)	
Ferghana	147	0.7%	(0.1, 4.6)	0.7%	(0.1, 4.6)	1.4%	(0.2, 8.9)	
Khorazm	180	0.6%	(0.1, 3.7)	--	--	0.6%	(0.1, 3.7)	
Tashkent oblast	139	--	--	0.7%	(0.1, 4.7)	0.7%	(0.1, 4.7)	
Age (in months)								
0-11	452	0.9%	(0.3, 2.5)	1.7%	(0.7, 3.9)	2.5%	(1.3, 4.9)	0.82
12-23	481	0.7%	(0.2, 2.2)	1.7%	(0.7, 4.1)	1.9%	(1.0, 3.7)	
24-35	441	0.7%	(0.2, 2.2)	1.7%	(0.7, 4.1)	2.4%	(1.2, 4.8)	
36-47	448	0.5%	(0.1, 1.9)	2.4%	(1.2, 4.5)	2.8%	(1.6, 5.1)	
48-59	350	1.3%	(0.5, 3.5)	2.0%	(1.0, 4.2)	3.3%	(1.8, 6.0)	
Wealth quintile								
Poorest	495	0.9%	(0.4, 2.5)	3.3%	(2.0, 5.7)	4.3%	(2.6, 6.9)	<0.05
Second	443	0.1%	(0.0, 0.4)	0.7%	(0.2, 2.0)	0.8%	(0.3, 2.1)	
Middle	461	1.0%	(0.4, 2.8)	1.4%	(0.6, 3.3)	2.5%	(1.3, 4.6)	
Fourth	414	0.9%	(0.3, 2.5)	1.8%	(0.8, 4.0)	2.6%	(1.4, 5.0)	
Wealthiest	380	0.3%	(0.0, 2.1)	1.9%	(0.8, 4.1)	2.2%	(1.0, 4.5)	
Mother's educational level								
Secondary or less	892	0.8%	(0.3, 1.6)	2.0%	(1.2, 3.3)	2.7%	(1.7, 4.4)	0.75
Special secondary or more	1316	0.7%	(0.3, 1.4)	1.8%	(1.1, 2.8)	2.5%	(1.6, 3.7)	

Note: The N's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.
[b] CI=confidence interval calculated taking into account the complex sampling design .
[c] Moderate underweight was defined as a weight-for-age z-score less than-2.0 but greater than or equal to-3.0 Z-score. A Z-score less than-3.0 defined severe underweight.
[d] P value <0.05 indicates that one at least subgroup is significantly different from the others. Chi-square results are based on any underweight.

3.3.6 Anaemia, iron deficiency, and iron deficiency anaemia

About 15 percent of children less than 5 years old were anaemic (Table 18). Less than 1 percent of child anaemia is classified as severe (see APPENDIX 2). According to WHO, anaemia in children can be considered a mild public health problem [31].

The highest anaemia prevalence occurs in children 6-11 months of age and the prevalence decreases with age. Although male children have a slightly higher anaemia prevalence than females, the difference is not statistically significant. Other variables, such as urban/rural residence, region, household wealth and mother's educational level were not associated with anaemia with statistical significance. The distribution of haemoglobin values for children is shown in Figure 12. It is roughly symmetric with the majority of values above the cut-off point of 110 g/L. Mean haemoglobin concentration among all children 6-59 months old was 120.2 g/L (95%CI 119.5, 120.8 g/L).

Iron deficiency was much more common than anaemia in children 6-59 months of age. Its prevalence was not statistically significantly different between children in urban and rural areas, poorer and wealthier households, nor between children whose mothers had different levels of education. On the other hand, the prevalence of iron deficiency was significantly higher in boys than girls, and in some regions, with the highest levels in Karakalpakstan and lowest in Bukhara. Iron deficiency was most common in children 12-23 months, but unlike anaemia, the prevalence did not substantially decline until the fourth year of life.

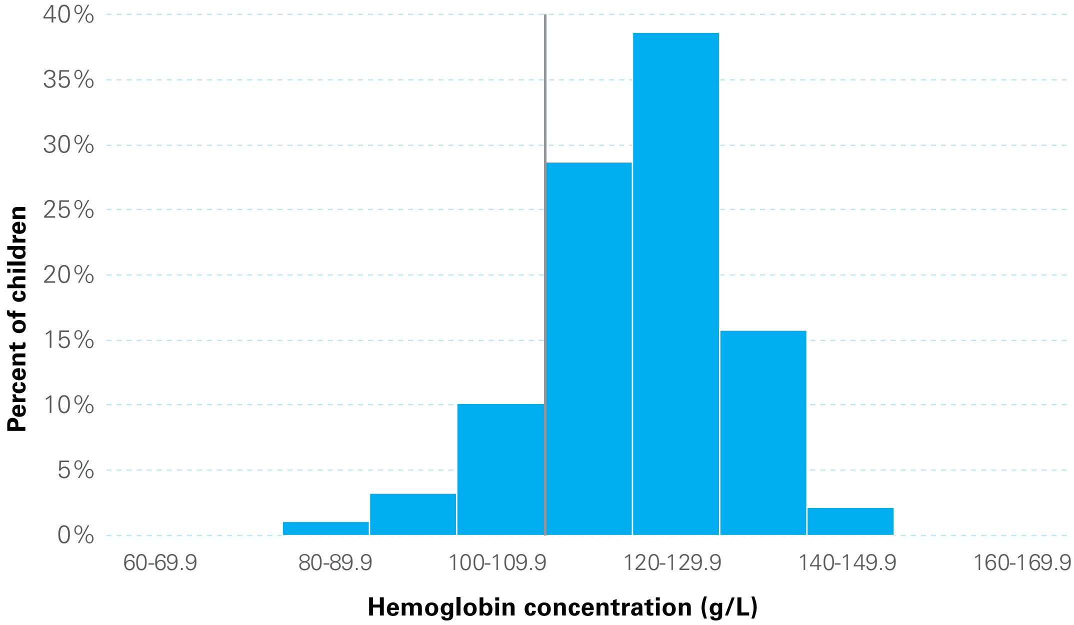

Figure 12. **Distribution of adjusted haemoglobin (g/L) in children 6-59 months, Uzbekistan 2017**

Figure 13 illustrates the overlap between anaemia and iron deficiency in children 6-59 months of age, showing a large overlap between anaemia and iron deficiency.

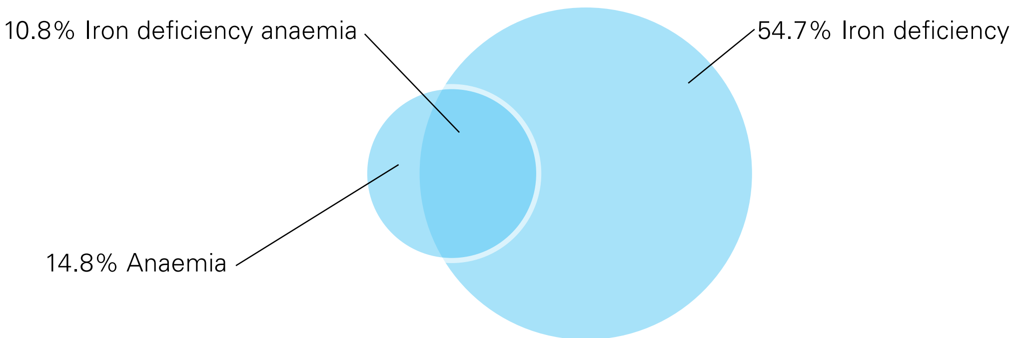

Figure 13. **Venn diagram showing overlap between anaemia and iron deficiency in children 6-59 months of age, Uzbekistan 2017**

Table 18. **Prevalence of anaemia, iron deficiency, and iron deficiency anaemia in children 6-59 months, by various demographic characteristics, Uzbekistan 2017.**

	Anaemia				Iron deficiency [e]				Iron deficiency anaemia			
Characteristic	**N**	**% [a, b]**	**95% CI [c]**	**p-value [d]**	**N**	**% [a]**	**95% CI [c]**	**p-value [d]**	**N**	**% [a, f]**	**95% CI [c]**	**p-value [d]**
TOTAL	1936	14.7%	(13.1, 16.4)		1736	54.7%	(51.9, 57.4)		1736	10.8%	(9.4, 12.4)	
Urban/rural												
Urban	463	15.6%	(12.7, 18.9)	0.66	406	57.6%	(52.4, 62.7)	0.27	406	13.1%	(10.2, 16.6)	0.22
Rural	1473	14.7%	(13.0, 16.7)		1330	54.3%	(51.1, 57.4)		1330	10.9%	(9.3, 12.7)	
Sex												
Male	1036	16.1%	(14.0, 18.5)	0.07	932	57.0%	(53.3, 60.5)	<0.05	932	12.1%	(10.1, 14.4)	0.06
Female	900	13.1%	(10.9, 15.6)		802	51.7%	(48.0, 55.4)		802	9.3%	(7.5, 11.5)	
Region												
Karakalpakstan	144	16.7%	(11.2, 24.1)	0.13	123	66.7%	(58.7, 73.7)	<0.05	123	14.6%	(8.9, 23.2)	0.22
Andijon	144	16.0%	(10.6, 23.3)		134	53.0%	(44.7, 61.2)		134	11.2%	(6.7, 18.2)	
Bukhara	139	23.0%	(16.5, 31.2)		118	39.8%	(32.1, 48.1)		118	9.3%	(6.5, 13.2)	
Jizzakh	154	13.0%	(8.8, 18.7)		143	53.8%	(44.2, 63.2)		143	9.8%	(6.3, 14.8)	
Kashqadarya	143	12.6%	(9.1, 17.1)		136	51.5%	(41.6, 61.3)		136	11.0%	(7.7, 15.5)	
Namangan	126	8.7%	(4.4, 16.5)		123	61.8%	(52.0, 70.7)		123	8.9%	(4.6, 16.8)	
Navoiy	114	14.0%	(8.9, 21.4)		108	58.3%	(47.3, 68.6)		108	13.9%	(8.5, 21.8)	
Samarkand	140	17.9%	(12.4, 25.0)		99	46.5%	(34.9, 58.4)		99	4.0%	(1.7, 9.4)	
Surkhandarya	183	14.8%	(10.8, 19.8)		161	54.7%	(45.4, 63.7)		161	13.7%	(9.8, 18.7)	
Sirdarya	139	17.3%	(11.5, 25.1)		137	58.4%	(45.2, 70.5)		137	16.8%	(11.3, 24.2)	
Tashkent city	95	13.7%	(7.8, 22.8)		89	64.0%	(52.4, 74.2)		89	11.2%	(5.2, 22.4)	
Ferghana	127	13.4%	(8.7, 20.0)		107	49.5%	(40.6, 58.5)		107	10.3%	(6.3, 16.3)	
Khorazm	159	10.1%	(6.5, 15.3)		157	54.8%	(45.7, 63.6)		157	8.9%	(5.3, 14.5)	
Tashkent oblast	129	17.8%	(12.4, 25.0)		101	59.4%	(51.7, 66.7)		101	14.9%	(9.0, 23.5)	
Age (in months)												
6-11	210	30.5%	(24.6, 37.3)	<0.001	176	50.2%	(42.3, 58.0)	<0.001	176	20.0%	(14.8, 26.5)	<0.001
12-23	468	26.0%	(21.8, 30.6)		391	73.3%	(68.5, 77.5)		391	21.1%	(17.1, 25.7)	
24-35	436	12.7%	(10.0, 16.1)		400	65.9%	(60.4, 71.0)		400	9.8%	(7.2, 13.2)	
36-47	441	7.1%	(5.1, 10.0)		411	47.3%	(42.1, 52.6)		411	5.2%	(3.3, 7.9)	
48-59	346	1.9%	(0.9, 3.9)		327	31.7%	(26.5, 37.4)		327	1.7%	(0.8, 3.8)	
Wealth quintile												
Poorest	426	14.5%	(11.3, 18.3)	0.71	389	57.2%	(51.2, 63.0)	0.36	389	11.9%	(8.9, 15.7)	0.38
Second	395	14.2%	(11.3, 17.8)		358	50.9%	(44.9, 56.8)		358	10.9%	(8.3, 14.3)	
Middle	411	16.8%	(13.0, 21.3)		373	56.3%	(50.4, 62.1)		373	12.0%	(9.0, 15.8)	
Fourth	364	14.8%	(11.3, 19.1)		316	56.5%	(50.5, 62.2)		316	11.1%	(7.9, 15.4)	
Wealthiest	327	13.0%	(9.8, 17.0)		288	51.1%	(45.2, 57.0)		288	7.6%	(5.0, 11.2)	
Mother's educational level												
Secondary or less	798	14.9%	(12.5, 17.7)	0.86	726	54.5%	(50.4, 58.5)	0.99	726	10.2%	(8.1, 12.8)	0.50
Special secondary or more	1139	14.6%	(12.6, 16.9)		1011	54.5%	(50.9, 58.1)		1011	11.2%	(9.4, 13.3)	

Note: The N's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data; for iron deficiency and iron deficiency anaemia, the numbers are smaller than for anaemia due to unsuccessful blood collection (only sufficient blood could be obtained for the on-site analysis of haemoglobin concentration).

[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.

[b] Anaemia defined as haemoglobin < 110 g/L adjusted for altitude.

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

[e] Iron deficiency defined as serum ferritin < 12 µg/l.

[f] Iron deficiency anaemia defined as serum ferritin < 12.0 µg/L and haemoglobin < 110 g/L.

Of the morbidity conditions included in the survey, only lower respiratory infection was statistically significantly associated with anaemia (Table 19), and this association was negative. Household sanitation was not significantly associated with anaemia. Reported consumption of iron-rich or iron-fortified foods was also not associated with anaemia in children 6-59 months of age. On the other hand, the presence of inflammation, iron deficiency, and/or vitamin A deficiency were all statistically significantly associated with anaemia.

Table 19. **Correlation between various factors and anaemia in children 6-59 months of age, Uzbekistan 2017**

Characteristic	Total number of children per sub-group	% [a] Anaemic	P value[b]
Child had diarrhea			
Yes	22	19.6%	0.16
No	265	14.4%	
Child had fever			
Yes	22	14.4%	0.91
No	265	14.7%	
Child had lower respiratory infection			
Yes	6	6.7%	<0.05
No	277	14.9%	
Child's household had adequate sanitation			
Yes	252	14.6%	0.77
No	37	15.4%	
Reported having consumed iron rich or iron fortified foods			
Yes	130	27.1%	0.83
No	55	27.9%	
Reported having consumed iron-fortified bread			
Yes	105	16.9%	0.08
No	171	13.7%	
Reported having consumed iron-fortified infant formula			
Yes	278	14.7%	0.98
No	11	14.9%	
Reported having consumed fortified baby cereal			
Yes	279	14.9%	0.58
No	10	12.5%	
Child had inflammation			
Yes	96	17.0%	<0.01
No	143	11.5%	

Characteristic	Total number of children per sub-group	% [a] Anaemic	P value[b]
Child iron deficient			
Yes	198	19.7%	<0.001
No	41	5.3%	
Child vitamin A deficient			
Yes	25	24.0%	<0.01
No	202	12.2%	

Note: The N's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection among regions.
[b] Chi-square test; P value <0.05 indicates that the groups are statistically significantly different from each other.

None of the morbidity conditions included in the survey were statistically significantly associated with iron deficiency (Table 20), and whether a household had improved sanitation was only marginally associated with iron deficiency. Reportedly having consumed iron-fortified bread was negatively associated with iron deficiency, but no other dietary factors were associated. While inflammation was not associated with iron deficiency, being vitamin A deficient increased the risk of being iron deficient.

Table 20. **Correlation between various factors and iron deficiency in children 6-59 months of age, Uzbekistan 2017**

Characteristic	Total number of children per sub-group	% [a] Iron deficient	P value
Child had diarrhea			
Yes	49	48.8%	0.30
No	900	54.9%	
Child had fever			
Yes	67	51.9%	0.6
No	882	54.7%	
Child had lower respiratory infection			
Yes	33	46.8%	0.25
No	911	55.0%	
Child's household had improved sanitation			
Yes	817	53.4%	0.06
No	135	63.8%	
Reported having consumed iron rich or iron fortified foods			
Yes	267	65.2%	0.48
No	107	68.6%	

Characteristic	Total number of children per sub-group	% [a] Iron deficient	P value
Reported having consumed iron-fortified bread			
Yes	601	49.4%	<0.05
No	317	59.4%	
Reported having consumed iron-fortified infant formula			
Yes	31	45.6%	0.18
No	924	55.1%	
Reported having consumed fortified baby cereal			
Yes	40	52.1%	0.64
No	916	55.0%	
Child had inflammation			
Yes	292	55.7%	0.56
No	664	54.1%	
Child vitamin A deficient			
Yes	72	69.7%	<0.05
No	848	53.8%	

Note: The N's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection among regions.
[b] Chi-square test; P value <0.05 indicates that the groups are statistically significantly different from each other.

3.3.7 Vitamin A deficiency

The nationwide prevalence of vitamin A deficiency indicates a mild public health problem among children 6-59 months of age in Uzbekistan [28]; further, only 4 children had retinol levels below 0.35 μmol/L (denoting severe vitamin A deficiency as defined by WHO [28]). Male children had a slightly higher prevalence than female children, but the difference was not statistically significant. Differences in prevalence between urban and rural children are minor, but statistically significant. Although some regions have a region-specific prevalence of vitamin A deficiency greater than the 10 percent cut-off defining a moderate public health problem, the confidence intervals for these estimates include this cut-off point. As a result, we cannot conclude that any individual regions in Uzbekistan have more than a mild public health problems with vitamin A deficiency in young children.

In addition, vitamin A deficiency is not consistenly less common in children with increasing household wealth. Nor is there a statistically significant difference in the prevalence of vitamin A deficiency by mother's educational level.

Table 21. **Prevalence of vitamin A deficiency in children 6-59 months, by various demographic characteristics, Uzbekistan 2017**

Characteristic	Total number of children per sub-group	% [a] with VAD [b]	95% CI [c]	Chi-Square p-value [d]
TOTAL	1665	6.4%	(5.3, 7.7)	
Urban/rural				
Urban	382	5.8%	(3.6, 9.0)	0.46
Rural	1283	6.9%	(5.7, 8.5)	
Sex				
Male	901	7.4%	(5.8, 9.5)	0.078
Female	764	5.2%	(3.8, 7.1)	
Region				
Karakalpakstan	120	3.3%	(1.4, 7.7)	<0.05
Andijon	132	12.9%	(9.4, 17.4)	
Bukhara	118	1.7%	(0.4, 6.6)	
Jizzakh	143	11.2%	(6.7, 18.1)	
Kashqadarya	134	5.2%	(2.4, 10.9)	
Namangan	121	7.4%	(3.6, 14.9)	
Navoiy	101	7.9%	(4.0, 15.1)	
Samarkand	88	6.8%	(3.4, 13.2)	
Surkhandarya	133	3.8%	(1.6, 8.5)	
Sirdarya	136	8.8%	(4.5, 16.7)	
Tashkent oblast	99	7.1%	(3.9, 12.6)	
Ferghana	97	5.2%	(2.0, 12.6)	
Khorazm	156	5.8%	(3.2, 10.1)	
Tashkent city	87	4.6%	(1.8, 11.3)	
Age (in months)				
0-11	163	7.1%	(4.0, 12.5)	<0.01
12-23	371	10.0%	(7.3, 13.4)	
24-35	382	7.6%	(5.2, 11.1)	
36-47	403	5.0%	(3.1, 8.1)	
48-59	317	2.3%	(1.1, 4.5)	
Wealth quintile				
Poorest	365	9.5%	(6.8, 13.2)	0.057
Second	335	4.8%	(2.9, 7.8)	
Middle	366	5.0%	(3.1, 7.9)	
Fourth	308	7.1%	(4.7, 10.4)	
Wealthiest	279	5.3%	(3.2, 8.7)	
Mother's educational level				
Secondary or less	699	7.1%	(5.3, 9.5)	0.34
Special secondary or more	966	5.9%	(4.6, 7.6)	

Note: The N's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data; for VAD, the numbers are smaller than for anaemia due to unsuccessful blood collection (only sufficient blood could be obtained for the on-site analysis of haemoglobin concentration) or insufficient sample volumes for retinol analysis.

[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.

[b] VAD = Vitamin A deficiency, defined as retinol adjusted for inflammation <0.70 umol/L.

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

3.4 All Women

3.4.1 Pregnancy and birth history

Table 22 below shows the distribution of pregnancy related variables among all women. At the time of the survey more than 10% of the women were pregnant and almost one-fifth were lactating. One-quarter of the surveyed women have never been pregnant and the majority of women who had ever been pregnant had 2-3 pregnancies or births. Additional tables that present these variables by age group are shown in APPENDIX 3.

