SLMS Sierra Leone Micronutrient Survey, 2013

2013 SIERRA LEONE MICRONUTRIENT SURVEY (SLMS)

FINAL REPORT

Recommended Citation: Ministry of Health and Sanitation (Sierra Leone), UNICEF, Helen Keller International, and WHO. 2013 Sierra Leone Micronutrient Survey. Freetown, Sierra Leone; 2015.

Funding and coordinating agencies

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ACKNOWLEDGEMENTS

The Sierra Leone Micronutrient Survey 2013 (SLMS) was accomplished thanks to the effort and support of numerous individuals and agencies. The SLMS is a product of a truly participatory process of intensive consultations and teamwork involving a collaborative effort of members of the Nutrition Technical Committee and development partners who formed the Micronutrient Taskforce. All of them participated in the crucial stages leading to the successful implementation of the survey. We thank them for their guidance throughout the project and hope that together we can achieve the goal of improving the nutritional status of Sierra Leone's vulnerable groups.

We are grateful to the many individuals whose support and commitment made this survey a reality. First and foremost, we thank the parents and children who participated in the survey and the field workers (supervisors, interviewers, phlebotomists, laboratory technicians, and drivers) who conducted the fieldwork in spite of the many challenges encountered on the ground.

A special thank you goes to WHO and UNICEF for providing technical support to the country team. The Ministry of Health and Sanitation also appreciates the major financial support for the survey provided by Irish Aid through UNICEF and DFATD through WHO. Without their valuable contribution this survey would not have been successfully accomplished.

We want to extend our thanks to Helen Keller international for the fieldwork implementation, Sierra Leone Standards Bureau for analyzing household salt collected and the GroundWork LLC team for their tremendous technical support in the entire survey and in preparing this report.

Finally to the Directorate of Food and Nutrition, for their leadership and dedication in working efficaciously for the women and children of Sierra Leone towards the attainment of a malnutrition-free Country, I say thank you and keep up the good work.

We would like to dedicate this report to Dr. Dauda Koroma, SLMS Team leader who tragically died from Ebola in December 2014. The report is also dedicated to the many medics, nurses and community health workers who likewise have died or lost loved ones during this dreadful epidemic whilst serving their patients and their nation.

Dr. Brima Kargbo
Chief Medical Officer (GOOR)
Ministry of Health and Sanitation

ABBREVIATIONS

AGP	α-1-acid glycoprotein
CDC	U.S. Centers for Disease Control and Prevention
CI	Confidence Interval
CRP	C-reactive protein
DFATD	Department of Foreign Affairs, Trade and Development of Canada
DHS	Demographic and Health Survey
EA	Enumeration area
ELISA	Enzyme-linked immunosorbent assay
HKI	Helen Keller International
HPLC	High-performance liquid chromatography
ICCIDD	International Council for the Control of Iodine Deficiency Disorders
ID	Iron deficiency
IDA	Iron deficiency anemia
IDW	Inverse distance weighting
IYCF	Infant and young child feeding
MICS	Multiple Indicator Cluster Survey
PHRL	Public Health Reference Laboratory
ppm	parts per million
SLMS	Sierra Leone Micronutrient Survey
sTfR	Soluble transferrin receptor
RBP	Retinol Binding Protein
RUTF	Ready to use therapeutic food
SUN	Scaling up Nutrition
UNDP	United Nations Development Programme
WHO	World Health Organization

EXECUTIVE SUMMARY

Introduction

Sierra Leone is ranked 183 out of 187 countries on the United Nations Development Programme (UNDP) Human Development Index. Life expectancy at birth is 47.8 years and annual gross domestic product per capita is 340 US$. Sierra Leone's 2008 Demographic and Health Survey illustrated that anemia is a severe public health problem, affecting 75.9% of children 6-59 months of age and 45.2% adult women. Data on micronutrient deficiencies, iodized salt coverage, and the prevalence of iodine deficiency are limited. Prior to the Sierra Leone Micronutrient Survey (SLMS), there were no representative estimates of the prevalence or severity of vitamin A or iron deficiencies in pre-school children, and no representative estimates of the prevalence of iodine, vitamin A, iron, folate, or vitamin B_{12} deficiencies in women of reproductive age.

Nutritional deficiencies are suggested to be one of the leading causes of mortality and morbidity in Sierra Leone, therefore an up-to-date and thorough investigation of the micronutrient status of vulnerable groups is warranted. Information collected by the SLMS will enable the government and international agencies to monitor the current status of national nutrition programs (e.g. salt iodization and vitamin A supplementation) and to plan future nutrition interventions.

Objectives

The 2013 SLMS provides for the first time a comprehensive picture of anemia and micronutrient deficiencies in Sierra Leonean children 6-59 months of age, non-pregnant women, and pregnant women. Vitamin A and iron deficiencies were assessed in children and non-pregnant women, and folate and B12 deficiencies were assessed in non-pregnant women. Furthermore, the SLMS expands upon the information on iodine status collected as part of the 1992 and 2003 iodine deficiency surveys and assessed iodine deficiency in pregnant and non-pregnant women.