Table 22 **Pregnancy and birth variables in randomly selected non-pregnant women 15-49 years of age and pregnant women, Uzbekistan 2017**

Characteristic	Total number of women per sub-group	% [a]	(95% CI)[b]
TOTAL	2560	100%	--
Currently Pregnant			
Yes	251	10.3%	(9.1, 11.6)
No	2269	89.7%	(88.4, 90.9)
Currently lactating			
Yes	427	17.1%	(15.5, 18.9)
No	2093	82.9%	(81.1, 84.5)
Number of pregnancies			
0	619	24.5%	(22.8, 26.3)
1	316	13.1%	(11.7, 14.6)
2	526	21.0%	(19.4, 22.7)
3	461	18.1%	(16.6, 19.7)
4	284	11.2%	(9.8, 12.7)
5+	314	12.1%	(10.9, 13.5)
Number of births (live and still)			
0	698	27.8%	(26.0, 29.5)
1	398	16.4%	(14.9, 18.1)
2	618	24.6%	(22.9, 26.4)
3	502	19.7%	(18.2, 21.2)
4	225	8.7%	(7.5, 10.1)
5+	79	2.8%	(2.3, 3.6)
Delivered live baby in past 2 years			
Yes	1211	49.0%	(46.9, 51.1)
No	1309	51.0%	(48.9, 53.1)

Note: The N's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval, calculated taking into account the complex sampling design.

3.4.2 Knowledge and practices related to fortified foods and wheat flour

Only just over one-quarter of the women included in the survey had heard of fortified wheat flour, and among them, more than one-half reported always using fortified flour (see Table 23). Of women who had heard of fortified four, the most commonly cited that benefit of using fortified flour was "improves health status", followed by "prevents iron deficiency" and "prevents vitamin and mineral deficiency". In contast to flour, almost all women had heard of and reported using iodized salt at the time of the survey. The most commonly cited reasons why using iodized salt is important were "prevents iodine deficiency" and "improves health status". Additional tables presenting these results by age, education, marital status and wealth are presented in APPENDIX 3.

Table 23. **Extent of knowledge about and use of fortified foods in all women (non-pregnant 15-49 years of age and pregnant), Uzbekistan 2017**

Characteristic	Total number of women per sub-group	% [a]	(95% CI)[b]
Have heard of fortified wheat flour			
Yes	630	26.3%	(24.1, 28.7)
No	1,789	69.0%	(66.5, 71.4)
Don't know	101	4.7%	(3.8, 5.8)
Reports using fortified flour[c]			
Always	348	57.4%	(52.4, 62.2)
Usually	43	7.2%	(5.3, 9.8)
Sometimes	91	13.7%	(10.6, 17.4)
Never	89	12.8%	(10.1, 16.2)
Don't know	59	8.9%	(6.7, 11.8)
Reported benefits of fortified wheat flour [d]			
Improves health	438	70.7%	(66.4, 74.7)
Prevents anaemia	109	15.1%	(11.9, 19.0)
Prevents iron deficiency	165	23.5%	(19.6, 28.0)
Prevents vitamin and mineral deficiency	138	21.8%	(18.4, 25.7)
Prevents congenital defects	3	0.6%	(0.1, 2.4)
Better productivity and energy	36	5.9%	(4.2, 8.3)
Better intellectual development in children	13	2.2%	(1.2, 4.0)
Other	26	3.6%	(2.3, 5.7)
Don't know any benefit	23	3.5%	(2.2, 5.5)

Characteristic	Total number of women per sub-group	% [a]	(95% CI)[b]
Have heard of iodized salt			
Yes	2,357	93.8%	(92.4, 94.9)
No	138	5.0%	(4.1, 6.1)
Don't know	25	1.2%	(0.7, 1.9)
Reports using iodized salt[c]			
Always	2,242	94.5%	(93.1, 95.6)
Usually	52	2.2%	(1.6, 3.0)
Sometimes	20	0.9%	(0.6, 1.6)
Never	3	0.2%	(0.0, 0.7)
Don't know	40	2.2%	(1.6, 2.9)
Why iodized salt important[d]			
Prevents iodine deficiency	1,887	80.0%	(77.9, 81.9)
Improves intelligence	43	1.9%	(1.3, 2.8)
Prevents vitamin deficiency	71	3.5%	(2.7, 4.5)
Improves health status	396	17.5%	(15.5, 19.7)
Other	142	6.0%	(4.9, 7.3)
Don't know	28	1.2%	(0.8, 1.9)

Note: The N's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval, calculated taking into account the complex sampling design.
[c] Only if ever heard of fortified flour or iodized salt; note that this variable is based on self-reporting.
[d] Benefits of fortified wheat flour and iodized salt asked only of women who had heard of fortified wheat flour or iodized salt previously. Respondents could report more than one benefit.

3.5 Non-pregnant women of reproductive age

3.5.1 Characteristics

Characteristics of non-pregnant women randomly selected for the survey are presented in Table 24. About three-quarters of non-pregnant women included in the survey sample were from rural areas. More than half of the women attended special secondary school or more. The majority of the women were married and about half of the women had given birth in the past 2 years prior to the survey. Systemic inflammation is present in less than 20 percent of women, indicating overall a low level of infection.

Table 24. **Description of non-pregnant women 15 - 49 years, Uzbekistan 2017**

Characteristic	Total number of non-pregnant women per sub-group	% [a]	(95% CI)[b]
TOTAL	2269	100%	-
Urban/rural			
Urban	620	27.6%	(23.5, 32.1)
Rural	1649	72.4%	(67.9, 76.5)
Region			
Karakalpakstan	168	7.4%	(5.0; 10.9)
Andijon	146	6.4%	(4.3; 9.6)
Bukhara	168	7.4%	(4.9; 11.0)
Jizzakh	181	8.0%	(5.3; 11.7)
Kashqadarya	177	7.8%	(5.2; 11.6)
Namangan	153	6.7%	(4.5; 10.0)
Navoiy	133	5.9%	(3.9; 8.8)
Samarkand	150	6.6%	(4.4; 9.9)
Surkhandarya	193	8.5%	(5.7; 12.6)
Sirdarya	167	7.4%	(4.9; 10.9)
Tashkent oblast	155	6.8%	(4.5; 10.2)
Ferghana	140	6.2%	(4.1; 9.3)
Khorazm	193	8.5%	(5.7; 12.5)
Tashkent city	145	6.4%	(4.1; 9.8)
Age (in years)			
15-19	305	13.3%	(11.9, 14.8)
20-24	388	17.5%	(15.8, 19.3)
25-29	425	18.9%	(17.0, 20.9)
30-34	362	15.9%	(14.2, 17.8)
35-39	267	11.6%	(10.4, 13.0)
40-44	238	10.3%	(9.0, 11.7)
45-49	281	12.5%	(11.2, 13.9)
Wealth Quintile			
Poorest	469	21.2%	(18.3, 24.3)
Second	454	19.4%	(16.9, 22.1)
Middle	455	20.5%	(18.3, 22.9)
Fourth	418	18.9%	(16.6, 21.4)
Wealthiest	460	20.1%	(17.4, 23.1)
Educational level			
Secondary or less	990	43.1%	(40.4, 45.8)
Special secondary or more	1279	56.9%	(54.2, 59.6)

Characteristic	Total number of non-pregnant women per sub-group	% [a]	(95% CI)[b]
Marital Status			
Currently not married	632	28.2%	(26.2, 30.3)
Currently married	1637	71.8%	(69.7, 73.8)
Given birth in past 2 years			
Yes	1069	48.1%	(45.8, 50.5)
No	1200	51.9%	(49.5, 54.2)
Currently breastfeeding a child			
Yes	421	18.7%	(16.9, 20.7)
No	1848	81.3%	(79.3, 83.1)
Inflammation[c]			
None	1756	83.8%	(81.9, 85.6)
Early (High CRP, Normal AGP)	131	6.6%	(5.5, 7.8)
Acute (High CRP, High AGP)	112	5.7%	(4.7, 6.9)
Convalescent (Normal CRP, High AGP)	87	3.9%	(3.1, 4.9)

Note: The N's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data.
[a] All percentages except region-specific estimates are weighted for unequal probability of selection between regions.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] For thresholds of inflammatory markers, see Table 3.

3.5.2 Dietary diversity and consumption of vitamins and supplements

Non-pregnant women consumed, on average, more than 4 food groups in the 24 hours prior to the interview. About 40 percent met the minimum dietary diversity by eating at least 5 food groups during this time period (Table 25). The mean number of food groups as well as the number of women who met minimum dietary diversity significantly differed between the regions. Meeting minimum dietary diversity was most common in Namangan and Jizzakh (APPENDIX 3). On the other hand, fewer women met minimum dietary diversity in Andijon and Surkhandarya.

Consumption of vitamin supplements was very low in Uzbekistan. Only one out of ten had taken iron supplementation and consumption of folic acid, vitamin A, and/or multi-vitamins was much less common (see Table 25). Consumption of iron, folic acid and multivitamin supplements significantly differed between regions, with the highest level in Namangan, Ferghana and Tashkent Oblast and the lowest level in Samarkkand, Kashqadarya, Karakalpakstan and Surkhandarya (APPENDIX 3). Knowledge about and use of fortified foods differed with statistical significance among regions; more than half of the women living in Ferhana had ever heard of fortified flour, compared to only less than 10 percent in Karakalpakstan. Although significantly different between regions, knowledge and use of iodized salt was much more common in all regions.

Table 25. **Dietary diversity and consumption of vitamin supplements in non-pregnant women 15 - 49 years, Uzbekistan 2017**

Characteristic	Total number of non-pregnant women per sub-group	%[a] or mean	(95% CI)[b]
Number of MDD-W[c] food groups consumed (mean)	2179	**4.22**	(4.12, 4.32)
Meets minimum dietary diversity (MDD-W, 5+ food groups)			
Yes	905	**40.4%**	(37.7, 43.1)
No	1274	**59.6%**	(56.9, 62.3)
Consumed iron tablets or syrup in past six months			
Yes	209	9.7%	(8.5, 11.2)
No	2040	90.3%	(88.8, 91.5)
Consumed folic acid tablets or syrup in past six months			
Yes	62	3.0%	(2.2, 4.0)
No	2186	97.0%	(96.0, 97.8)
Consumed vitamin A tablets in past six months			
Yes	61	2.8%	(2.2, 3.7)
No	2188	97.2%	(96.3, 97.8)
Consumed multivitamin tablets in past six months			
Yes	123	5.5%	(4.5, 6.6)
No	2118	**94.5%**	(93.4, 95.5)

Note: The N's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data.
[a] Percentages weighted for unequal probability of selection between regions.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] MDD-W = Mimumum dietary diversity for women as recommended in FAO and FHI 360 [22].

3.5.3 Anthropometry

The prevalence of undernutrition and overweight/obesity, as measured by body mass index, is shown in Table 26 and Figure 14 below, and the distribution of BMI is shown in Figure 16. Relatively few women were underweight, about one-half had a normal

BMI, about one-quarter of women were overweight, and 15 percent were obese. Although undernutrition is somewhat present in Uzbek women, 109 (76 percent) of the 143 women with low BMI had BMIs between 17.0-18.4 and as such, were only at risk for chronic energy deficiency.

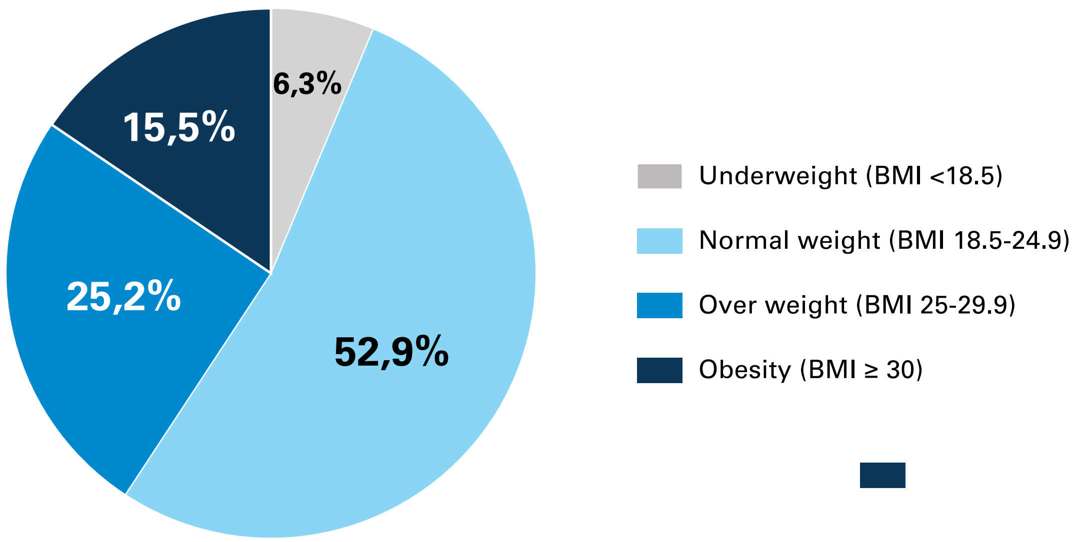

Figure 14. **Prevalence of underweight, normal weight, and overweight and obesity in non-pregnant women 15-49 years of age, Uzbekistan 2017**

On the other hand, overweight and obesity were very common in Uzbek women and increase with age (Figure 15). In the youngest age group only about 11 percent of women were overweight or obese, increasing up to 76 percent in women 45-49 years of age. Also, women with a lower education level are statistically significantly more likely to be overweight or obese than women with a higher educational level.

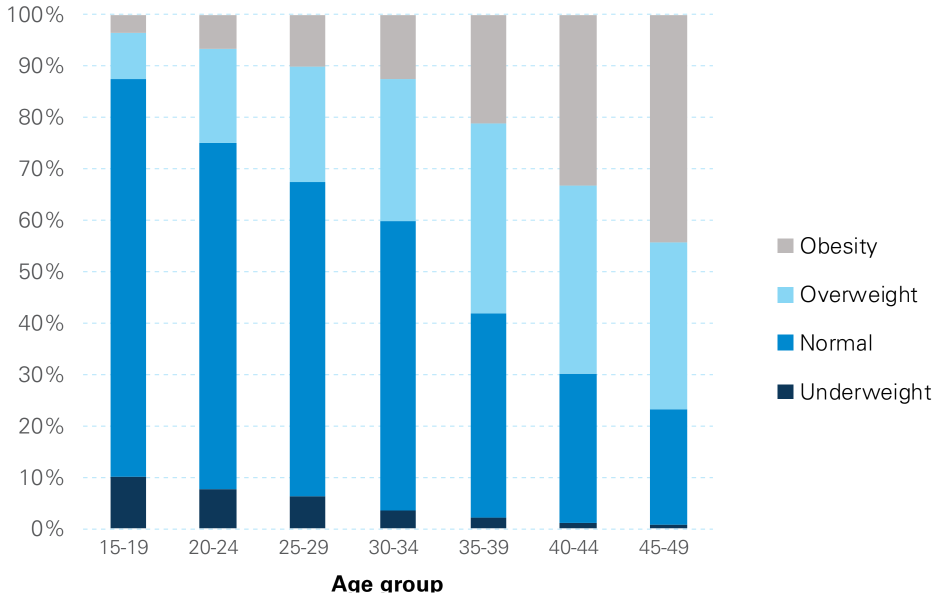

Figure 15. **Prevalence of normal weight, overweight, and obesity in non-pregnant women 15-49 years of age, by age group, Uzbekistan 2017**

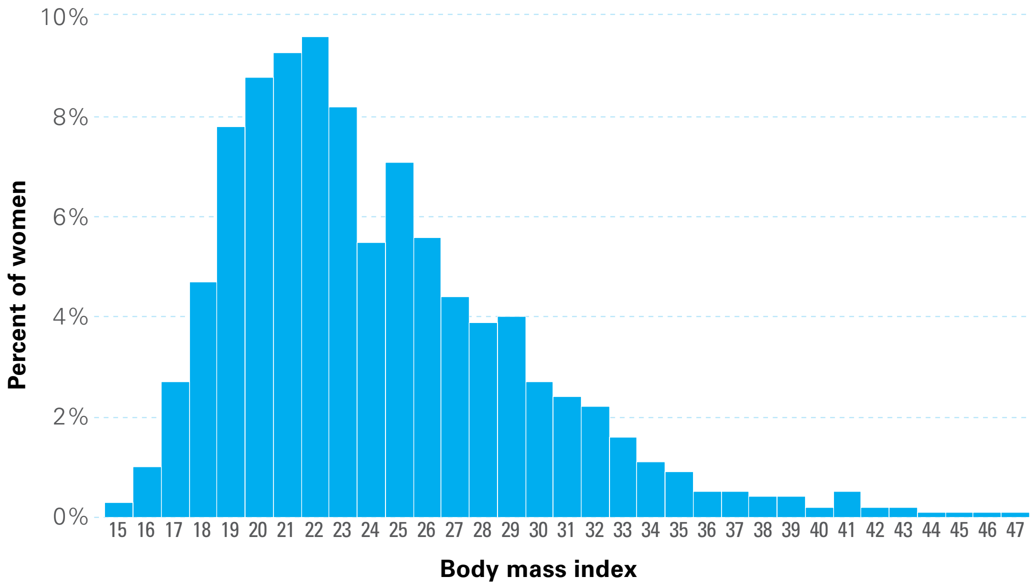

Figure 16. **Distribution of BMI values in non-pregnant women 15-49 years of age, Uzbekistan 2017**

Table 26. **Prevalence of low and high BMI in non-pregnant women 15-49 years of age, by various demographic characteristics, Uzbekistan 2017[a]**

Characteristic	N	Mean BMI	Underweight[b]				% Normal	% Overwt	% Obese	P value [c]	% Overwt and obesity (BMI ≥25)	P value [c]
			% Severe	% Moderate	% At risk	% <BMI 18.5						
TOTAL	2217	24.7	0.5%	1.0%	4.8%	6.3%	52.9%	25.2%	15.5%		40.7%	
Urban/rural												
Urban	607	25.2	0.2%	0.5%	6.6%	7.2%	49.8%	25.1%	17.9%	0.380	43.0%	0.184
Rural	1610	24.6	0.7%	1.2%	4.3%	6.1%	54.1%	25.7%	14.0%		39.8%	
Region												
Karakalpakstan	164	24.9	–	–	7.4%	7.4%	49.1%	29.4%	14.1%		43.6%	0.635
Andijon	135	25.2	0.7%	0.7%	5.1%	6.6%	51.8%	21.9%	19.7%	0.571	41.6%	
Bukhara	165	24.1	0.6%	–	3.0%	3.6%	60.0%	24.8%	11.5%		36.4%	
Jizzakh	179	24.7	–	0.6%	5.0%	5.6%	53.6%	27.4%	13.4%		40.8%	
Kashqadarya	176	24.5	–	1.7%	3.4%	5.1%	56.8%	30.1%	8.0%		38.1%	
Namangan	150	24.4	1.3%	1.3%	4.7%	7.3%	52.7%	25.3%	14.7%		40.0%	
Navoiy	129	24.9	–	0.8%	7.7%	8.5%	46.2%	32.3%	13.1%		45.4%	
Samarkand	148	24.6	–	0.7%	5.4%	6.1%	53.4%	24.3%	16.2%		40.5%	
Surkhandarya	185	23.9	3.8%	2.2%	4.8%	10.8%	55.9%	17.7%	15.6%		33.3%	
Sirdarya	159	24.2	–	1.3%	5.6%	6.9%	54.4%	26.9%	11.9%		38.8%	
Tashkent oblast	150	24.8	–	0.7%	5.3%	6.0%	53.3%	24.7%	16.0%		40.7%	
Ferghana	139	24.7	–	–	5.8%	5.8%	50.0%	26.1%	18.1%		44.2%	
Khorazm	193	25.7	0.5%	2.1%	2.1%	4.7%	48.2%	25.4%	21.8%		47.2%	
Tashkent city	145	25.2	–	1.4%	4.8%	6.2%	53.8%	22.1%	17.9%		40.0%	
Age (in years)												
15-19	296	21.4	0.7%	1.4%	9.9%	11.9%	77.4%	9.1%	1.6%	<0.001	10.7%	<0.001
20-24	375	22.2	1.0%	3.0%	7.6%	11.6%	67.2%	18.5%	2.6%		21.1%	
25-29	419	23.4	0.7%	1.2%	6.1%	8.0%	61.4%	22.3%	8.3%		30.6%	
30-34	361	24.6	–	0.3%	3.6%	3.9%	56.1%	27.8%	12.2%		40.0%	
35-39	259	26.5	0.4%	–	2.2%	2.5%	39.7%	36.7%	21.0%		57.7%	
40-44	229	28.1	0.5%	–	1.0%	1.5%	29.0%	36.3%	33.2%		69.5%	
45-49	275	29.5	0.3%	0.3%	0.7%	1.4%	22.5%	32.4%	43.7%		76.1%	
Wealth quintile												
Poorest	456	24.2	1.3%	2.3%	5.2%	8.8%	55.2%	21.0%	15.0%	0.081	36.0%	0.106
Second	439	24.6	0.2%	0.4%	4.3%	4.8%	56.1%	26.0%	13.1%		39.1%	
Middle	450	25.0	0.2%	0.4%	3.9%	4.6%	51.5%	25.8%	18.1%		44.0%	
Fourth	408	24.8	0.5%	0.8%	5.3%	6.6%	52.4%	25.1%	15.9%		41.1%	
Wealthiest	451	25.0	0.4%	1.1%	5.0%	6.5%	49.6%	28.4%	15.5%		43.9%	
Educational level												
Secondary or less	979	25.6	0.3%	0.6%	4.8%	5.8%	47.6%	25.8%	20.8%	0.354	46.6%	<0.001
Special secondary or more	1238	24.1	0.7%	1.3%	4.8%	6.8%	57.0%	24.7%	11.5%		36.2%	

Note: The N's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.

[b] Severe undernutrition defined as BMI <16.0; moderate undernutrition defined as BMI 16.0-16.9; at risk of undernutrition defined as BMI 17.0-18.5; normal BMI defined as BMI 18.5 – 14.9; overweight defined as BMI 15.0-19.9; obese defined as BMI >30.

[c] P value <0.05 indicates that one subgroup is significantly different from the other; P values calculated for 'obese' and 'overweight and obese'.

3.5.4 Anaemia, iron deficiency, and iron deficiency anaemia

About 20 percent of non-pregnant women were anaemic (see Table 27). Less than 1 percent of non-pregnant women were severely anaemic, whereas moderate and mild anaemia were present in 6.8 percent and 12.9 percent of women, respectively (see APPENDIX 3). Overall mean haemoglobin in non-pregnant women was 128.2g/L (95% CI: 127.6, 128.9). The distribution of haemoglobin concentration is shown in Figure 14, showing that the majority of measurements are greater than the anaemia cutoff of 120 g/L.

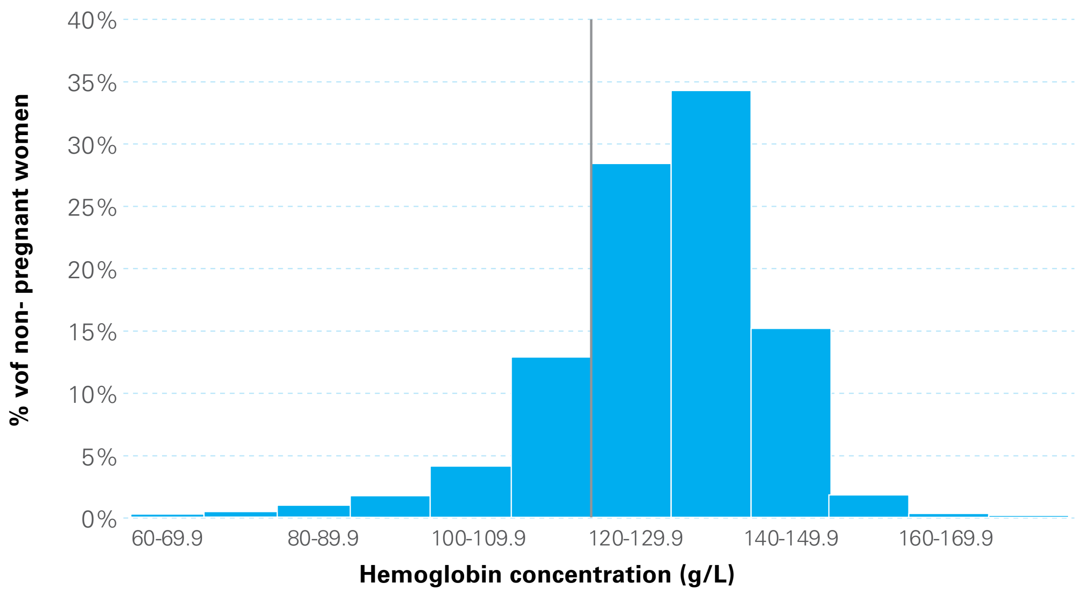

Figure 17. **Distribution of haemoglobin values in non-pregnant women 15-49 years of age, Uzbekistan 2017**

The prevalence of anaemia differed significantly by region. The highest anaemia prevalence was found in Tashkent Oblast and Karakalpakstan, while the lowest anaemia prevalence was found in Namangan and Kashqadarya. No significant differences in the prevalence of anaemia were observed by age, urban/rural residence, educational status, or household wealth.

Almost one-half of non-pregnant women had iron deficiency (Table 27). The prevalence of iron deficiency did not differ with statistical signficance between women in urban areas and women in rural areas. In addition, there was no clear trend in iron deficiency by age. Iron deficiency was statistically signficantly more common in some regions than other, ranging from 42.1 percent in Kashqadarya to 62.4 percent in Karakalpakstan. Women with more education were more likely to be iron deficiency than women with less education. Similarly, women from wealthier households were more likely to be iron deficiency than those from poor households.

Figure 18 shows the overlap between iron deficiency and anaemia.

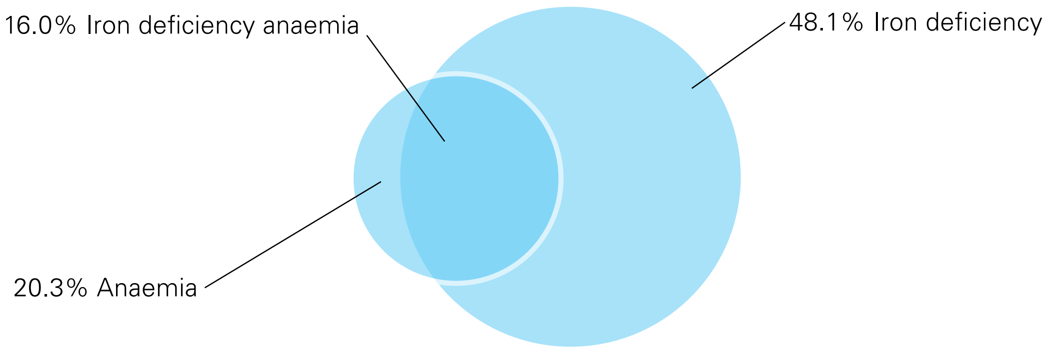

Figure 18. **Venn diagram showing overlap between anaemia and iron deficiency in non-pregnant women 15-49 years of age, Uzbekistan 2017**

Figure 19 shows the geopraphic distribution of anaemia prevalence by Oblast. Besides Karakalpakstan and Khorezm, there are several Oblasts in the east of Uzbekistan that show higher anaemia prevalence.

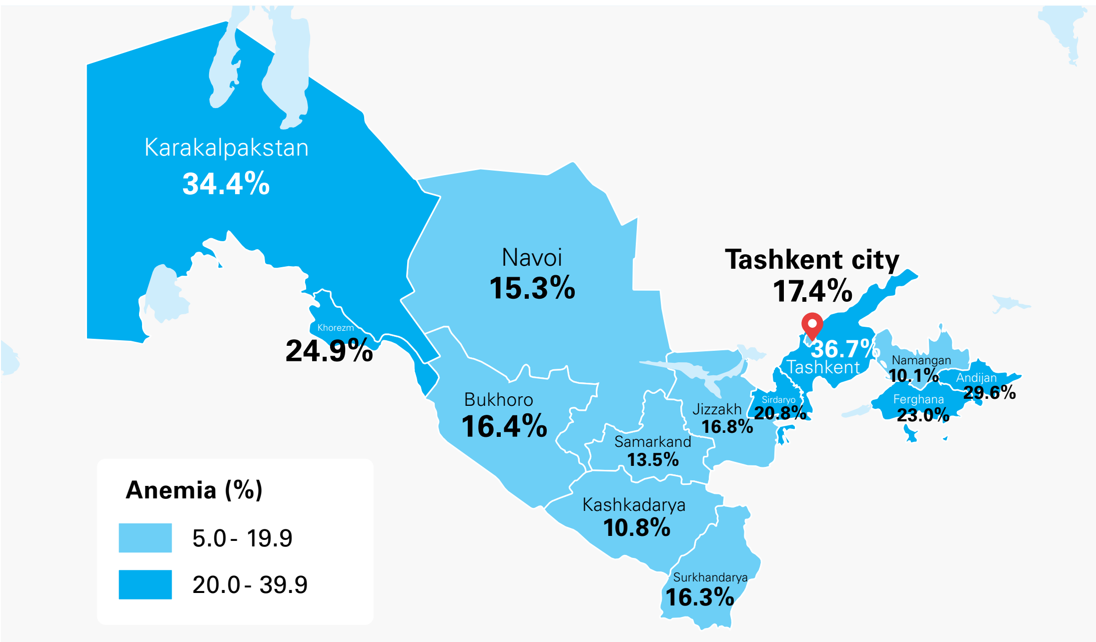

Figure 19. **Geographic distribution of anaemia prevalence in non-pregnant women, Uzbekistan 2017**

Table 27. **Prevalence of anaemia, iron deficiency, and iron deficiency anaemia in non-pregnant women 15-49 years of age, by various demographic characteristics, Uzbekistan 2017**

Characteristic	Anaemia[a] N	Anaemia[a] %[b]	Anaemia[a] (95% CI)[c]	Anaemia[a] p-value[d]	Iron deficiency[e] N	Iron deficiency[e] %[b]	Iron deficiency[e] (95% CI)[c]	Iron deficiency[e] p-value[d]	Iron deficiency anaemia[f] N	Iron deficiency anaemia[f] %[b]	Iron deficiency anaemia[f] (95% CI)[c]	Iron deficiency anaemia[f] p-value[d]
TOTAL	2207	20.3%	(18.3, 22.4)		2077	48.1%	(45.9, 50.3)		2075	16.0%	(14.4, 17.9)	
Urban/rural												
Urban	607	19.2%	(15.8, 23.1)	0.51	582	50.5%	(46.3, 54.7)	0.21	582	16.8%	(13.9, 20.3)	0.83
Rural	1600	20.7%	(18.3, 23.2)		1495	47.3%	(44.6, 50.0)		1493	16.4%	(14.4, 18.7)	
Region												
Karakalpakstan	163	34.4%	(27.2, 42.3)	<0.001	157	62.4%	(52.9, 71.1)	<0.05	157	31.2%	(23.5, 40.1)	<0.001
Andijon	135	29.6%	(22.6, 37.8)		131	44.3%	(37.6, 51.1)		131	23.7%	(17.6, 31.1)	
Bukhara	165	16.4%	(11.2, 23.2)		153	45.1%	(35.3, 55.3)		153	11.8%	(7.2, 18.6)	
Jizzakh	179	16.8%	(11.8, 23.3)		171	45.6%	(34.9, 56.8)		171	16.4%	(11.3, 23.1)	
Kashqadarya	176	10.8%	(7.1, 16.1)		171	42.1%	(37.3, 47.1)		171	8.8%	(5.6, 13.4)	
Namangan	148	10.1%	(6.0, 16.6)		148	43.9%	(36.4, 51.7)		148	7.4%	(4.1, 13.2)	
Navoiy	124	15.3%	(9.8, 23.2)		120	54.2%	(43.7, 64.3)		120	15.0%	(9.4, 23.1)	
Samarkand	148	13.5%	(8.7, 20.3)		139	47.5%	(40.7, 54.3)		138	10.1%	(6.4, 15.8)	
Surkhandarya	184	16.3%	(10.5, 24.4)		167	44.9%	(36.9, 53.2)		166	12.7%	(7.8, 19.9)	
Sirdarya	159	20.8%	(16.3, 26.1)		151	45.7%	(39.2, 52.3)		151	18.5%	(14.0, 24.1)	
Tashkent oblast	150	36.7%	(26.3, 48.5)		142	52.1%	(43.0, 61.1)		142	27.5%	(19.1, 37.8)	
Ferghana	139	23.0%	(15.5, 32.8)		134	48.5%	(40.7, 56.4)		134	16.4%	(11.0, 23.7)	
Khorazm	193	24.9%	(19.0, 31.8)		153	44.4%	(37.9, 51.2)		153	17.0%	(11.9, 23.6)	
Tashkent city	144	17.4%	(12.6, 23.4)		140	56.4%	(48.7, 63.9)		140	16.4%	(11.7, 22.6)	
Age (in years)												
15-19	295	16.6%	(12.3, 22.0)	0.13	272	49.0%	(42.5, 55.5)	0.25	272	11.7%	(8.2, 16.5)	<0.01
20-24	372	16.1%	(12.3, 20.9)		351	45.3%	(40.0, 50.8)		351	11.2%	(8.1, 15.2)	
25-29	417	22.1%	(18.1, 26.7)		393	54.3%	(49.1, 59.4)		392	18.7%	(14.9, 23.2)	
30-34	359	19.7%	(15.8, 24.3)		344	47.5%	(42.3, 52.8)		344	15.3%	(11.8, 19.5)	
35-39	259	23.9%	(19.0, 29.7)		240	46.7%	(39.9, 53.6)		240	20.9%	(16.2, 26.7)	
40-44	228	23.0%	(17.9, 29.0)		211	45.7%	(38.6, 53.0)		211	19.8%	(15.0, 25.7)	
45-49	274	21.8%	(17.1, 27.4)		263	45.2%	(38.7, 52.0)		262	16.4%	(12.2, 21.8)	
Wealth quintile												
Poorest	456	19.0%	(15.0, 23.8)	0.24	427	41.5%	(36.8, 46.4)	<0.05	427	13.7%	(10.4, 17.8)	0.52
Second	434	18.1%	(14.3, 22.7)		407	48.9%	(43.6, 54.2)		406	14.7%	(11.4, 18.7)	
Middle	449	21.9%	(18.3, 26.1)		423	47.3%	(42.1, 52.6)		422	17.4%	(14.0, 21.4)	
Fourth	407	24.1%	(19.3, 29.5)		380	50.6%	(44.8, 56.3)		380	17.7%	(13.6, 22.7)	
Wealthiest	448	18.3%	(14.6, 22.8)		427	52.8%	(47.6, 57.9)		427	16.9%	(13.2, 21.4)	
Educational level												
Secondary or less	973	20.6%	(17.9, 23.6)	0.73	913	44.4%	(41.1, 47.8)	<0.01	912	16.0%	(13.7, 18.6)	0.96
Special secondary or more	1234	20.0%	(17.5, 22.7)		1164	50.9%	(47.9, 53.8)		1163	16.1%	(14.0, 18.5)	

Note: The N's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data; for iron deficiency and iron deficiency anaemia, the numbers are smaller than for anaemia due to unsuccessful blood collection (only sufficient blood could be obtained for the on-site analysis of haemoglobin concentration).

[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.

[b] Anaemia defined as haemoglobin < 120 g/L adjusted for altitude.

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

[e] Iron deficiency defined as serum ferritin < 12 µg/l after adjustment for inflammation.

[f] Iron deficiency anaemia defined as serum ferritin < 12.0 µg/L and haemoglobin < 120 g/L.

Household sanitation, women's dietary factors, and the presence of inflammation were not statistically significantly associated with anaemia in non-pregnant women in Uzbekistan (Table 28). On the other hand, women with either iron deficiency or vitamin A deficiency were much more likely to be anaemic. Folate and vitamin B12 deficiency were not associated with anaemia.

Table 28. **Correlation between various factors and anaemia in non-pregnant women 15-49 years of age, Uzbekistan 2017**

Characteristic	Total number of non-pregnant women per sub-group	% [a] Anaemic	P value
Woman's household had improved sanitation			
Yes	1964	20.7%	0.23
No	240	16.8%	
Woman had minimal dietary diversity			
Yes	880	19.1%	0.48
No	1244	20.5%	
Woman took iron supplements in past 6 months			
Yes	205	22.1%	0.51
No	1984	20.1%	
Woman had inflammation			
Yes	330	17.2%	0.20
No	1754	20.4%	
Woman is iron deficient			
Yes	999	33.4%	<0.001
No	1078	7.2%	
Woman is vitamin A deficient			
Yes	44	47.3%	<0.001
No	1948	19.3%	
Woman is folate deficient			
Yes	935	21.1%	0.22
No	1154	18.7%	
Woman is vitamin B12 deficient			
Yes	400	19.3%	0.81
No	1691	19.9%	

Note: The N's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection among regions.
[b] Anaemia defined as haemoglobin < 120 g/L adjusted for altitude.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others. CRP>5g/L and/or AGP>1g/L.
[e] Iron deficiency defined as serum ferritin < 12 μg/l after adjustment for inflammation.
[f] Vitamin A deficiency, defined as low retinol binding protein (<0.7 nmol/L), values adjusted for inflammation using the Thurnham approach.

Household sanitation was positively associated with iron deficiency among women, while there was a negative association between inflammation and iron deficiency (Table 29). No other factors investigated were significantly associated with iron defiency.

Table 29. **Correlation between various factors and iron deficiency in non-pregnant women 15-49 years of age, Uzbekistan 2017**

Characteristic	Total number of non-pregnant women per sub-group	% [a] Iron deficient	P value
Woman's household had improved sanitation			
Yes	1848	49.0%	<0.05
No	226	40.9%	
Woman had minimal dietary diversity			
Yes	841	49.6%	0.25
No	1160	46.8%	
Woman took iron supplements in past 6 months			
Yes	197	434%	0.16
No	1862	48.7%	
Woman had inflammation			
Yes	328	42.0%	<0.05
No	1751	49.3%	
Woman is vitamin A deficient			
Yes	43	59.3%	0.17
No	1942	47.9%	
Woman is folate deficient			
Yes	928	49.8%	0.20
No	1151	46.7%	
Woman is vitamin B12 deficient			
Yes	400	47.1%	0.68
No	1679	48.3%	

Note: The N's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection among regions.
[b] Anaemia defined as haemoglobin < 120 g/L adjusted for altitude.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others. CRP>5g/L and/or AGP>1g/L.
[e] Iron deficiency defined as serum ferritin < 12 µg/l after adjustment for inflammation.
[f] Vitamin A deficiency, defined as low retinol binding protein (<0.7 nmol/L) , values adjusted for inflammation using the Thurnham approach.

3.5.5 Vitamin A deficiency

Vitamin A deficiency is not common in non-pregnant Uzbek women. Nonetheless, there were differences in vitamin A prevalence among the regions. Although there are statistically significant differences by age, there seems to be no clear trend of increased or decreased prevalence of vitamin A deficiency by age. Likewise, there is no clear trend by household wealth.

Table 30. **Prevalence of vitamin A deficiency in non-pregnant women 15-49 years of age, by various demographic characteristics, Uzbekistan 2017**

Characteristic	Total number of non-pregnant women per sub-group	%[a, b]	(95% CI)[c]	p-value [d]
TOTAL	1990	2.6%	(1.9, 3.7)	
Urban/rural				
Urban	558	4.1%	(2.3, 7.2)	0.053
Rural	1432	2.0%	(1.4, 3.0)	
Region				
Karakalpakstan	144	0.7%	(0.1, 4.5)	<0.01
Andijon	131	6.9%	(3.7, 12.5)	
Bukhara	149	1.3%	(0.3, 5.1)	
Jizzakh	171	0%	-	
Kashqadarya	157	1.3%	(0.4, 4.4)	
Namangan	146	0.7%	(0.1, 4.5)	
Navoiy	121	1.7%	(0.4, 6.3)	
Samarkand	130	6.2%	(2.8, 13.0)	
Surkhandarya	146	2.1%	(0.8, 5.4)	
Sirdarya	147	1.4%	(0.4, 5.0)	
Tashkent oblast	140	0.7%	(0.1, 4.8)	
Ferghana	134	3.7%	(1.1, 12.0)	
Khorazm	137	2.2%	(0.7, 6.3)	
Tashkent city	137	3.6%	(1.6, 8.1)	
Age (in years)				
15-19	261	2.1%	(0.8, 5.4)	<0.05
20-24	338	2.7%	(1.1, 6.3)	
25-29	374	2.4%	(1.2, 4.9)	
30-34	331	5.8%	(3.6, 9.3)	
35-39	229	1.3%	(0.4, 4.1)	
40-44	201	1.3%	(0.3, 5.2)	
45-49	253	1.4%	(0.4, 4.4)	

Characteristic	Total number of non-pregnant women per sub-group	%[a, b]	(95% CI)[c]	p-value [d]
Wealth quintile				
Poorest	411	2.6%	(1.5, 4.6)	0.34
Second	388	1.8%	(0.9, 3.8)	
Middle	399	3.3%	(1.4, 7.3)	
Fourth	370	1.4%	(0.5, 3.6)	
Wealthiest	409	3.9%	(2.1, 7.0)	
Educational level				
Secondary or less	870	3.4%	(2.3, 5.2)	0.054
Special secondary or more	1120	2.0%	(1.3, 3.1)	

Note: The N's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data; for VAD, the numbers are smaller than for anaemia due to unsuccessful blood collection (only sufficient blood could be obtained for the on-site analysis of haemoglobin concentration) or insufficient sample volumes for retinol analysis.
[a] Vitamin A deficiency defined as retinol binding protein <0.7 μmol/L after adjustment for inflammation.
[b] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] Chi-square p-value <0.05 indicates that at least one subgroup is statistically signficantly different from the others.

3.5.6 Folate deficiency

Folate deficiency was found in almost one-half of non-pregnant women (Table 31). Urban women have a higher prevalence of folate deficiency than rural women, but this difference does not reach statistical signficance. There are substantial differences in prevalence among regions, ranging from 22.9 per centin Khorazm to 58.8 percent in Ferghana. Although there are statistically significant differences by age, there is no clear age-specific trend in the prevalence of folate deficiency, nor is there is any trend by household wealth or substantial difference by educational level.