The SLMS also provide information on the prevalence of malaria among children 6-59 months of age, pregnant and non-pregnant women. Other variables that may potentially influence or cause various types of micronutrient deficiencies, such as socio-economic status, household food consumption patterns, individual food consumption patterns, infant feeding practices, and intake of micronutrient supplements were also assessed.

Methodology

The SLMS is a stratified cross-sectional national survey was designed to produce estimates of priority micronutrient indicators in children 6-59 months of age and non-pregnant women for two strata – urban and rural. Two-stage sampling was conducted; census enumeration areas (EA) in each stratum were randomly selected with probability

proportional to population size in the first stage of sampling and households were randomly selected during the second stage of sampling. The SLMS collected data about 1) households, 2) children 0-59 months of age, 3) non-pregnant women of child-bearing age (15-49 years of age), and 4) pregnant women. For households, the coverage of adequately (i.e. ≥15 ppm) iodized salt by quantitative measurement of salt iodine content was the primary indicator. In children 6-59 months, key indicators included the prevalence of anemia, iron deficiency, iron deficiency anemia, vitamin A deficiency, and malaria. In non-pregnant women, the primary indicators collected included the prevalence of anemia, iron deficiency, iron deficiency anemia, vitamin A deficiency, folate deficiency, vitamin B_{12} deficiency, iodine deficiency, and malaria. For pregnant women, only the prevalence of anemia, iodine deficiency, and malaria were assessed due small number of pregnant women selected and the difficulty to assess some micronutrient deficiencies during pregnancy. The SLMS was implemented six months following the previous Maternal and Child Health Week (June 2013) where vitamin A supplements were provided to children 6-59 months.

Results

In this executive summary, only national estimates are presented but table 1 refers readers to the corresponding table in the report containing more detailed results. At the household level, the coverage of adequately iodized salt is relatively high, but still below the coverage recommended (>90%) to result in a sustainable reduction of iodine deficiency disorders (Table 1). Nonetheless, sub-national analyses identified geographic areas with very low coverage of adequately iodized salt.

In children, the prevalence of anemia is considered a serious public health problem; more than 50% of children are affected with moderate and severe anemia. In addition, more than half of children had malaria at the time of the SLMS. Vitamin A deficiency affects nearly one-third of children, and because children had not recently received vitamin A supplements, this deficiency prevalence represents the underlying deficiency in children. Contrary to malaria and vitamin A deficiency, the prevalence of iron deficiency and iron deficiency anemia in children is relatively low. This suggests that iron is not a main contributor to anemia in Sierra Leone.

In women, anemia is also a serious public health problem, affecting about 70% of pregnant and 45% non-pregnant women. Malaria affects approximately one-third of pregnant and non-pregnant women. Iodine status is high in both pregnant and non-pregnant women. In non-pregnant women, the prevalence of iron deficiency, iron deficiency anemia, vitamin A deficiency, and B_{12} deficiency are relatively low. On the contrary, folate deficiency affects nearly 8 out of 10 non-pregnant women.

Table 1. Summary results of the Sierra Leone Micronutrient Survey, 2013

Target group	Indicator[a]	Result	Table[b]
Households			
	Salt iodine 0-14.9 ppm	19.3%	Table 13
	Salt iodine ≥ 15 ppm	80.7%	Table 13
Children 6-59 months			
	Anemia	76.3%	Table 23
	Mild anemia	25.2%	Table A8-10
	Moderate anemia	45.8%	Table A8-10
	Severe anemia	5.4%	Table A8-10
	Iron deficiency	5.2%	Table 23
	Iron deficiency anemia	3.8%	Table 23
	Vitamin A deficiency	17.4%	Table 26
	Malaria	52.6%	Table 20
	Exclusive breastfeeding (<6 months)	41.9%	Table 21
	Minimum acceptable diet (6-23 months)	13.0%	Table 21
	Minimum dietary diversity (6-23 months)	35.2%	Table 21
	Minimum meal frequency (6-23 months)	25.9%	Table 21
Non-pregnant women			
	Anemia	44.8%	Table 32
	Mild anemia	24.2%	Table A9-1
	Moderate anemia	19.5%	Table A9-1
	Severe anemia	1.1%	Table A9-1
	Iron deficiency	8.3%	Table 32
	Iron deficiency anemia	6.1%	Table 32
	Vitamin A deficiency	2.1%	Table 34
	Folate deficiency	79.2%	Table 35
	B_{12} deficiency	0.5%	Table 36
Non-lactating	Median UIC [c]	203.3 µg/L	Table 37
Lactating	Median UIC [c]	175.6 µg/L	Table 38
	Malaria	35.1%	Table 31
Pregnant women			
	Anemia	70.0%	Table 42
	Mild anemia	28.2%	Table A9-4
	Moderate anemia	39.6%	Table A9-4
	Severe anemia	2.3%	Table A9-4
	Median UIC [c]	175.8 µg/L	Table 44
	Malaria	28.6%	Table 41

[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, residence, wealth quintiles and other analyses.

[c] Median urinary iodine concentration (UIC); when median UIC values are above 100 µg/L (150 µg/L for pregnant women) population group is considered as having adequate iodine status.