Table 31. **Prevalence of folate deficiency in non-pregnant women 15-49 years of age, by various demographic characteristics, Uzbekistan 2017**

Characteristic	Total number of non-pregnant women per sub-group	%[a, b]	(95% CI)[c]	p-value [d]
TOTAL	2089	44.6%	(42.0, 47.2)	
Urban/rural				
Urban	587	48.3%	(43.2, 53.5)	0.09
Rural	1502	43.1%	(40.0, 46.2)	

Characteristic	Total number of non-pregnant women per sub-group	%[a, b]	(95% CI)[c]	p-value [d]
Region				
Karakalpakstan	158	53.2%	(43.9, 62.2)	<0.001
Andijon	132	58.3%	(49.4, 66.7)	
Bukhara	155	52.3%	(41.1, 63.2)	
Jizzakh	171	46.8%	(38.1, 55.7)	
Kashqadarya	174	45.4%	(35.7, 55.5)	
Namangan	148	56.1%	(47.0, 64.8)	
Navoiy	120	39.2%	(29.0, 50.3)	
Samarkand	139	28.1%	(21.0, 36.4)	
Surkhandarya	167	45.5%	(37.5, 53.7)	
Sirdarya	151	42.4%	(33.0, 52.4)	
Tashkent oblast	143	38.5%	(28.8, 49.1)	
Ferghana	136	58.8%	(49.7, 67.4)	
Khorazm	153	22.9%	(15.6, 32.2)	
Tashkent city	142	38.7%	(31.4, 46.6)	
Age (in years)				
15-19	272	38.2%	(32.5, 44.2)	<0.05
20-24	352	43.0%	(37.1, 49.2)	
25-29	397	50.6%	(44.6, 56.7)	
30-34	346	40.9%	(35.8, 46.3)	
35-39	243	48.6%	(41.8, 55.5)	
40-44	212	50.6%	(43.2, 58.0)	
45-49	264	40.6%	(34.2, 47.3)	
Wealth quintile				
Poorest	429	44.1%	(38.3, 50.1)	0.24
Second	410	44.1%	(38.6, 49.8)	
Middle	424	39.4%	(34.4, 44.6)	
Fourth	383	47.2%	(41.0, 53.5)	
Wealthiest	430	47.9%	(42.1, 53.8)	
Educational level				
Secondary or less	919	44.9%	(41.5, 48.4)	0.80
Special secondary or more	1170	44.3%	(40.9, 47.8)	

Note: The N's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data; for folate deficiency, the numbers are smaller than for anaemia due to unsuccessful blood collection (only sufficient blood could be obtained for the on-site analysis of haemoglobin concentration) or insufficient sample volumes for retinol analysis.

[a] Folate deficiency defined as serum folate <10 nmol/L.

[b] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] Chi-square p-value <0.05 indicates that at least one subgroup is statistically signficantly different from the others.

3.5.7 B12 deficiency

About one-fifth of non-pregnant women had vitamin B12 deficiency. Vitamin B12 deficiency was more common in rural women and much more common in some regions than others. In addition, although there is marginal statistical signficance for differences in the prevalence of vitamin B12 deficiency by age, there is no clear trend. In contrast, there are statistically significant differences by household wealth with a trend of decreasing prevalence of deficiency with increasing household wealth. There is no difference in the prevalence by educational level.

Table 32. **Prevalence of vitamin B12 deficiency in non-pregnant women 15-49 years of age, by various demographic characteristics, Uzbekistan 2017**

Characteristic	Total number of non-pregnant women per sub-group	%[a,b]	(95% CI)[c]	p-value [d]
TOTAL	2091	19.1%	(17.0, 21.4)	
Urban/rural				
Urban	589	15.8%	(12.7, 19.5)	<0.05
Rural	1502	20.4%	(17.9, 23.3)	
Region				
Karakalpakstan	158	29.7%	(24.0, 36.2)	<0.001
Andijon	132	4.5%	(2.3, 8.8)	
Bukhara	155	6.5%	(3.4, 12.0)	
Jizzakh	171	26.3%	(20.7, 32.9)	
Kashqadarya	174	13.8%	(8.9, 20.8)	
Namangan	148	33.8%	(24.6, 44.3)	
Navoiy	120	11.7%	(7.0, 18.8)	
Samarkand	139	25.9%	(17.6, 36.5)	
Surkhandarya	167	13.8%	(9.4, 19.8)	
Sirdarya	152	23.0%	(16.4, 31.3)	
Tashkent oblast	143	13.3%	(8.5, 20.2)	
Ferghana	136	27.9%	(20.4, 37.0)	
Khorazm	153	24.2%	(16.3, 34.2)	
Tashkent city	143	11.9%	(6.5, 20.8)	
Age (in years)				
15-19	272	25.0%	(19.8, 31.1)	0.06
20-24	352	18.5%	(14.2, 23.7)	
25-29	398	16.3%	(12.8, 20.6)	
30-34	346	15.1%	(11.2, 20.1)	
35-39	243	21.1%	(16.0, 27.3)	
40-44	213	23.1%	(17.2, 30.4)	
45-49	264	18.2%	(13.6, 23.9)	

Characteristic	Total number of non-pregnant women per sub-group	%[a,b]	(95% CI)[c]	p-value [d]
Wealth quintile				
Poorest	429	22.4%	(17.9, 27.6)	<0.05
Second	410	21.1%	(17.1, 25.8)	
Middle	425	21.4%	(16.9, 26.6)	
Fourth	384	17.8%	(13.4, 23.3)	
Wealthiest	430	12.4%	(9.1, 16.7)	
Educational level				
Secondary or less	920	19.1%	(16.1, 22.6)	0.99
Special secondary or more	1171	19.1%	(16.6, 21.9)	

Note: The N's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data; for vitamin B12 deficiency, the numbers are smaller than for anaemia due to unsuccessful blood collection (only sufficient blood could be obtained for the on-site analysis of haemoglobin concentration) or insufficient sample volumes for retinol analysis.
[a] Vitamin B12 deficiency defined as serum B12 <150 pmol/L.
[b] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] Chi-square p-value <0.05 indicates that at least one subgroup is statistically signficantly different from the others.

3.5.8 Iodine status

The median urinary iodine concentration in non-pregnant women is above the cut-off of 100 µg/L which defines an iodine-sufficient population (Table 33). The median urinary iodine concentration is higher in urban non-pregnant women than rural women. The region-specific estimates indicate that some regions, such as Namangan and Samarkand, have median urinary iodine concentrations well below the cut-off defining population sufficiency. An important proportion of women in these regions could have inadequate iodine intake. There is no age group with iodine insufficiency; however, woman living in the poorest households have a median concentration which is borderline. There is little difference between women with different educational levels. Median urinary iodine concentration is substantially higher in women living in households in which the household salt iodine concentration is higher.

Table 33. **Median urinary iodine concentration in non-pregnant women 15-49 years, Uzbekistan 2017**

Characteristic	Total number of non-pregnant women per sub-group	Median UIC [a]	(95% CI)[b]	P Value[c]
TOTAL	2085	135.3	(128.4, 143.2)	-
Urban/rural				
Urban	586	148.2	(137.0, 159.0)	<0.05
Rural	1499	129.3	(120.9, 137.1)	
Region				
Karakalpakstan	159	149.5	(119.9, 168.6)	<0.001
Andijon	119	109.2	(87.7, 125.8)	
Bukhara	155	225.4	(202.1, 284.1)	
Jizzakh	174	137.8	(116.1, 175.3)	
Kashqadarya	173	133.6	(120.4, 161.1)	
Namangan	139	57.9	(47.6, 68.88)	
Navoiy	113	176.4	(148.1, 193.7)	
Samarkand	136	71.4	(61.7, 85.5)	
Surkhandarya	152	126.3	(107.9, 145.4)	
Sirdarya	153	110.7	(97.0, 132.1)	
Tashkent oblast	140	151.9	(128.2, 195.4)	
Ferghana	138	115.0	(101.4, 136.2)	
Khorazm	191	288.9	(255.7, 309.3)	
Tashkent city	145	185.0	(159.0, 206.5)	
Age (in years)				
15-19	273	155.6	(136.3, 173.8)	0.65
20-24	356	126.9	(112.9, 143.9)	
25-29	392	127.7	(117.4, 143.1)	
30-34	339	138.4	(124.3, 158.6)	
35-39	237	131.0	(108.4, 155.3)	
40-44	219	127.2	(109.4, 168.9)	
45-49	268	145.8	(124.2, 168.7)	
Wealth quintile				
Poorest	431	99.3	(90.8, 113.4)	<0.001
Second	406	126.9	(118.4, 141.3)	
Middle	430	160.0	(142.7, 174.4)	
Fourth	383	143.3	(125.4, 165.4)	
Wealthiest	422	163.0	(152.7, 180.5)	
Educational level				
Secondary or less	911	133.6	(122.5, 144.3)	0.74
Special secondary or more	1176	136.3	(127.2, 146.4)	
Level of iodization of household salt				
None (<5 ppm)	812	89.9	(84.0, 98.1)	<0.001
Insufficient (5-14.9 ppm)	372	139.1	(125.5, 150.7)	
Adequate (15+ ppm)	710	208.9	(193.7, 229.8)	

Note: The N's are un-weighted denominators in each subgroup; the sum of subgroups may not equal the total because of missing data.
[a] Median's are weighted for unequal selection probability; UIC = urinary iodine concentration
[b] CI=conf idence interval calculated by bootstrapping without taking into account the complex sampling design. Actual confidence intervals probably narrower.
[c] P-values are calculated using non-parametric median testd None = <5 ppm, Insufficient = 5-14.9 ppm, Adequate = 15+ppm.

Figure 20 shows the geographic distribution of median urinary concentration by Oblast. Namangan and Samarkand have median urinary iodine concentrations indicating iodine deficiency [13].

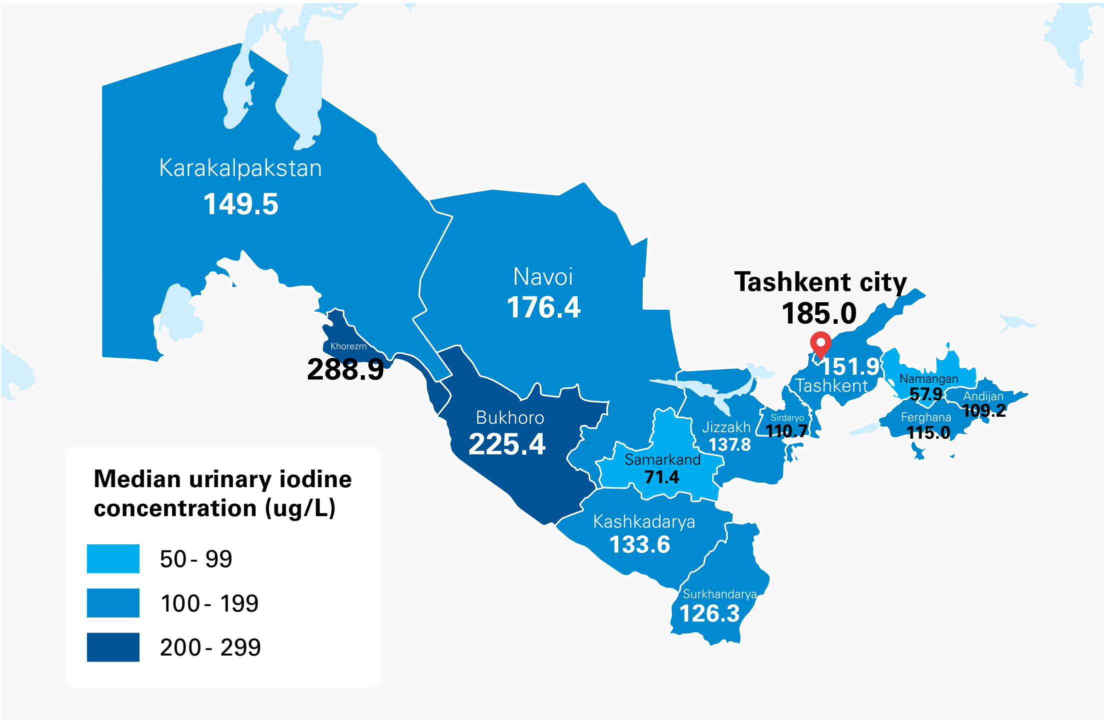

Figure 20. **Geographic distribution of median urinary iodine concentration in non-pregnant women, Uzbekistan 2017**

3.6 Pregnant women

3.6.1 Characteristics

In Table 34 the characteristics of the pregnant women participating in the survey are described. Three quarters of the surveyed women resided in rural areas and only one quarter in urban areas. The sample was almost equaly distributed among the different regions and wealth quintiles. Although no age restriction was used for the recruitment of pregnant women, most were between 20-29 years and in their second trimester of pregnancy. The majority of women had been pregnant 1-3 times, including the current pregnancy, and given birth to 1-2 children.

Table 34. **Description of pregnant women, Uzbekistan 2017**

Characteristic	Total number of pregnant women per sub-group	% [a]	(95% CI)[b]
TOTAL	251	100%	
Urban/rural			
Urban	59	24.9%	(19.1, 31.8)
Rural	192	75.1%	(68.2, 80.9)
Region			
Karakalpakstan	14	5.6%	(2.8; 10.8)
Andijon	21	8.4%	(4.8; 14.2)
Bukhara	17	6.8%	(3.7; 12.0)
Jizzakh	13	5.2%	(2.7; 9.8)
Kashqadarya	17	6.8%	(4.1; 11.0)
Namangan	23	9.2%	(5.7; 14.4)
Navoiy	16	6.4%	(3.1; 12.5)
Samarkand	25	10.0%	(5.9; 16.3)
Surkhandarya	20	8.0%	(4.3; 14.2)
Sirdarya	17	6.8%	(3.7; 12.0)
Tashkent oblast	21	8.4%	(4.7; 14.4)
Ferghana	16	6.4%	(3.5; 11.3)
Khorazm	19	7.6%	(4.1; 13.6)
Tashkent city	12	4.8%	(2.2; 10.3)
Age (in years)			
15-19	15	5.7%	(3.2, 9.8)
20-29	181	73.9%	(67.3, 79.6)
30-39	51	18.7%	(14.2, 24.1)
40+	4	1.7%	(0.6, 5.0)
Wealth Quintile			
Poorest	43	19.2%	(14.4, 25.1)
Second	53	20.5%	(15.3, 26.9)
Middle	52	20.1%	(15.0, 26.5)
Fourth	52	21.7%	(16.4, 28.0)
Wealthiest	47	18.5%	(13.5, 24.9)
Educational level			
Secondary or less	72	29.4%	(23.4, 36.1)
Special secondary or more	179	70.6%	(63.9, 76.6)
Trimester of pregnancy			
1	62	25.6%	(20.1, 32.0)
2	99	40.3%	(34.1, 46.9)
3	83	34.1%	(28.3, 40.4)

Characteristic	Total number of pregnant women per sub-group	% [a]	(95% CI)[b]
Number of times been pregnant			
1	81	33.0%	(27.1, 39.6)
2	78	31.5%	(25.7, 38.0)
3	53	19.8%	(15.1, 25.4)
4	21	8.1%	(5.2, 12.4)
5+	18	7.6%	(4.5, 12.5)
Number of times given birth			
0	69	27.2%	(21.5, 33.7)
1	101	40.6%	(33.8, 47.7)
2	55	22.3%	(17.6, 28.0)
3	16	5.4%	(2.9, 9.7)
4	9	4.2%	(1.7, 10.3)
5+	1	0.3%	(0.0, 2.3)

Note: The N's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.

3.6.2 Dietary diversity and consumption of vitamins and supplements

Pregnant women consumed, on average, more than 4 food groups in the 24 hours prior to the interview, and about half met minimum dietary diversity. Almost 50 percent of the surveyed women consumed iron tablets in the past six months prior to the survey. Folic acid consumption was even more common. On the other hand, only about every tenth woman consumed vitamin A supplements and one-third consumed multivitamin pills in the 6 months prior to the survey (see Table 35).

Table 35. **Dietary diversity and consumption of vitamin supplement in pregnant women, Uzbekistan 2017**

Characteristic	Total number of pregnant women per sub-group	% [a] or mean	(95% CI)[b]
Number of food groups consumed (mean) (MDD-W)	244	4.6	(4.3, 4.8)
Meet minimum dietary diversity (5+ food groups)			
Yes	128	51.3%	(44.8, 57.8)
No	116	48.7%	(42.2, 55.2)
Consumed iron tablets or syrup in past six months			
Yes	109	45.8%	(38.9, 52.9)
No	132	54.2%	(47.1, 61.1)
Consumed folic tablets in past six months			
Yes	181	75.2%	(68.3, 81.0)
No	62	24.8%	(19.0, 31.7)
Consumed multivitamin tablets in past six months			
Yes	98	36.9%	(30.9, 43.3)
No	140	63.1%	(56.7, 69.1)

Note: The N's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection among regions.
[b] CI=confidence interval calculated taking into account the complex sampling design.

3.6.3 Mid-upper arm circumference

Only 2.5 percent of pregnant women were diagnosed as undernourished using MUAC as the indicator. Because this proportion is so low, no further subgroup analysis was done.

3.6.4 Anaemia

As shown in Table 36, about one-third of pregnant women had anaemia, posing a moderate public health problem according to WHO classification [31]. Although the differences are not statistically significant, data suggest that pregnant women between 40-49 years of age and women in their third trimester of pregnancy had a higher prevalence of anaemia compared to other women. Neither household wealth nor urban rural residency and women´s education were associated with anaemia.

Table 36. **Prevalence of anaemia in pregnant women, by various demographic characteristics, Uzbekistan 2017**

Characteristic	Total number of pregnant women per sub-group	%[a, b]	(95% CI) [c]	p-value [d]
TOTAL	243	32.8%	(26.9, 39.4)	
Urban/rural				
Urban	55	32.9%	(21.4, 46.9)	0.99
Rural	188	32.8%	(26.1, 40.4)	
Age (in years)				
15-19	14	10.5%	(1.5, 47.8)	0.22
20-29	175	32.3%	(25.5, 39.9)	
30-39	50	39.2%	(25.8, 54.5)	
40-49	4	60.7%	(14.3, 93.4)	
Wealth quintile				
Poorest	40	29.2%	(17.5, 44.7)	0.84
Second	51	34.2%	(21.4, 49.8)	
Middle	52	35.6%	(22.9, 50.8)	
Fourth	51	37.4%	(24.4, 52.5)	
Wealthiest	45	27.3%	(16.2, 42.3)	
Educational level				
Secondary or less	67	33.1%	(22.0, 46.4)	0.96
Special secondary or more	176	32.7%	(25.8, 40.5)	
Trimester of pregnancy				
1	58	22.1%	(13.1, 34.8)	0.08
2	98	31.7%	(22.8, 42.2)	
3	80	41.0%	(29.8, 53.1)	

Note: The N's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Anaemia defined as haemoglobin < 110 g/L adjusted for altitude.
[b] Percentages weighted for unequal probability of selection among regions.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

The distribution of haemoglobin concentration is shown in Figure 21, showing that the majority of measurements are greater than the anaemia cutoff. Overall mean haemoglobin concentration in pregnant women was 113.6 g/L (95% CI: 111.9, 115.3).

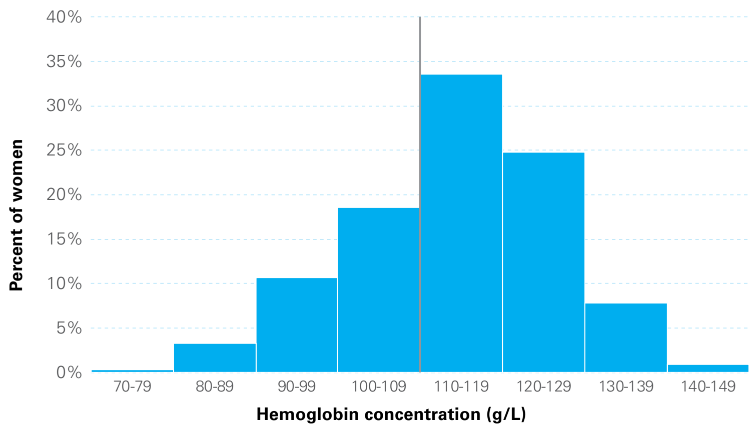

Figure 21. **Distribution of haemoglobin (g/L) in pregnant women, Uzbekistan 2017**

3.6.5 Iodine deficiency

In general, none of the subgroups of pregnant women shown in Table 37 had a median urinary iodine concentration high enough to define that subgroup as iodine sufficient. The exception is pregnant women whose household salt was adequately iodized. These women had a median which was significantly higher than the 150 µg/L cut-off point. Moreover, median urinary iodine concentration showed no trend by household wealth or trimester of pregnancy; however, similar to non-pregnant women, there was a substantial trend in increasing urinary iodine concentration with increasing iodine concentration in household salt.

Table 37. **Median urinary iodine concentration in pregnant women**

Characteristic	Total number of pregnant women per sub-group	Median UIC [a]	(95% CI)[b]	P Value[c]
TOTAL	227	117.3	(101.8, 139.9)	-
Urban/rural				
Urban	54	123.6	(89.1, 152.8)	0.85
Rural	173	117.3	(98.6, 144.1)	
Age (in years)				
15-19	14	106.9	(24.8, 212.9)	0.45
20-29	168	110.9	(88.6, 139.2)	
30-39	43	126.5	(92.4, 177.1)	
40-49	2	50.9	(27.9, 73.8)	
Wealth quintile				
Poorest	39	89.2	(52.8, 133.3)	0.16
Second	51	118.0	(76.8, 153.5)	
Middle	45	149.2	(102.1, 217.2)	
Fourth	47	101.4	(69.6, 165.9)	
Wealthiest	41	137.4	(100.4, 199.9)	
Educational level				
Secondary or less	62	112.5	(86.4, 151)	0.69
Special secondary or more	165	117.6	(96.7, 143.7)	
Trimester of pregnancy				
1	58	109.7	(74.3, 164)	0.25
2	91	136.8	(94.5, 191.9)	
3	72	106.5	(86.0, 134.0)	
Level of iodization of household salt				
None (<5 ppm)	96	78.4	(54.3, 97.7)	<0.001
Insufficient (5-14.9 ppm)	36	106.9	(51.4, 161.2)	
Adequate (15+ ppm)	72	205.8	(176.1, 253.4)	

Note: The N's are un-weighted numbers (denominator) in each subgroup; the sum of subgroups may not equal the total because of missing data.
[a] Median's are weighted for unequal selection probability; UIC = urinary iodine concentration
[b] CI=confidence interval calculated by bootstrapping without taking into account the complex sampling design. Actual confidence intervals probably narrower.
[c] P-values are calculated using non-parametric median testd None:<5 ppm, Insufficient: 5-14.9 ppm, Adequate: 15+ ppm

DISCUSSION AND CONCLUSIONS

4. DISCUSSION AND CONCLUSIONS

The UNS 2017 was designed to yield data for each of the 14 Oblasts in Uzbekistan, and provides representative data on anaemia and micronutrient status among children aged 6-59 months and women of reproductive age, along with information on household coverage with iodized salt and fortified wheat flour. Additionally, the UNS 2017 provide s updated measures of indicators of under- and overnutrition among children less than 5 years old and women of reproductive age.

The UNS 2017 had a high household response rate (95 per cent) and individual response rate (>90%) for interview and anthropometry data. Due to these high response rates, the UNS 2017 results are highly representative of the population in Uzbekistan. Of note, 69 percent of the UNS household sample was categorized as 'rural' population, and this is close to the MICS 2006 (which reported 71 percent of children living in rural dwellings) [19], while the State Committee of the Republic of Uzbekistan on Statistics indicates that just about half of the population is supposedly rural [2]. In 2009, the government of Uzbekistan issued decree # 68 "On additional measures to improve the administrative territorial structure of settlements of the Republic of Uzbekistan" that approved reclassification of rural settlements into urban settlements. The sampling frame complied by the Ministry of Health is, however, based on previous classification of makhallas.

4.1 Strengths and limitation of the UNS 2017

The UNS 2017 survey had several strengths in its design and planned implementation, but also some design-inherent limitations and limitations stemming from its implementation. These strengths and limitations are discussed here to provide the reader with a full picture of strengths and potential caveats when interpreting the findings presented in this report.

The design of the UNS 2017 aimed at providing representativeness for each oblast, and due to the hight response rates, this aim was achieved. That said, one limitation was the lack of up-to-date census data as the base for the sampling frame. Thus, UNICEF and the Ministry of Health obtained population counts from each of the over 4000 makhallas and in order to render these submissions as accurately as possible, a tedious procedure had to be applied.

Although there has been no anaemia prevalence assessment recently, the anaemia prevalence found in children in the UNS 2017 is considerably lower than previous estimates [5,41], which is a striking difference despite the relatively long time interval between the two surveys. There are some technical differences that may partly explain the differences, although it is not known to what extent. For example, the UNS 2017 used the Hemocue Hb 301 device, which has been described to yield slightly higher haemoglobin readings [42] than the Hb 201+, although such a bias is not described consistently [43]. The UNS 2017 used venous blood samples for all participants, as compared to the Health Examination Survey 2002, where capillary blood was used. There have recently been reports positing that haemoglobin measurements from capillary blood samples will likely yield reduced haemoglobin concentrations and thus, increased anaemia prevalence [44,45]. Based on this, the anaemia results in general have to be used with caution, be it on previously existing data or the current data from the UNS 2017. It is worth noting that the differences in anaemia prevalence estimates for children are much larger between the UNS 2017 and the 2002 survey (15 percent vs. 49 per cent) than the estimates for non-pregnant women between the UNS and the 2008 survey (20 percent vs. 34 percent [41]). Of note, the 2008 survey used venous blood and also used the Hemocue 301 and as such, the method is identical to the one used in the UNS 2017. Thus, despite some methodological influences, there seems to be a consistent pattern of reduced anaemia overall.

The quantitative analysis of salt iodine content and semi-quantitative analysis wheat flour iron content provide important advantages over qualitative testing and this refined analysis enabled the UNS 2017 to draw stronger conclusion compared to previous surveys, in particular with regards to adequately iodized salt. Further, the inclusion of measuring urinary iodine content in women from the same households allows to run correlations.

Due to budgetary limitation, the UNS only included women in half of recruited households. While the resulting sample yielded a sufficiently powered sample for women estimates, this approach limits the assessment of mother-child linkages, e.g. with regard to anthropometric measures. Also partly due to limited funds but also due to lack of laboratory capacity, certain potentially desirable biomarkers could not be assessed, such as zinc or vitamin D deficiency, or certain haemoglobin disorders.

Given the limited laboratory capacity for certain biomarkers measured in this survey, considerable efforts were put into capacity strengthening and incorporating quality control mechanisms. These activities took quite some time and explain the delayed release of this report. But also, a long time gap between blood sample collection and laboratory analysis has been described to affect biomarker stability, in particular folate [46,47]. Despite the storage of samples for about one year, considerable biomarker degradation is unlikely as samples were stored at -80°C.

Although this problem went undetected during training, standardization and the field work phase despite constant supervision, during data analysis, it turned out that the anthropometric measures among children in the Bukhara oblast had a systematic height bias, which resulted in the exclusion of anthropometric measures from this oblast.

4.2 Household-level findings

Household-level interviews revealed that almost all households use safe water for drinking, have access to adequate sanitation facilities, and use clean fuel for cooking. These results are consistent with other national surveys in Uzbekistan [5].

Salt was sampled from most households, and notable discrepancies were observed between respondent perception of salt iodization status, salt labelling, and the actual iodine concentration found. The high level of conviction at the household level of using iodized salt was also confirmed in the women questionnaire, where over 90 percent of respondents knew what iodized salt is, claimed to always use iodized salt for cooking and were aware of the benefits of consuming iodized salt. However, analysis of salt samples found that only about 60 percent of salt samples contained some iodine, and less than 40 percent were considered adequately iodized. Furthermore, the UNS 2017 found that salt packages that were labeled as 'iodized' were less often adequately iodized than packages without such labeling or where the original packaging could no longer be observed.

Household coverage estimates with adequately iodized salt are considerably lower than previously reported: UNICEF's MICS of 2006 reported that 53 percent of salt samples were adequately iodized [19]; further, the MICS reported quite different regional household coverage with iodized salt than the UNS 2017. However, the rapid test kits used in the MICS cannot accurately distinguish between salt containing iodine at inadequate concentrations from adequately iodized salt [48]. As such, the salt iodization results of the UNS 2017 were produced using a methodology that is more accurate and precise than the rapid test kits.

Most households in Uzbekistan bake their own bread (62 per cent) and of the remaining proportion, the predominant bread type is 'Lepeshka'. Of all flour samples collected, only one third were fortified, but it has to be noted that the fortification standard only requires certain flours to be fortified. In particular, imported flour does not need to be fortified and reportedly, almost half of the flour used is imported.

At the time of the UNS 2017 implementation, the old flour fortification standard was in place. As iron (as electrolytic iron) used to be one of the six micronutrients included in Uzbekistan's wheat fortification standards, the UNS 2017 findings indicate that subsequently, levels of the other five micronutrients that should be included in the micronutrient premix added to wheat flour (i.e. zinc, vitamin B1, B2, B3, and folic acid) were also only present at near adequate levels in about 30 percent of samples.

4.3 Children less than 5 years of age

Infant and young child feeding practices are mostly adequate with regard to early initiation and continued breastfeeding. While exclusive breastfeeding rates found in the UNS 2017 (50 per cent) are considerably higher than in the 2006 MICS (26 per cent) [19], improvements can be made to further increase the prevalence of exclusive breastfeeding in the first six months of life. Other child feeding indicators, such as minimum acceptable diet (a composite indicator of dietary diversity and food frequency) can be improved. Although it is known that a minimum acceptable diet alone is not sufficient to avoid stunting, it has been described recently to affect linear growth faltering [49].

Also, vitamin A supplementation in the six months preceding the survey is quite low with only about 40 percent having received the supplements. Reported consumption of iron-fortified bread the children was rather high at over 60 per cent, but considering the relatively low household coverage with adequately fortified flour, it remains doubtful that the reported figures reflect actual consumption of bread made from fortified flour.

Regarding recent morbidity, only relatively few caregivers reported that the child had fever, lower respiratory infection or diarrhea in the past 2 weeks, but over half of these caregivers stated having sought medical advice or treatment. The relatively high levels of knowledge of caregivers and reported adequate health seeking behavior indicate that there is a certain interest in being competent about child health and nutrition. However, it appears that perceived 'good actions' (e.g. stating that theyonly use iodized salt or iron-fortified bread) and actual actions (not using iodized salt or iron-fortified flour, because they are not adequately fortified) cannot always be matched.

As previously discussed, anthropometric measures had to be discarded for the region of Bukhara due to quality issues. Notwithstanding, results for the other Oblasts indicate that stunting, wasting and underweight are rather uncommon in young children in Uzbekistan. They are consistently lower than proportions reported in the 2006 MICS [19]. The prevalence of stunting and wasting observed in Uzbekistan was also lower than recent estimates from Turkmenistan, Tajikistan, and Azerbaijan [50–52]. The prevalence of underweight in Uzbekistan, however, was similar to that found in Turkmenistan and Azerbaijan.

The prevalence of child overweight and obesity (4.6 percent nationally) is considered to be of low public health relevance at present [40], and is slightly lower that the prevalence found by the 2006 MICS (7.3 per cent) [19]. Although the prevalence is apparently decreasing, the 2006 MICS did not present confidence intervals, so it is not possible to determine if a change occurred using simple comparisons. Regardless, the estimates are indicative of a potential public health problem that should be carefully monitored. The overweight and obesity prevalence of children in Uzbekistan is compareable to the prevalences recently found in Turkmenistan (5.9 per cent) and Tajikistan [50,51], but considerable lower that the prevalence in Azerbaijan [52].

Anaemia prevalence of just below 15 percent nationally in children 6-59 months is considered to be of moderate public health relevance according to WHO categorization [31]. The most recent national estimates before the UNS 2017 date back to 2002 and then, an anaemia prevalence of 49 percent was reported in children 6-35 months of age [5]. Thus, even when considering that the UNS 2017 may have slightly underestimated anaemia prevalence due to the use of the haemoglobin measuring device and that the 2002 survey likely overestimated anaemia prevalence due to haemoglobin measurements from a fingerprick sample (see strengths and limitations chapter above), as well as considering the narrower age range in 2002, there has clearly been a trend towards lower anaemia prevalence in this age group. The UNS 2017 found some variation across the regions but differences were not statistically significant; also, no urban/rural differences could be found.

At almost 55 per cent, iron deficiency was relatively high in children and regional differences could be observed, ranging from 39 percent to 67 per cent. Because of the relatively low anaemia prevalence, it is not surprising to see that iron deficiency anaemia (IDA) is, with 11 percent also relatively low in this group; however, 11 percent of IDA among a group with 15 percent anaemia means that almost ¾ of anaemia is associated with iron deficiency. As such, reducing iron deficiency in such a context will likely drastically reduce the anaemia prevalence as well. Besides iron deficiency, only vitamin A deficiency, inflammation (as measured using AGP and CRP), and acute lower respiratory infection were associated with anaemia in bivariate analyses.

Serum retinol concentrations were measured to assess the extent of vitamin A deficiency prevalence in the UNS 2017 and a prevalence of just over 6 percent denotes a mild public health problem among children 6-59 months of age in Uzbekistan, as per WHO's categorization [28]. That said, notable regional differences exist, and for Andijon and Jizzak oblasts, vitamin A deficiency is considered a 'moderate' public health problem.

4.4 Non-pregnant women

Of the women interviewed, one out of ten was pregnant and one out of five was lactating. For presentations of the biological indicators, the pregnant women are presented separately in this report, because their physiological needs are very different and different variables were collected.

While over 90 percent of women had heard about iodized salt —and could cite a correct benefit of using iodized salt — only 26 percent ever heard about fortified wheat flour. There were remarkable regional differences in women's knowledge of food fortification. While nationally, 4 in 10 non-pregnant women consumed 5 or more food groups the day preceding the survey interview, there were notable regional differences, ranging from less than 10 percent in Surkhandarya to over 80 percent in Namangan.

With 6 percent underweight, undernutrition is somewhat present in non-pregnant women in Uzbekistan, but the majority of underweight women had BMIs between 17.0-18.4 and as such were only at risk for chronic energy deficiency. On the other hand, 40 percent of Uzbek women were overweight (25 per cent) or obese (15 per cent). While there are no urban/rural or regional differences or differences by socio-economic status in the prevalence of overweight or obese women, there is a strong age-dependent pattern with increasing prevalence of overweight or obesity with increasing age. The most recent previous data on overweight/obesity were collected as part of the 2014 STEPS survey [53] and because women aged 18-64 years old were included, it is impossible to disentangle if the prevalence of overweight or obesity hasincreased between 2014 to 2017. Despite the limited comparability, the high burden of overweight and obesity should be addressed further in national policies. The well-documented link between overweight/obesity and type 2 diabetes, blood pressure, cardiovascular diseases and all-cause mortality highlights the importance of tackling the problem [54,55]. Over and above, there is growing evidence of an intergenerational effect in that children born to overweight/obese mothers are more likely to be stunted or to also become overweight later in life [56].

One in five women were anaemic, but almost half of the women suffered from iron deficiency. Among anaemic women, 80 percent had concurrent iron deficiency, indicating that the main driver of anaemia in Uzbek women is likely iron deficiency. The anaemia prevalence in this population group denotes a 'moderate' public health problem [31]. However, there are important regional differences, with anaemia prevalence around 10 percent in Namangan and Kashqadarya to 30 percent or more in Andijon and Karakalpakstan. Besides iron deficiency, anaemia was only significantly positively associated with vitamin A deficiency in women, but only few women were vitamin A deficient. When compared to its neighbors, the prevalence of anaemia in Uzbekistan was 10-16 percentage points lower than that found in Kazakhstan, Kyrgyzstan, Tajikistan, and Turkmenistan [57]. However, these differences could potentially be a result of differing methodologies of blood collection and/or measurement (see Section 4.1).

Vitamin A deficiency prevalence was less than 3 per cent, considered to be low by WHO categories [28]. Despite the low numbers overall, it is noteworthy that in Andijon and Samarkand, the prevalence of vitamin A deficiency is more than double than for most other regions.

Folate deficiency affects four out of ten women and although no prevalence thresholds for determining the public health severity exist, folate deficiency can be considered highly prevalent, and there are important regional differences. Vitamin B12 deficiency affects about 20 percent of women. Vitamin B12 deficiency was more common in rural women than urban women.

Overall, iodine status indicates adequate iodine intake among non-pregnant women. However, the region-specific estimates indicate that some regions, such as Namangan and Samarkand, have median urinary iodine concentrations well below the cut-off defining population sufficiency. A considerable proportion of women in these regions could have inadequate iodine intake. An important finding of the UNS 2017 is that there is a dose-response type pattern between median urinary iodine concentration and household-level adequacy of iodized salt: women from households with non-iodized salt are falling into the category of iodine deficiency, whilst those that live in households consuming somewhat iodized or adequately iodized salt are adequate in terms of their iodine status.

4.5 Pregnant women

For pregnant women, because their number is limited, the UNS 2017 could only provide analyses for selected sub-groups. Dietary diversity is only slightly better than among non-pregnant women, yet supplement consumption is considerably higher, in particular with regard to iron and folic acid supplements, which is provided during antenatal care visits.

A small proportion of pregnant women has low MUAC, rendering any sub-group analysis difficult.

With regard to anaemia, one-third of pregnant women are affected. Only gestational age (by trimester) was positively associated with anaemia, which is not surprising as the blood volume increases are largest with progressing pregnancy [58].

Using thresholds currently recommended by the World Health Organization [13], overall median urinary iodine concentration indicates that this population group is iodine deficient. Most sub-group analyses yielded the same picture, except that pregnant women living in households with adequately iodized salt are iodine sufficient, corroborating the importance of ensuring adequate salt iodization in Uzbekistan.

RECOMMENDATIONS

5. RECOMMENDATIONS

Using the findings presented in this report and an understanding of Uzbekistan's programmematic and research environment, the following programmematic and research recommendations have been developed. While these recommendations describe the policy and programmematic options that can be taken, they do not specify which governmental or non-governmental agencies are responsible for addressing each recommendation. Moving forward, nutrition stakeholders in Uzbekistan should review these recommendations to determine which agencies are best placed to address certain issues and improve the nutrition situation of children and women in Uzbekistan.

5.1 Strengthen salt iodization law enforcement

The UNS 2017 report found that women from households consuming non-iodized salt were more likely to be iodine deficient. The same applies for pregnant women, a very important population group, as the unborn child will be affected by maternal iodine deficiency. Further, the report finds that there is a high knowledge among respondents about the importance of consuming iodized salt and that many respondents believe they are consuming iodized salt. However, the report also clearly illustrates that the information about whether or not salt is iodized on salt package labels does not match the salt iodine content. Although a small proportion of iodine could be lost through extended inappropriate storage, it is evident that the law enforcement at the level of salt production, importation, and distribution needs to be considerably strengthened.

5.2 Strengthen wheat flour fortification

Although anaemia prevalence was found to be relatively low in Uzbekistan, the prevalence of iron deficiency was high. As iron deficiency was significantly associated with anaemia, addressing iron deficiency could likely reduce the anaemia prevalence. Findings of the UNS 2017 reveal two important aspects around this topic, namely:

1. Even flour produced locally which should be be fortified is not always complying with the standards.

2. Compared to earlier assessments, there seems to be a market shift toward higher volumes of imported (non-fortified) wheat flour, in particular from Kazakhstan; this flour is not mandated to be fortified as per the current law in Uzbekistan.

Therefore, similarly to the salt iodization situation above, adherence to fortification standards of locally-produced wheat flour should be strengthened at the level of production and distribution. Mandatory fortification should be extended to all grades of flour produced in Uzbekistan. Additionally, and this has gained importance in the recent past due to higher proportions of imported wheat flour, the fortification standards should be revisited and imported wheat flour should be mandated to be fortified.

A recent revision of the wheat flour fortification standards [18] shows that responsible stakeholders have already considered the addition of vitamin B12 to the premix. This is an important stept towards a contribution to further reducing this deficiency.

These measures (law enforcement, mandating fortification for all flours for human consumption both locally produced and imported) would be expected to increase coverage with adequately fortified wheat flour and to provide additional micronutrients. If both are implemented, reductions of anaemia, iron, folate and vitamin B12 deficiency are plausible.

5.3 Reduce overweight and obesity among women

Since around 40 percent of non-pregnant women were classified as either overweight or obese, there is an imperative need to educate women about approaches to maintain healthy weight and to prevent overweight and obesity. Since increased parity has been associated with overweight and obesity prevalence in similar contexts, it is recommended that antenatal and postnatal care provided by doctors and nurses be expanded to include behavior change messages and counseling for mothers. Nutrition education should start from school education to ensure behavioral changes early in life.

5.4 Monitor overweight and obesity prevalence in children

Although the UNS 2017 reported relatively low prevalence of overweight and obesity in young children, the high prevalence among women calls for careful monitoring in order to ideally instill appropriate behaviors early in life, since such changes are often more easily induced in younger people. Further, it is advisable to also include school-age children in such monitoring programmes and if need arises, design behavior change communication campaigns at the level of schools.

5.5 Strengthen other strategies to tackle micronutrient deficiencies

Infant and young child feeding practices and dietary diversity in non-pregnant women should be further improved. This can happen through caregiver education antenatal and postnatal visits, as well as through school programmes.

Although iron and folic acid supplement consumption in pregnant women was around 50 per cent, this coverage should be further raised to bridge potential nutrient gaps during periods of need. Further, recent evidence proposes the provision of multiple micronutrient supplements rather than iron and folic acid supplements as a cost-effective alternative [59].

Similarly, because food fortification of staples may not be the most appropriate approach to reach young children 6-23 months of age, since their food intake is limited compared against their micronutrient need, programmes to provide micronutrient powder may be envisioned or scaled-up for this age group, in particular in more vulnerable regions.

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APPENDICES

APPENDIX 1. ADDITIONAL HOUSEHOLD TABLES

Table A1 - 1 **Distribution of household interview results for households randomly selected for participation, Uzbekistan 2017**

Characteristic	Interview completed		No household member or competent respondent at home during visit		Entire household absent for long period or moved away		Interview refused		Dwelling vacant or not found		Other [b]	
	N	% [a]	N	% [a]	N	% [a]	N	% [a]	N	% [a]	N	% [a]
Total	3882	94.8%	46	1.1%	118	2.9%	35	0.9%	5	0.1%	11	0.3%
Residence												
Urban	1192	92.2%	13	1.0%	65	5.0%	21	1.6%	1	0.1%	1	0.1%
Rural	2690	95.9%	33	1.2%	53	1.9%	14	0.5%	4	0.1%	10	0.4%
Region												
Karakalpakstan	279	97.2%	3	1.0%	2	0.7%	3	1.0%	0	0%	0	0.0%
Andijon	278	96.9%	2	0.7%	4	1.4%	2	0.7%	1	0.3%	0	0.0%
Bukhara	267	92.7%	7	2.4%	9	3.1%	5	1.7%	0	0%	0	0.0%
Jizzakh	282	99.3%	0	0.0%	0	0.0%	0	0.0%	0	0%	2	0.7%
Kashqadarya	262	89.4%	5	1.7%	16	5.5%	3	1.0%	0	0%	7	2.4%
Namangan	273	91.0%	12	4.0%	11	3.7%	3	1.0%	1	0.3%	0	0.0%
Navoiy	283	95.0%	1	0.3%	14	4.7%	0	0.0%	0	0%	0	0.0%
Samarkand	277	94.5%	2	0.7%	11	3.8%	3	1.0%	0	0%	0	0.0%
Surkhandarya	268	98.5%	0	0.0%	0	0.0%	4	1.5%	0	0%	0	0.0%
Sirdarya	301	98.4%	1	0.3%	2	0.7%	1	0.3%	0	0%	1	0.3%
Tashkent oblast	271	90.9%	2	0.7%	19	6.4%	3	1.0%	3	0%	0	0.0%
Ferghana	276	96.2%	4	1.4%	5	1.7%	2	0.7%	0	0%	0	0.0%
Khorazm	286	95.3%	4	1.3%	8	2.7%	1	0.3%	0	0%	1	0.3%
Tashkent city	279	91.8%	3	1.0%	17	5.6%	5	1.6%	0	0%	0	0.0%

Note: The N's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data.
[a] Percentages not weighted for unequal probability of selection.
[b] Other: included dwelling destroyed or other reasons noted by interviewer.

APPENDIX 2. ADDITIONAL CHILD TABLES

Table A2- 9. **Proportion of mild, moderate and severe anaemia in children 6-59 months of age, Uzbekistan 2017**

Characteristic	Severe anaemia			Moderate anaemia			Mild anaemia			P value [d]
	Number affected	% [a, b]	(95% CI)[c]	Number affected	% [a, b]	(95% CI)[c]	Number affected	% [a, b]	(95% CI)[c]	
TOTAL	2	0.1%	(0, 0.5)	70	4.5%	(3.5, 5.7)	175	10.1%	(8.6, 11.8)	
Residence										
Urban	1	0.2%	(0.0, 1.7)	17	4.2%	(2.7, 6.5)	44	10.9%	(8.3, 14.2)	0.828
Rural	1	0.1%	(0.0, 0.6)	53	4.2%	(3.2, 5.5)	131	10.3%	(8.7, 12.2)	
Region										
Karakalpakstan	0	0%	-	8	5.7%	(3.3, 9.5)	16%	11.3	(6.6, 18.9)	0.972
Andijon	0	0%	-	6	4.3%	(2.1, 8.6)	16%	11.4	(7.0, 18.2)	
Bukhara	1	0.7%	(0.1, 4.9)	7	5.1%	(2.5, 10.2)	23%	16.9	(12.2, 22.9)	
Jizzakh	0	0%	-	3	2.0%	(0.7, 5.8)	15%	10.1	(6.1, 16.2)	
Kashqadarya	0	0%	-	3	3.4%	(0.9, 12.0)	8%	9.1	(4.6, 17.1)	
Namangan	0	0%	-	2	1.6%	(0.4, 6.0)	9%	7.4	(3.7, 14.1)	
Navoiy	0	0%	-	2	1.9%	(0.5, 7.1)	13%	12.3	(7.4, 19.7)	
Samarkand	0	0%	-	10	11.8%	(6.4, 20.6)	6%	7.1	(2.4, 19.0)	
Surkhandarya	0	0%	-	9	5.3%	(2.8, 9.8)	18%	10.7	(7.2, 15.5)	
Sirdarya	0	0%	-	2	3.7%	(1.0, 12.4)	5%	9.3	(4.3, 18.7)	
Tashkent oblast	1	0.9%	(0.1, 5.8)	6	5.1%	(2.3, 11.1)	15%	12.8	(7.5, 21.2)	
Ferghana	0	0%	-	6	5.3%	(2.6, 10.5)	8%	7.0	(3.8, 12.5)	
Khorazm	0	0%	-	3	1.9%	(0.6, 5.4)	13%	8.2	(4.9, 13.4)	
Tashkent city	0	0%	-	3	3.2%	(1.1, 8.7)	10%	10.5	(5.3, 19.8)	
Age Group (in months)										
6-11	0	0%	-	15	9.3%	(5.6, 15.1)	44	23.5%	(17.6, 30.5)	<0.001
12-23	1	0.3%	(0.0, 2.0)	33	9.0%	(6.4, 12.5)	67	16.0%	(12.3, 20.5)	
24-35	1	0.2%	(0.0, 1.5)	11	3.0%	(1.6, 5.5)	33	8.7%	(6.3, 12.0)	
36-47	0	0%	-	9	2.3%	(1.2, 4.4)	21	5.3%	(3.4, 8.2)	
48-59	0	0%	-	1	0.2%	(0.0, 1.1)	7	1.9%	(0.8, 4.2)	
Sex										
Male	1	0.1%	(0.0, 0.9)	43	5.1%	(3.8, 7.0)	106	11.3%	(9.4, 13.6)	0.136
Female	1	0.1%	(0.0, 0.7)	27	3.7%	(2.6, 5.3)	69	8.7%	(6.7, 11.0)	
Wealth Quintile										
Lowest	0	0%	-	16	4.9%	(3.0, 7.9)	32	9.0%	(6.4, 12.4)	0.814
Second	0	0%	-	10	3.2%	(1.7, 5.9)	40	10.6%	(7.9, 14.1)	
Middle	0	0%	-	15	4.8%	(2.9, 7.9)	44	11.9%	(8.8, 16.0)	
Fourth	1	0.4%	(0.1, 2.6)	18	5.5%	(3.5, 8.7)	32	10.1%	(7.1, 14.2)	
Highest	1	0.3%	(0.0, 1.8)	10	3.7%	(2.0, 6.8)	27	9.0%	(6.2, 12.7)	
Mother's educational level										
Secondary or less	0	0%	-	30	3.8%	(2.6, 5.6)	89	11.1%	(9.0, 13.5)	0.449
Special secondary or more	2	0.4%	(0.1, 1.6)	52	4.7%	(3.5, 6.1)	117	9.8%	(8.0, 11.9)	

Note: The n's are un-weighted numerators for each subgroup; subgroups that do not sum to the total have missing data.
[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.
[b] Severe anaemia: <70 g/L, moderate anaemia: 70-99 g/L, mild anaemia: 100-109 g/L; all adjusted for altitude.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

APPENDIX 3. ADDITIONAL WOMAN TABLES

Table A3- 1. **Proportion of mild, moderate, and severe anaemia in non-pregnant women (15-49 years), Uzbekistan 2017**

Characteristic	Severe anaemia			Moderate anaemia			Mild anaemia			P value[d]
	N	%[a]	(95% CI)[c]	N	%[a]	(95% CI)[c]	N	%[a]	(95% CI)[c]	
TOTAL	14	0.6%	(0.3, 1.1)	156	6.8%	(5.7, 7.9)	280	12.9%	(11.4, 14.7)	
Urban/rural										
Urban	5	0.9%	(0.4, 2.2)	37	6.1%	(4.5, 8.3)	72	12.2%	(9.7, 15.2)	0.574
Rural	9	0.5%	(0.2, 1.0)	119	7.0%	(5.8, 8.4)	208	13.2%	(11.3, 15.5)	
Region										
Karakalpakstan	5	3.1%	(1.2, 7.7)	21	12.9%	(8.8, 18.5)	30	18.4%	(13.7, 24.2)	0.053
Andijon	1	0.7%	(0.1, 5.1)	13	9.6%	(6.2, 14.7)	26	19.3%	(13.1, 27.5)	
Bukhara	0	--	--	7	4.2%	(2.2, 8.1)	20	12.1%	(8.1, 17.8)	
Jizzakh	1	0.6%	(0.1, 3.8)	15	8.4%	(4.7, 14.5)	14	7.8%	(4.3, 13.9)	
Kashqadarya	1	0.6%	(0.1, 3.9)	8	4.5%	(2.2, 9.0)	10	5.7%	(2.9, 11.0)	
Namangan	0	--	--	6	4.1%	(1.7, 9.2)	9	6.1%	(3.5, 10.3)	
Navoiy	2	1.6%	(0.4, 5.8)	6	4.8%	(2.3, 10.0)	11	8.9%	(5.1, 15.0)	
Samarkand	0	--	--	5	3.4%	(1.5, 7.3)	15	10.1%	(6.0, 16.7)	
Surkhandarya	0	--	--	14	7.6%	(4.4, 12.9)	17	9.2%	(5.8, 14.4)	
Sirdarya	0	--	--	14	8.8%	(5.4, 14.0)	19	11.9%	(8.6, 16.3)	
Tashkent oblast				17	11.3%	(6.7, 18.5)	38	25.3%	(16.4, 37.0)	
Ferghana	1	0.7%	(0.1, 4.6)	10	7.2%	(4.4, 11.6)	21	15.1%	(10.0, 22.1)	
Khorazm	1	0.5%	(0.1, 3.4)	13	6.7%	(4.0, 11.2)	34	17.6%	(12.2, 24.7)	
Tashkent city	2	1.4%	(0.4, 5.0)	7	4.9%	(2.6, 8.9)	16	11.1%	(7.1, 16.9)	
Age (in years)										
15-19	0	0%	-	15	5.8%	(3.5, 9.5)	30	10.8%	(7.3, 15.7)	0.387
20-24	1	0.4%	(0.0, 2.5)	20	4.9%	(3.1, 7.7)	41	11.1%	(8.0, 15.3)	
25-29	2	0.4%	(0.1, 1.8)	26	6.0%	(4.0, 8.9)	63	15.6%	(12.1, 20.0)	
30-34	4	0.9%	(0.3, 2.6)	25	5.5%	(3.6, 8.4)	51	13.3%	(10.0, 17.4)	
35-39	4	1.1%	(0.4, 2.9)	24	9.4%	(6.3, 13.9)	33	13.4%	(9.6, 18.3)	
40-44	1	0.7%	(0.1, 4.8)	22	9.9%	(6.4, 15.0)	27	12.4%	(8.6, 17.5)	
45-49	2	0.9%	(0.2, 3.5)	24	8.1%	(5.3, 12.1)	34	12.8%	(9.3, 17.4)	
Wealth quintile										
Poorest	3	0.6%	(0.2, 2.2)	34	7.2%	(4.9, 10.3)	54	11.4%	(8.5, 15.1)	0.217
Second	2	0.4%	(0.1, 1.5)	37	7.8%	(5.6, 10.8)	41	9.9%	(7.1, 13.6)	
Middle	6	1.0%	(0.4, 2.2)	33	6.9%	(4.9, 9.6)	61	14.1%	(11.0, 17.9)	
Fourth	2	0.6%	(0.2, 2.4)	32	8.3%	(5.7, 11.9)	60	15.1%	(11.4, 19.8)	
Wealthiest	1	0.3%	(0.0, 2.4)	19	3.7%	(2.4, 5.9)	63	14.2%	(10.9, 18.4)	
Educational level										
Secondary or less	7	0.8%	(0.4, 1.7)	70	7.0%	(5.4, 8.9)	123	13.0%	(10.8, 15.5)	
Special secondary or more	7	0.5%	(0.2, 1.0)	86	6.6%	(5.3, 8.2)	157	12.9%	(10.9, 15.3)	

Note: The n's are un-weighted numerators for each subgroup; subgroups that do not sum to the total have missing data.
[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.
[b] Severe anaemia: <80 g/L, moderate anaemia: 80-109 g/L, mild anaemia: 109-119 g/L; all adjusted for altitude.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

Table A3 – 2. **Distribution of pregnancy and birth variables in randomly selected non-pregnant women 15-49 years of age and pregnant women, by age group; Uzbekistan 2017**

Characteristic	15-19 y	20-24 y	25-29 y	30-34 y	35-39 y	40-44 y	45-49 y	P value
Currently pregnant								
Yes	4.7%	19.3%	18.7%	9.4%	2.3%	1.9%	--	0.000
No	95.3%	80.7%	81.3%	90.6%	93.0%	98.1%	100.0%	
Currently lactating								
Yes	1.2%	26.9%	34.4%	20.5%	11.8%	--	0.3%	0.000
No	98.8%	73.1%	65.6%	79.5%	88.2%	100.0	99.7%	
Number of pregnancies								
0	94.4%	39.7%	10.5%	9.3%	5.3%	3.0%	5.0%	0.000
1	5.2%	31.9%	18.5%	6.6%	3.9%	3.7%	5.1%	
2	0.4%	23.5%	39.5%	25.5%	15.2%	12.2%	12.4%	
3	--	3.0%	23.2%	30.3%	26.2%	27.3%	22.2%	
4	--	1.3%	6.1%	18.4%	22.9%	22.1%	19.4%	
5 +	--	0.6%	2.2%	10.0%	26.5%	31.7%	36.0%	
Number of births (live and still)								
0	98.7%	48.2%	13.6%	10.7%	6.2%	3.2%	5.6%	0.000
1	1.3%	36.7%	27.2%	10.1%	6.7%	5.4%	6.0%	
2	--	13.7%	43.2%	36.7%	26.2%	21.8%	20.4%	
3	--	1.4%	13.6%	30.7%	37.8%	39.5%	34.3%	
4	--	--	2.5%	10.2%	19.0%	22.5%	20.9%	
5 +	--	--	--	1.6%	4.2%	7.6%	12.7%	
Delivered live baby in past 2 years								
Yes	1.6%	46.1%	69.4%	59.9%	50.1%	56.2%	46.5%	0.000
No	98.4%	53.9%	30.6%	40.1%	49.9%	43.8%	53.5%	

Table A3- 3. **Dietary and knowledge characteristics and indicators in non-pregnant women 15-49 years of age, by Region, Uzbekistan 2017**

Characteristic	Karakalpakstan	Andijon	Bukhara	Jizzakh	Kashqadarya	Namangan	Navoiy	Samarkand	Surkhandarya	Sirdarya	Tashkent oblast	Ferghana	Khorazm	Tashkent city	P value
Number of MDD-W[a] food groups consumed (mean)	4.49	2.93	4.67	5.89	3.97	6.05	4	3.53	2.91	4.22	4.25	4.8	3.77	4.59	<0.001
Meets minimum dietary diversity (MDD-W, 5+ food groups)															
Yes	46.3%	12.3%	51.2%	74.3%	35.0%	84.3%	30.8%	24.4%	9.3%	39.5%	40.1%	53.2%	30.1%	51.0%	<0.001
No	53.7%	87.7%	48.8%	25.7%	65.0%	15.7%	69.2%	75.6%	90.7%	60.5%	59.9%	46.8%	69.9%	49.0%	
Consumed iron tablets or syrup in past six months															
Yes	10.2%	10.2%	9.0%	7.7%	5.8%	17.6%	6.1%	4.7%	7.2%	6.3%	12.3%	15.8%	7.3%	11.7%	<0.001
No	89.8%	89.8%	91.0%	92.3%	94.2%	82.4%	93.9%	95.3%	92.8%	93.7%	87.7%	84.2%	92.7%	88.3%	
Consumed folic acid tablets or syrup in past six months															
Yes	0.6%	2.0%	4.2%	2.2%	0.6%	4.6%	1.5%	3.4%	2.1%	1.9%	5.9%	6.5%	1.6%	2.8%	0.052
No	99.4%	98.0%	95.8%	97.8%	99.4%	95.4%	98.5%	96.6%	97.9%	98.1%	94.1%	93.5%	98.4%	97.2%	
Consumed multivitamin tablets in past six months															
Yes	6.6%	4.8%	7.2%	4.4%	1.7%	13.1%	6.8%	2.0%	1.0%	5.9%	7.8%	10.8%	2.6%	5.0%	<0.001
No	93.4%	95.2%	92.8%	95.6%	98.3%	86.9%	93.2%	98.0%	99.0%	94.1%	92.2%	89.2%	97.4%	95.0%	
Has heard of fortified flour															
Yes	8.9%	26.7%	18.5%	32.6%	29.9%	36.6%	30.8%	22.0%	23.3%	13.8%	25.2%	54.3%	22.3%	11.7%	<0.001
No	90.5%	71.9%	73.8%	66.3%	57.6%	56.2%	66.2%	72.0%	76.7%	84.4%	72.9%	36.4%	77.7%	84.1%	
Don't know	0.6%	1.4%	7.7%	1.1%	12.4%	7.2%	3.0%	6.0%	0%	1.8%	1.9%	9.3%	0%	4.1%	
Uses fortified flour															
Always	4.8%	17.4%	12.9%	12.8%	21.3%	28.9%	15.5%	19.9%	10.9%	6.7%	11.2%	37.0%	11.9%	1.4%	<0.001
Usually	0.6%	2.1%	4.5%	0.6%	1.9%	3.5%	1.6%	1.4%	1.6%	00	1.3%	3.1%	1.6%	1.4%	
Sometimes	2.4%	1.4%	0.6%	10.6%	2.6%	5.6%	3.1%	1.4%	3.1%	0.6%	2.0%	10.2%	4.7%	2.2%	
Never heard of or never use	92.2%	78.5%	80.0%	68.7%	67.1%	61.3%	77.5%	76.6%	83.4%	91.5%	82.2%	44.9%	79.8%	93.5%	
Don't know	0%	0.7%	1.9%	7.3%	7.1%	0.7%	2.3%	0.7%	1.0%	1.2%	3.3%	4.7%	2.1%	1.4%	
Has heard of iodized salt															
Yes	99.4%	96.6%	98.2%	92.3%	79.7%	91.5%	99.3%	94.0%	97.9%	78.4%	92.3%	97.1%	95.9%	95.9%	<0.001
No	0%	3.4%	0.6%	7.7%	12.4%	6.5%	0.7%	5.4%	2.1%	21.0%	7.1%	2.9%	4.1%	3.4%	
Don't know	0.6%	0%	1.2%	0%	7.9%	2.0%	0%	0.7%	0%	0.6%	0.6%	0%	0%	0.7%	
Uses iodized salt															
Always	96.4%	96.6%	89.2%	91.2%	58.9%	90.7%	98.5%	94.6%	95.3%	77.1%	91.6%	96.4%	95.9%	88.2%	<0.001
Usually	2.4%	0%	10.2%	0%	3.7%	2.7%	0%	0%	0.5%	1.2%	0.6%	0.7%	0%	5.6%	
Sometimes	1.2%	0%	0%	1.1%	4.9%	0%	0%	0%	1.6%	0%	0%	0%	0%	0.7%	
Never heard of or never use	0%	3.4%	0.6%	7.7%	14.7%	6.7%	0.8%	5.4%	2.1%	21.1%	7.1%	2.9%	4.1%	3.5%	
Don't know	0%	0%	0%	0%	17.8%	0%	0.7%	0%	0.5%	0.6%	0.6%	0%	0%	2.1%	

[a] MDD-W = Minimum dietary diversity for women as recommended in FAO and FHI 360. Minimum Dietary Diversity for Women: A Guide for Measurement. Rome: FAO. 2016.

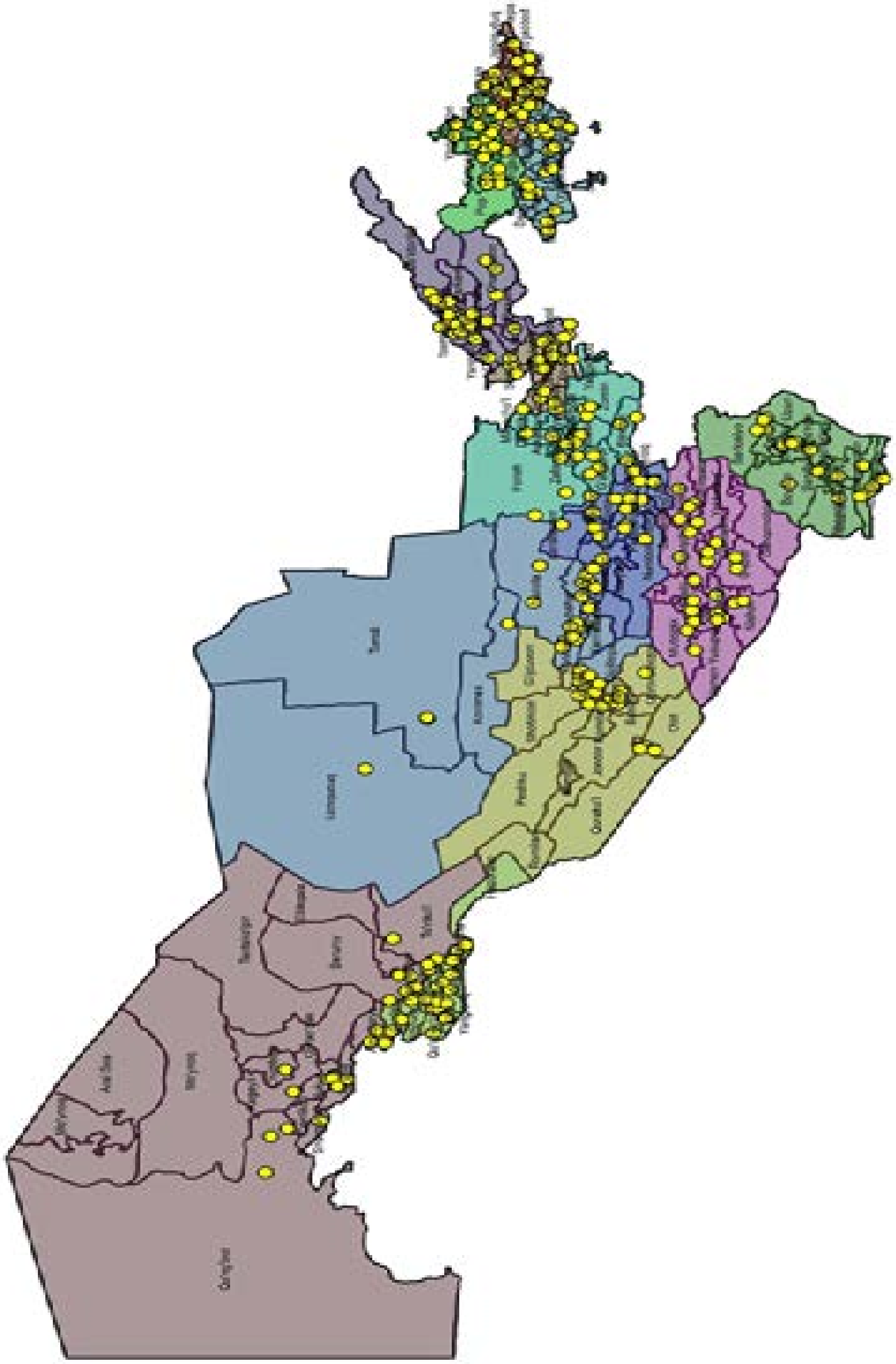
Table A3- 4. **Dietary and knowledge characteristics and indicators in non-pregnant women 15-49 years of age, by age group, education and marital status, Uzbekistan 2017**

Characteristic	Women's age groups								Women's education			Woman is currently married		
	15-19 y	20-24 y	25-29 y	30-34 y	35-39 y	40-44	45-49 y	P value	Secondary or less	Secondary or above	P value	Yes	No	P value
Number of MDD-W food groups consumed (mean)	4.05	4.15	4.13	4.35	4.32	4.27	4.33		4.07	4.33		4.28	4.06	
Meets minimum dietary diversity (MDD-W, 5+ food groups)														
Yes	35.9%	39.2%	38.6%	44.4%	42.9%	37.6%	44.4%	0.291	35.8%	43.8%	0.000	41.2%	38.2%	0.206
No	64.1%	60.8%	61.4%	55.6%	57.1%	62.4%	55.6%		64.2%	56.2%		58.8%	61.8%	
Consumed iron tablets or syrup in past six months														
Yes	4.3%	12.0%	14.6%	9.1%	9.8%	5.2%	9.8%	0.000	8.2%	10.9%	0.075	10.7%	7.3%	0.028
No	95.7%	88.0%	85.4%	90.9%	90.2%	94.8%	90.2%		91.8%	89.1%		89.3%	92.7%	
Consumed folic acid tablets or syrup in past six months														
Yes	0.8%	3.9%	7.6%	2.3%	1.5%	0.6%	1.4%	0.000	2.3%	3.5%	0.209	3.8%	1.0%	0.001
No	99.2%	96.1%	92.4%	97.7%	98.5%	99.4%	98.6%		97.7%	96.5%		96.2%	99.0%	
Consumed multivitamin tablets in past six months														
Yes	3.5%	8.7%	8.1%	4.5%	6.0%	0.4%	4.0%	0.000	3.0%	7.4%	0.000	5.9%	4.5%	0.212
No	96.5%	91.3%	91.9%	95.5%	94.0%	99.6%	96.0%		97.0%	92.6%		94.1%	95.5%	
Has heard of fortified flour														
Yes	16.0%	22.3%	22.6%	28.0%	36.6%	35.5%	31.8%	0.000	23.1%	28.6%	0.013	28.3%	20.5%	0.003
No	81.1%	70.8%	72.0%	66.6%	58.8%	60.8%	66.7%		72.9%	66.2%		67.2%	74.2%	
Uses fortified flour														
Always	14.1%	12.6%	12.6%	18.6%	19.8%	21.0%	17.0%	0.003	13.6%	17.5%	0.076	16.5%	13.9%	0.007
Usually	0.6%	2.7%	2.2%	1.4%	2.8%	1.8%	2.2%		1.8%	2.1%		2.3%	1.1%	
Sometimes	0.8%	2.8%	4.3%	3.3%	4.4%	5.5%	6.3%		3.5%	4.0%		4.0%	3.1%	
Never heard of or never use	84.0%	78.7%	79.4%	74.3%	68.9%	69.4%	70.8%		79.2%	73.6%		74.2%	81.1%	
Don't know	0.5%	3.2%	1.5%	2.5%	4.1%	2.4%	3.7%		2.0%	2.8%		3.0%	0.8%	
Has heard of iodized salt														
Yes	89.7%	91.5%	93.8%	95.0%	96.6%	91.6%	93.2%	0.010	93.3%	94.2%	0.173	94.9%	90.6%	0.001
No	9.5%	6.3%	5.3%	3.2%	3.4%	1.3%	1.4%		5.8%	4.4%		4.2%	7.3%	
Don't know	0.8%	2.2%	0.9%	1.8%		0.5%	0.1%		0.9%	1.4%		0.9%	2.1%	
Uses iodized salt														
Always	86.5%	88.0%	89.3%	91.3%	90.1%	92.6%	91.6%	0.191	89.1%	90.1%	0.377	90.7%	86.8%	0.018
Usually	2.2%	2.0%	2.1%	2.1%	90.1%	1.7%	2.3%		1.7%	2.4%		1.8%	3.0%	
Sometimes		**0.8%**	**1.2%**	**0.6%**	**2.5%**	**0.9%**	**1.2%**		**0.9%**	**1.0%**		**1.1%**	**0.6%**	
Never heard of or never use	10.0%	6.4%	5.6%	3.3%	2.1%	2.9%	3.4%		6.2%	4.5%		4.4%	7.7%	
Don't know	1.3%	2.8%	1.8%	2.8%	3.4%	1.7%	1.4%		2.1%	2.0%		2.1%	1.9%	

Table A3 - 5. **Dietary and knowledge characteristics and indicators in non-pregnant women 15-49 years of age, by wealth quintile, Uzbekistan 2017**

Characteristic	Poorest	Second	Middle	Fourth	Wealthiest	P value
Number of MDD-Wa food groups consumed (mean)	3.75	4.18	4.26	4.37	4.57	
Meets minimum dietary diversity (MDD-W, 5+ food groups)						
Yes	30.7%	39.6%	41.0%	40.3%	50.7%	0.000
No	69.3%	60.4%	59.0%	59.7%	49.3%	
Consumed iron tablets or syrup in past six months						
Yes	6.4%	6.9%	9.1%	3.5%	2.8%	0.001
No	93.6%	93.1%	90.9%	86.5%	87.2%	
Consumed folic acid tablets or syrup in past six months						
Yes	2.0%	2.1%	1.6%	4.6%	4.6%	0.022
No	98.0%	97.9%	98.4%	95.4%	95.4%	
Consumed multivitamin tablets in past six months						
Yes	3.3%	4.3%	4.5%	6.3%	9.0%	0.003
No	96.7%	95.7%	95.5%	93.7%	91.0%	
Has heard of fortified flour						
Yes	25.0%	25.6%	26.6%	26.4%	28.2%	0.982
No	70.1%	68.8%	68.6%	69.7%	67.3%	
Don't know	4.9%	5.5%	4.8%	4.0%	4.5%	
Uses fortified flour						
Always	15.6%	16.9%	16.5%	15.1%	15.6%	0.856
Usually	2.0%	1.9%	1.5%	1.2%	2.8%	
Sometimes	4.0%	2.0%	4.6%	4.5%	3.6%	
Never heard of or never use	75.5%	77.5%	75.0%	75.8%	75.7%	
Don't know	2.8%	1.6%	2.4%	3.3%	2.3%	
Has heard of iodized salt						
Yes	90.5%	91.9%	97.0%	93.0%	96.5%	0.002
No	7.0%	6.0%	2.8%	6.3%	3.0%	
Don't know	2.5%	2.0%	0.3%	0.7%	0.5%	
Uses iodized salt						
Always	84.2%	89.4%	93.1%	90.0%	91.7%	0.004
Usually	2.4%	89.4%	1.6%	0.8%	3.9%	
Sometimes	2.0%	1.9%	1.0%	0.3%	0.6%	
Never heard of or never use	7.7%	0.7%	3.1%	6.4%	3.0%	
Don't know	3.7%	6.2%	1.3%	2.6%	0.8%	

APPENDIX 4. MAP OF SELECTED ENUMERATION AREAS



Map with clusters as yellow dots courtesy of DGP Research and Consulting, Tashkent, Uzbekistan

APPENDIX 5. A PRIORI SAMPLE SIZE CALCULATIONS

Table A5-1. **Sample sizes of households to obtain sufficient numbers of various target groups, by target group and major nutritional outcomes (assuming a 94% household response rate)**

Target group	Indicator	Estimated Prevalence (%)*	Desired precision (± percentage points)	Design effect*	Individual response rate (%)	Household to select in 1 stratum**	Household to select in 14 strata**	Precision In 1 stratum (± %)	National precision (± %)
Household	Adeq. iodized salt	70	10	2.0	-	172	2’408	7.7	2.1
	Adeq. fortified flour	50	10	2.0	-	256	3’584	9.4	2.5
Children < 5 years of age	Anaemia	50	10	1.5	80	295	4’130	10.1	2.7
	Iron deficiency	50	10	1.5	80	295	4’130	10.1	2.7
	Vit A deficiency	50	10	1.5	80	295	4’130	10.1	2.7
	Wasting	10	5	1.5	85	399	5’586	5.9	1.6
	Stunting	20	5	1.5	85	707	9’898	7.8	2.1
Non-pregnant women 15-49 Years of age***	Anaemia	50	10	1.5	85	133	1’862	5.6	1.5
	Iron deficiency	50	10	1.5	85	133	1’862	8.5	2.3
	Vit A deficiency	25	7	1.5	85	203	2’842	9.6	2.6
	Folate deficiency	50	10	1.5	85	141	1’974	8.3	2.2
	Vit B12 deficiency	50	10	1.5	85	141	1’974	9.9	2.6
	Urinary iodine	25	7	2.0	80	287	4’018	9.6	2.6
	Underweight	10	5	1.5	90	180	2’520	9.9	2.6
	Overweight/obese	30	7	1.5	90	215	3’010	9.9	2.6
Pregnant women	Anaemia	50	10	1.5	85	2’577	36’078	29.1	7.8
	Underweight	10	5	1.5	90	3’501	49’014	17.5	4.7

*Estimated prevalence and design effect are from most recently available data or, if data not available, 50% prevalence was assumed to maximize sample size
**The required number of children and women was converted to the number of households to select assuming that the average household size in Uzbekistan is 5.4 persons and 12.1%, 25.3% and 1.3% of the population are children less than 5 years of age, women 15-49 years of age and pregnant women, respectively
***Non-pregnant women included from every second selected household only

Table A5-2. **Given a sample size of 4'000 households, prevalence at follow-up survey which will demonstrate a statistically significant difference between baseline and follow-up (using baseline assumptions from table A5-1 above)**

Target group	Indicator	Baseline	Follow-up prevalence (%) with statistically significant difference	
		Estimated prevalence (%)	All 14 strata together	1 stratum
Household	Adeq. Iodized salt	70	75	82
	Adeq. Fortified flour	50	55	65
Children < 5 years of age	Anaemia	50	45	33
	Iron deficiency	50	45	33
	Vit. A deficiency	50	45	33
	Wasting	10	7.6	2.3
	Stunting	20	16	8.8
Non-pregnant women 15-49 years of age	Anaemia	50	45	34
	Iron deficiency	50	45	34
	Vit. A deficiency	25	21	12
	Folate deficiency	50	45	34
	Vit. B12 deficiency	50	45	34
	Urinary iodine	25	20	10
	Underweight	10	7.7	2.6
	Overweight/obese	30	26	17
Pregnant women	Anaemia	50	37	-
	Underweight	10	3.6	-

APPENDIX 6. ETHICAL APPROVAL

O'ZBEKISTON RESPUBLIKASI
SOG'LIQNI SAQLASH VAZIRLIGI
ETIKA QO'MITASI

MINISTRY OF HEALTH
OF REPUBLIC OF UZBEKISTAN
ETHICAL COMMITTEE

100015, Toshkent shahar, Oybek ko'chasi, 45-uy Tel.: (99871) 256-37-38 256-14-89 Faks.: 256-45-04

№ 2/12

«17» 03 2017 yil

ВЫПИСКА
из протокола №2 заседания этического комитета МЗ РУз
от 9 марта 2017 года

Повестка дня:

Рассмотрение документов, представленных Министерством здравоохранения РУз, с просьбой одобрить проект на проведение "Национального исследования в области питания в Узбекистане, 2017" в рамках реализации Программы сотрудничества между Правительством РУз и ЮНИСЕФ на 2016-2020 годы. Общей целью исследования является получение обновленной, достоверной информации по текущему статусу питания детей и женщин в Узбекистане для разработки научно-обоснованных мер и механизмов, направленных на улучшение статуса питания и состояния микронутриентной недостаточности женщин репродуктивного возраста и детей (определение таких показателей как продолжительность исключительно грудного вскармливания, время введения прикорма и т.д.). Рекомендовано дополнительно рецензировать проект, протокол исследования и получено заключение Главного специалиста МЗ РУз по гигиене питания, д.м.н., проф. А.С.Худайберганова.

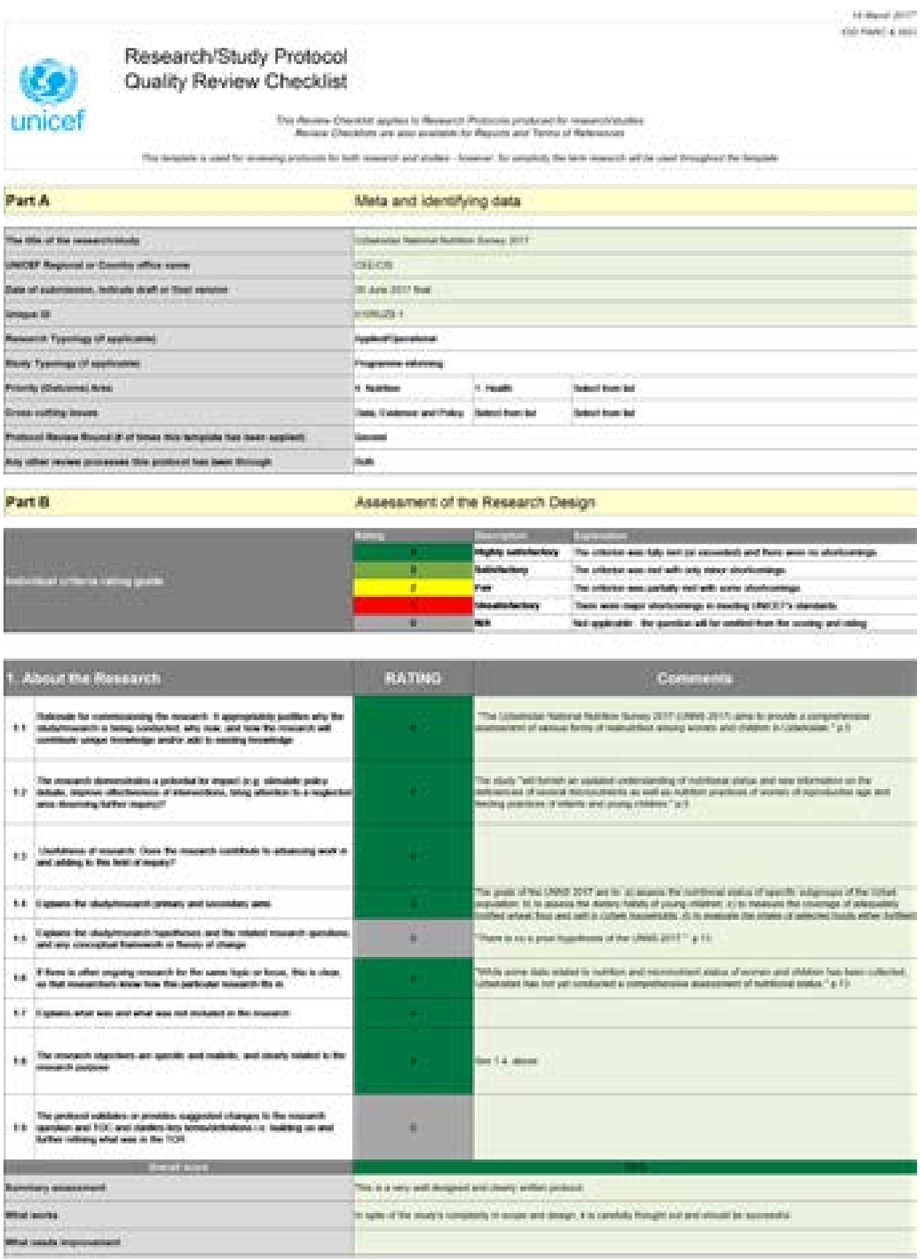
Решили: Рассмотрев документы, представленные Министерством здравоохранения РУз, заслушав представителя и заключение рецензента, одобрить проведение "Исследования по улучшению питания населения и профилактики микронутриентной недостаточности" в рамках реализации Программы сотрудничества между Правительством РУз и ЮНИСЕФ на 2016-2020 годы с учетом рекомендации Главного специалиста МЗ РУз по гигиене питания А.С.Худайберганова. Данный проект нацелено на представление комплексной оценки различных форм нарушения питания среди женщин и детей Узбекистана.

Зам председателя Этического
комитета МЗ РУз, профессор И.Р.Мавлянов

ETIKA QO'MITASI

Исполнитель:
ученый секретарь
М.И.Алиходжаева
Тел: (90) 902-11-47

External IRB appraisal, requested by UNICEF New York; appraisal shared by D. Michael Anderson, Ph.D., MPH, Chair & Human Research Protections Director, HML Institutional Review Board, Washington DC, USA:



2. How the research will be conducted		RATING	Comments
2.1	Results of the literature review: Includes a literature review which summarises extant theory and practice on the particular topic. The literature review is an indication that existing knowledge has been considered, that relevant questions have been identified, and that the study/research therefore has the potential to contribute new knowledge	[illegible]	
2.2	The literature review links to a reference list or an annex	[illegible]	There is a References section, but no literature review per se
2.3	The literature review includes an assessment of the robustness of the evidence considered (using appropriate standards, e.g. Cochrane standards for health research)	[illegible]	
2.4	The expected research review process and how it will be established	[illegible]	
2.5	Participants and end users: Captures the involvement of end users and other stakeholders in the research process	[illegible]	A dissemination plan is provided, although involvement of end users is not
2.6	Management: The management of the study is described and was suitable for delivering the research. The description includes: roles and responsibilities of researchers, field staff, donors and other collaborators; recording and reporting of suspected adverse events; data handling and record keeping; quality control	[illegible]	
2.7	Resourcing: The research team's qualifications and experience are appropriate as per the TOR's requirements and the research methods proposed	[illegible]	
2.8	Any significant resource requirements or resource issues are highlighted	[illegible]	
2.9	A detailed budget is provided, and is adequate to deliver the research overall, and appropriately allocated across the stages and activities proposed	[illegible]	
Overall score		[illegible]	
Summary assessment		Again, a very clear explanation of design	
What works		A good team and a solid design	
What needs improvement			

3. Methodology		RATING	Comments
3.1	The approach, methods and research framework are comprehensively described, and justified, and they are adequate to answer the research questions	[illegible]	
3.2	The limitations of the methodology are highlighted, along with mitigation strategies where appropriate	[illegible]	Limitations are not discussed
3.3	The proposed research methodology, including (where appropriate) the research design, sample population and size, definitions of key variables and concepts, data source or data collection methods, data analysis methods, and any other relevant methodological issues, as appropriate to the particular study design	[illegible]	
3.4	The sampling strategy is described, and is appropriate. Primary and secondary data sources are appropriate, adequate and reliable	[illegible]	
3.5	The sampling strategy describes how many units of measurement will be selected and how representative is the sample. Sample sizes are adequate	[illegible]	
3.6	Inclusion and exclusion criteria precisely describe the parameters of the variables chosen to be included and excluded (if applicable)	[illegible]	
3.7	Participation Criteria: Describes the exact characteristics of the study participants that were included in the sample (if applicable)	[illegible]	
3.8	The methodology enables the collection and analysis of disaggregated data to show difference between groups (where appropriate)	[illegible]	
3.9	Describes how study subjects (individuals, institutions, geographical areas, etc.) will be recruited/selected, for how long and how often they will be followed (at baseline, mid line, end line)	[illegible]	
3.10	If the study included an intervention (as in operational research studies where interventions were being tested and their effects studied), it should provide programmatic details on the interventions to be tested	[illegible]	
3.11	Methodology clearly defines the outcomes specified in the TORs. For instance, clearly describe how 'child growth' or 'cost effectiveness' will be defined	[illegible]	Unknown
3.12	If a quantitative analysis is used, explains the statistical models and power calculations, justifies the sample size and explains the analysis plan, including include dummy tables for the planned statistical analysis. If a qualitative analysis is used, explains how the data will be coded and analysed. Software to be used is noted. Analysis is appropriately linked to the theoretical framework and to the methodology used	[illegible]	Provided
3.13	If appropriate, the protocol provides a sequence of events (e.g. in a Gantt chart) that includes the entire duration of the study (i.e. including preparation, study conduct, and data analysis)	[illegible]	Provided
3.14	The protocol discusses any inherent imbalances or biases that interviews and other data collection may have created. The protocol describes how any bias was overcome, and the strategies were appropriate	[illegible]	The protocol is not very forthcoming about limitations
3.15	Explains key limitations of the study/research. Often this relates to its generalisability to other populations, units or contexts, budget, timeline, access to certain populations (e.g. in humanitarian settings), poor quality of data, sensitive topics and sometimes the inability to study these directly and using proxies	[illegible]	Same
Overall score		[illegible]	
Summary assessment		Sound methodology given the complexity of the design	
What works		Methodology and design are clear	
What needs improvement		Limitations are not well described	

4. Ethics		RATING	Comments
4.1	[illegible]	[illegible]	[illegible]
4.2	[illegible]	[illegible]	[illegible]
4.3	[illegible]	[illegible]	[illegible]
4.4	[illegible]	[illegible]	
4.5	[illegible]	[illegible]	
4.6	[illegible]	[illegible]	
Overall score		[illegible]	
Summary assessment		[illegible]	
What works		[illegible]	
What needs improvement			

5. Structure and clarity of the protocol		RATING	Comments
5.1	[illegible]	[illegible]	
5.2	[illegible]	[illegible]	
5.3	[illegible]	[illegible]	
5.4	[illegible]	[illegible]	
5.5	[illegible]	[illegible]	
5.6	[illegible]	[illegible]	
5.7	[illegible]	[illegible]	
5.8	[illegible]	[illegible]	[illegible]
5.9	[illegible]	[illegible]	
5.10	[illegible]	[illegible]	
5.11	[illegible]	[illegible]	[illegible]
Overall score		[illegible]	
Summary assessment		[illegible]	
What works			
What needs improvement			

Overall rating guide	
Highly satisfactory: 80% - 100%	[illegible]
Satisfactory: 60% - 79%	[illegible]
Fair: 40% - 59%	[illegible]
Unsatisfactory: [illegible]	[illegible]

Category	Score	Weighting	Weighted score
1. About the Research	[illegible]	[illegible]	[illegible]
2. How the research will be conducted	[illegible]	[illegible]	[illegible]
3. Methodology	[illegible]	[illegible]	[illegible]
4. Ethics	[illegible]	[illegible]	[illegible]
5. Structure and clarity of the protocol	[illegible]	[illegible]	[illegible]
TOTAL WEIGHTED SCORE	[illegible]	[illegible]	[illegible]
OVERALL RATING	[illegible]		
Summary assessment	[illegible]		
What works			
What needs improvement			
Final Review Outcome	[illegible]		

APPENDIX 7. INFORMATION SHEET AND CONSENT FORM

INFORMATION SHEET (FOR THE PARTICIPANT TO KEEP)	
Title of Study:	Uzbekistan National Micronutrient Survey
Principal Investigators:	Dr. Fakhriddin Nizamov
Certified Protocol Number	Letter 2/12, dated 17/03/2017

General Information

The Uzbekistan Nutrition Survey 2017 is conducted to understand the severity of various nutritional deficiencies, such as anaemia, iron deficiency, vitamin A deficiency, and under- and overweight in women and children. The survey is done by UNICEF, GroundWork in Switzerland. The survey is supported by Uzbekistan Ministry of Health.

We will ask questions about your household, and if there are selected women or children living in the household, we will ask individual questions to better understand their person and their food habits.

We would very much appreciate your participation in this survey. This information will help the Government to plan health services. The questionnaire for you usually takes about 30 minutes to complete. Whatever information you provide will be kept strictly confidential and will not be shown to other persons.

Following the completion of the questionnaire, we will measure height and weight and request to draw a small amount of blood from all women 15 to 49 years of age and children 6 to 59 months of age in a dedicated place near your household. This small blood sample will be used to test if you have anaemia or malaria, and these results will be provided to you directly. In addition, a small portion of blood will be collected to test for micronutrient deficiencies, such as iron, folate and vitamin A status. We will also test parts of your sample for haemoglobinopathies, or blood disorders.

Benefits/Risk of the study

For women and children, 5 mL of blood will be collected from the arm vein using a needle. Blood will be collected by trained technicians. The blood draw should take less than 5 minutes, and the anaemia results will be provided in less than 5 minutes following the taking of blood, and should you be diagnosed with severe anaemia, we will provide you with a referral to a nearby health facility for further testing and treatment. This survey poses no serious risks to you or other participating family members.

Other than the information about your haemoglobin levels and referral in case of diagnosis of severe anaemia, we cannot promise that the survey will help you directly. But the information we get will help the Government to evaluate its nutrition and health services and if needed, adapt them.

Confidentiality

All information which is collected about you and your household during the course of the interview will be kept strictly confidential, and any information about you and the household address will not be included in the final report so that you cannot be recognized.

Only the personnel doing the interview and the principal researchers will have access to identifiable information and by providing your signature/thumbprint, you allow the research team in doing so.

Compensation

Your participation in this interview is important and we do appreciate the time made available. As mentioned earlier, should you/your child be diagnosed with severe anaemia or malaria, I will let you know and fill in a referral form for you to seek treatment.

Withdrawal from Study

Participation in this survey is voluntary, and if we should come to any question you do not want to answer, just let me know and I will go on to the next question; or you can stop the interview at any time, without any consequences to you or your household. However, we hope that you will participate in this survey since your views are important. There will not be any negative effects on you, if you decide that you no longer want to continue with the interview.

If you are younger than 18 years, your legal parent will have to give signed consent for your participation. This information sheet will be for you/your caretaker to keep. If you have any question, do not hesitate to contact the principal researchers.

Contact for additional Information

If you have any questions about the study, you are welcome to call Dr. Fakhriddin Nizamov, from UNICEF Uzbekistan, who is in charge of this study, on (998-71) 2339512 and he will be happy to answer your questions.

UNS-WRITTEN INFORMED CONSENT FORM

Complete this form for only one person only; do NOT put information from 2 or more people on the same form!!

VOLUNTEER AGREEMENT

Child's participation

"I have read or have had someone read all information on the information sheet, have asked questions, received answers regarding participation in this study, and am willing to give consent for my child/ward to participate in this study. I have not waived any of my rights by signing this consent form. Prior to signing this consent form, I was given a copy of the information sheet for my personal records."

____

Name of mother or legal caregiver (if respondent is a minor)

____ __________________

Signature or mark of mother or legal caregiver Date

Adult woman's own participation

"I have read or have had someone read all information on the information sheet, have asked questions, received answers regarding participation in this study, and am willing to give consent to participate in this study. I have not waived any of my rights by signing this consent form. Prior to signing this consent form, I was given a copy of the information sheet for my personal records."

____

Name of participant

____ __________________

Signature or mark participant Date

CLUSTER ID: ☐ ☐ ☐ RESPONDENT Label: **A** ☐ ☐ ☐ ☐

U ☐ ☐ ☐ ☐ **B** ☐ ☐ ☐ ☐

HH Label: RESPONDENT Label:

If volunteers cannot read the form themselves, a witness must sign here:

I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

____

Name of witness

____ _________________________

Signature of witness Date

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

____

Name of Interviewer who obtained Consent Interviewer ID ☐☐

____________________________________ _________________________

Signature of Interviewer who obtained Consent Date

APPENDIX 8. AUTHORIZATION LETTER FROM MINISTRY OF HEALTH

O'ZBEKISTON RESPUBLIKASI SOG'LIQNI SAQLASH VAZIRINING

B U Y R U G' I

20 17 yil 29 - 09 № 543

Toshkent sh

Ўзбекистонда Овқатланиш бўйича Миллий тадқиқотларни ўтказиш тўғрисида

Ўзбекистон Республикаси Президентининг 2016 йил 2 ноябрдаги ПҚ-2650-сонли "2016-2020 йилларда Ўзбекистонда оналик ва болаликни муҳофаза қилиш тизимини шакллантиришни янада ривожлантириш чора-тадбирлари тўғрисида"ги Қарорини амалга ошириш, республика аҳолиси ўртасида овқатланишни яхшилаш, микронутриент етишмовчилиги профилактикаси ва овқатланиш ҳолатини комплекс баҳолаш бўйича миллий тадқиқот ўтказиш мақсадида **буюраман:**

1. Қуйидагилар:

Овқатланиш бўйича Миллий тадқиқот ўтказиш чора-тадбирлари режаси 1-иловага мувофиқ;

тадқиқот ўтказилишининг мониторинги бўйича Ўзбекистон Республикаси Соғлиқни сақлаш вазирлиги ишчи гуруҳининг таркиби 2-иловага мувофиқ;

тадқиқот ўтказилишини мувофиқлаштириш учун масъул мутахассислар рўйхати 3-иловага мувофиқ;

тадқиқотларни ўтказишда иштирок этувчи мутахассисларнинг рўйхати 4-иловага мувофиқ;

тадқиқот ўтказилиши учун ишлатиладиган материаллар ва ускуналарнинг рўйхати ва уларнинг ҳудудлар бўйича тақсимланиши 5-иловага мувофиқ тасдиқлансин.

2. Оналик ва болаликни муҳофаза қилиш бош бошқармаси (М.Ф.Садикова)га:

ўтказилаётган тадқиқот мониторингини БМТнинг Болалар (ЮНИСЕФ) ва Аҳолишунослик (ЮНФПА) Жамғармалари билан ҳамкорликда амалга ошириш, шунингдек тадқиқотни амалга оширишда ҳудудий соғлиқни сақлаш ташкилотлари ва тиббиёт муассасаларига услубий ва амалий ёрдам кўрсатиш;

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APPENDIX 9. TEAMS, TEAM MEMBERS, AND SUPERVISORS

Region	Supervisors	Team #	Team leader	Interviewers	Anthropometrist	Phlebotomist
Karakalpakstan	G. Abdisametova	5	A.Djumaniyazov	U. Espolova O. Utebaeva	G. Allaniyazova	A. Allamuratova
Andijon	A. Igamberdiev	1	Z. Khakimjanov	S. Alimova N. Tokhtasinova	G. Teshabaeva	Kh. Ismailova
Bukhara	F. Gaffarova	2	S. Beshimov	R. Rasulova D. Abdukadirova	F. Akromova	G. Bozorova
Jizzakh	G. Khaydarova	4	M. Sultanov	Z. Abdullaeva U. Tursunova	M. Nazarova	T. Kurbanova
Kashqadarya	R. Eshmurzaev	6	S. Makhmudov	Sh. Norboeva Sh. Nurboeva	Kh. Khaitov	Sh. Kurbonov
Namangan	L. Akhmedova	8	Kh. Abdullaev	O. Redjapova I.Muzafarova	A.Nabiev	Kh. Baltoboeva
Navoiy	O. Azamova	9	E. Nuriddinov	Sh. Ruzieva G. Shamsutdinova	M. Nematova	F. Tosheva
Samarkand	G. Khodjimetova	10	A.Muradov	N. Kobilova B. Kamolov	M. Khudoynazarova	F. Rajapova
Surkhandarya	Kh. Radjabov	11	U. Karaev	S. Chorieva M. Khamzaeva	G. Abdualimov	O. Boltaeva
Sirdarya	O. Esanova	12	A.Mirakhmedov	T. Pulatova L. Kholmirzaeva	O. Alimov	A. Fotikova
Tashkent oblast	S. Ismatullarva	14	Sh. Kalilov	D. Razzokova Sh. Khamzaeva	B. Aydarkulova	S. Isabaeva
Ferghana	Sh. Kuchkarov	13	Z. Ganieva	Sh. Anvarov R. Nurmatova	G. Usupova	M. Sottieva
Khorazm	K. Jumaniezov	7	U. Sapaeva	F. Allaberganova Sh. Khusinova	S. Kutlumuratova	S. Saidmurotova
Tashkent city	R. Khaitbaeva	13	B. Takhirov	N. Yakubova	N. Zakirova	N. Kholtoeva

APPENDIX 10. SURVEY QUESTIONNAIRES

UNS HOUSEHOLD QUESTIONNAIRE

Uzbek

http://groundworkhealth.org/wp-content/uploads/2019/09/UZ_1_UNS_Household_QUESTIONNAIRE_171005.pdf

Russian

http://groundworkhealth.org/wp-content/uploads/2019/09/RU_1_UNS_Household_QUESTIONNAIRE_171005.pdf

English

http://groundworkhealth.org/wp-content/uploads/2019/09/ENG_1_UNS_Household_QUESTIONNAIRE_171003.pdf

UNS WOMEN QUESTIONNAIRE

Uzbek

http://groundworkhealth.org/wp-content/uploads/2019/09/UZ_2_UNS_Women_QUESTIONNAIRE_171005.pdf

Russian

http://groundworkhealth.org/wp-content/uploads/2019/09/RU_2_UNS_Women_QUESTIONNAIRE_171005.pdf

English

http://groundworkhealth.org/wp-content/uploads/2019/09/ENG_2_UNS_Woman-QUESTIONNAIRE_171003.pdf

UNS CHILDREN QUESTIONNAIRE

Uzbek

http://groundworkhealth.org/wp-content/uploads/2019/09/UZ_3_UNS_Child_QUESTIONNAIRE_171005.pdf

Russian

http://groundworkhealth.org/wp-content/uploads/2019/09/RU_3_UNS_Child_QUESTIONNAIRE_171005.pdf

English

http://groundworkhealth.org/wp-content/uploads/2019/09/ENG_3_UNS_Child_QUESTIONNAIRE_171003.pdf

UNS WOMEN BIOLOGICAL FORM

Uzbek

http://groundworkhealth.org/wp-content/uploads/2019/09/UZ_4_UNS_Women_BIOLOGICAL_FORM_170620.pdf

Russian

http://groundworkhealth.org/wp-content/uploads/2019/09/RU_4_UNS_Women_BIOLOGICAL_FORM_170620.pdf

English

http://groundworkhealth.org/wp-content/uploads/2019/09/ENG_4_UNS_Women_BIOLOGICAL_FORM_170912.pdf

UNNS CHILDREN BIOLOGICAL FORM

Uzbek

http://groundworkhealth.org/wp-content/uploads/2019/09/UZ_5_UNS_Child-BIOLOGICAL_FORM_170621.pdf

Russian

http://groundworkhealth.org/wp-content/uploads/2019/09/RU_5_UNS_Child-BIOLOGICAL_FORM_170621.pdf

English

http://groundworkhealth.org/wp-content/uploads/2019/09/ENG_5_UNS_Child-BIOLOGICAL_FORM_170912.pdf

APPENDIX 11. REFERRAL FORM

Ўзбекистон Республикаси
Соғлиқни сақлаш вазирлиги

unicef

UNS-WRITTEN INFORMED CONSENT FORM

The Ministry of Health Uzbekistan and UNICEF are conducting a national nutrition survey to better understand the various nutritional conditions, such as such as overweight and obesity, anaemia, vitamin and mineral deficiencies in women and children. As part of this, the haemoglobin concentration is measured of women 15-49 years old, pregnant women, and children 6-59 months. Also, for children 0-59 months, malnutrition is assessed.

Any individual found the severely anaemic (<7.0 гр/dL for pregnant women and children; <8.0 гр/dL for non-pregnant women) or any child suffering from severe acute malnutrition (<-3 weight-for-age Z-scores) are hereby referred to a health facility.

This referral is to inform the health post about the results and possible treatment from on-site diagnostics:

Person is: ☐ Pregnant woman ☐ Child ☐ non-pregnant woman	**Haemoglobin** = ________________ гр/dL
Person's name: ______________________	**CHILDREN ONLY:** **Weight-for-age Z-score** = ______________ Edema: ☐ NO ☐ YES
Date: ______________________	Name of referring nurse: ______________________
Age: ______________________	Phone number of referring nurse: ______________
Name of health post: ______________	Signature of referring nurse: ______________

APPENDIX 12. DESIGN EFFECTS OF MAJOR OUTCOMES

Variable	Number in analysis	Design effect
Households		
Improved water source	3863	3.94
Improved sanitation	3866	1.96
Salt adequately fortified	3413	1.96
Wheat flour adequately fortified	3366	1.40
Children		
Low birth weight	2183	1.26
Had diarrhea in past 2 weeks	2250	1.36
Had fever in past 2 weeks	2249	1.48
Had LRI in past 2 weeks	2230	1.21
Early initiation of breastfeeding	926	1.42
Exclusive breastfeeding	238	1.46
Minimum dietary diversity	639	1.33
Minimum meal frequency	650	1.10
Minimum acceptable diet	640	0.94
Took vitamin A supplement in past 6 months	1945	2.37
Anaemia	1675	1.12
Non-pregnant women		
Heard of iodized salt	2245	1.44
Heard of fortified wheat flour	2180	1.79
Took folic acid supplement in past 6 months	2248	1.59
Took iron supplement in past 6 months	2249	1.24
Anaemia	2207	1.45
Pregnant women		
Took folic acid supplement in past 6 months	343	1.36
Took iron supplement in past 6 months	241	1.23
Anaemia	244	1.13

APPENDIX 13. ANTHROPOMETRY PLAUSABILITY CHECKS

	Height-for-age z-score (HAZ)			Weight-for-height z-score (WHZ)		
Characteristic	Mean	Standard Deviation	% HAZ flags	Mean	Standard Deviation	% WHZ flags
Andijon	-0.4379	-0.4379	0.5%	0.5262	1.11058	0.5%
Bukhara	1.4130	1.4130	10.6%	-1.0309	1.94962	3.1%
Ferghana	-0.6416	-0.6416	0.7%	0.4263	0.86373	1.3%
Jizzakh	-0.4528	-0.4528	0%	0.3443	0.95810	0%
Karakalpakstan	-0.2345	-0.2345	0%	0.1441	1.05340	0%
Kashqadarya	-0.5291	-0.5291	0%	0.1330	1.01076	0%
Khorazm	-0.3725	-0.3725	0%	0.4065	0.95411	0%
Namangan	-0.7353	-0.7353	2.1%	0.5430	0.96603	0%
Navoiy	-0.5471	-0.5471	0.7%	0.2002	1.06480	0%
Samarkand	-0.1863	-0.1863	0%	0.1987	1.07446	0.6%
Surkhandarya	-0.8035	-0.8035	0.9%	0.4535	1.25107	1.9%
Sirdarya	-0.6615	-0.6615	2.4%	0.2747	1.24426	1.8%
Tashkent city	-0.0824	-0.0824	0.9%	0.2921	1.03328	0%
Tashkent oblast	-0.3155	-0.3155	0%	0.3209	0.94502	0.7%

APPENDIX 14. INVESTIGATORS AND INSTITUTIONAL AFFILIATIONS

Survey Coordinator	
Fakhriddin Nizamov	UNICEF – Health Officer
Co-Investigators	
Fabian Rohner	GroundWork
Nicolai Petry	GroundWork
Rita Wegmüller	GroundWork
Bradley Woodruff	GroundWork
James P Wirth	GroundWork
Sufang Guo	UNICEF – Chief of Child Health and Wellbeing section
Nargiza Fuzailova	UNICEF – Immunization Officer
Zokir Nazarov	UNICEF – M&E Specialist
Otabek Akhmedov	UNICEF – Programme Associate
Nargiza Mamasadikova	UNICEF – Programme Associate
Marat Sodikov	Ministry of Health - Head of the Main Department of Maternal and Child Health
Barno Abdusamatova	Ministry of Health - Deputy Head of the Main Department of Maternal and Child Health
Dilorom Alimova	Ministry of Health - Deputy head of General Directorate of Sanitary Epidemiological Service
Nodira Islamova	Ministry of Health - Head of Maternal health Department of the Main Department of Maternal and Child Health
Dilorom Akhmedova	Director of Republic Specialized Scientific Practical Medical Centre of Pediatrics
Anvar Alimov	Director of Republic Specialized Scientific Practical Medical Centre of Endocrinology
Abdumalik Aripov	Ministry of Health- Chief laboratorian specialist. Head of Clinical Laboratory Diagnostics Department of Tashkent Institute of Postgraduate Medical Education
Feruza Yuldasheva	Republic Specialized Scientific Practical Medical Centre of Endocrinology- Junior Researcher, Laboratory of Endocrine Surgery
Jasur Komilov	MED STANDART LLC- Scientific and Testing Center of Medicines and Medical Products- Laboratory specialist
Regina Ishmakova	VITAMED medical clinic – head of the laboratory
Dilorom Gafurova	Donmahsulotlari IIChM, Research and Production Center – Director
Diyora Arifdjanova	UNICEF - Consultant
Nasir Abdullaev	UNICEF - Consultant


HIPPO

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