Discussion

The SLMS found that the majority of salt in Sierra Leone is adequately iodized as per international standards (15-40 ppm), and the high median urinary iodine concentration in non-pregnant women demonstrates an absence of iodine deficiency. Sierra Leone's iodization standards are (15-50 ppm at the retail level) are similar to international standards, however median urinary iodine concentrations are above levels of adequacy in certain population groups.

The SLMS shows that child feeding practices are very poor and need to be improved. While early initiation of breastfeeding is practiced by the vast majority of women, exclusive breastfeeding of infants 0-6 months old is not sufficiently widespread. Complementary feeding practices are also poor, with a high prevalence of inadequate dietary diversity and inadequate frequency of feeding.

According to World Health Organization classifications, anemia in all populations groups included in the SLMS is a severe public health problem, and the prevalence of anemia in women and children in Sierra Leone has not changed substantially since 2008. Iron deficiency was not associated with anemia in non-pregnant women and young children in Sierra Leone. Rather, anemia in children and women was associated with malaria, inflammation, and diarrhea (children only). Thus, there are likely other important causes of anemia, therefore anemia of chronic inflammation and hemoglobinopathies offer potential explanations.

Nearly all women were sufficient in vitamin A, whereas 17% of children were vitamin A deficient representing a moderate public health problem.

Recommendations

Based on the survey findings, several recommendations were made to help improve the nutrition and health of women and children in Sierra Leone. Regarding iodine status, it is recommended that Sierra Leone should conduct a situation analysis of salt production, trade, and consumption to increase iodized salt coverage in areas where sea salt harvesting is currently practiced. Further, iodine intake and status should be continuously monitored in Sierra Leone to ensure iodine status remains within current levels, without reaching excessive iodine intakes. Regarding anemia, it is recommended that the causes of anemia be thoroughly investigated because iron deficiency, malaria, and other commonly-found risk factors are not highly correlated with anemia in children and women in Sierra Leone. Nonetheless, efforts to combat malaria should be strengthen as malaria affects a large proportion of women and children. To reduce vitamin A deficiency in children, it is recommended that vitamin A supplementation be continued, that dietary diversification be promoted on vitamin A rich foods, and that vitamin A fortification of oil be considered. Infant and young child feeding practices are also generally poor in Sierra Leone, and should be improved via enhanced behaviour change and communication strategies. Lastly,

community-based interventions to protect children from environmental causes of subclinical inflammation should also be strengthened.

1. INTRODUCTION

1.1. Country overview

Sierra Leone is located in West Africa and is bordered by Guinea and Liberia. According to the World Bank, the population of Sierra Leone in 2013 was 6.1 million and is growing at 2% per year [1]. Approximately 40% of the population resides in urban areas, with 20% of the total population (approx. 1.2 million) in Freetown, Sierra Leone's capital city. Administratively, the country is divided into three provinces (Eastern, Northern, and Southern), the Western Area, and 14 administrative districts.

Sierra Leone is ranked 183 out of 187 countries on the United Nations Development Programme (UNDP) Human Development Index [2]. Life expectancy at birth is 47.8 years and annual gross domestic product per capita is 340 US$ [1]. Literacy in Sierra Leone is relatively low: only 36% of women and 54% of men are literate. Literacy is highly correlated with age, with higher levels of literacy among women and men 15-24 years old (62% and 76%, respectively) than women and men 45-49 years old (15% and 34%, respectively) [3].

Shortly after the completion of the fieldwork of the SLMS, Sierra Leone was gripped by the ebola epidemic in West Africa [4]. Since its outbreak, more than 10,000 ebola cases have been reported in Sierra Leone causing more than 3,100 deaths as of January 2015 [5]. The ebola epidemic in Sierra Leone has also put enormous strain on a relatively young national health system [6].

1.2. Micronutrient deficiencies in Sierra Leone

Data on micronutrient deficiencies in Sierra Leone is limited and predominantly focused on the coverage of iodized salt, prevalence of iodine deficiency, and prevalence of anemia in children 6-59 months old and women 15-49 years old. Specifically, two national iodine deficiency assessment surveys were undertaken in 1992 and 2003, a Demographic and Health Surveys (DHS) in 2008 and 2013, and three Multiple Indicator Cluster Surveys (MICS) in 2000, 2005, and 2010.

Urinary iodine status was measured only in 1992 and 2003 in children 8-14 years old; it showed an improvement in iodine status from 97% below the cut-off of 100 μg/L in 1992 to 34% below this cut-off in 2003. Given the skewed distribution of urinary iodine concentration in populations and the high variability of spot urine iodine concentrations, interpretation of changes in proportions must be done with caution.

The 2008 DHS found that more than three-quarters of children 6-59 months of age were anemic, with 47.4% of this population having either moderate or severe anemia [7]. This prevalence of anemia is classified as a severe public health problem by the World Health Organization (WHO) [8]. Data from the 2008 DHS shows that 45.2% of adult women were

anemic, demonstrating that anemia in adult women is also a severe public health problem [8]. There are no representative studies for Sierra Leone on the prevalence of hemoglobinopathies in this hyper-endemic malaria setting.

In general, data demonstrating the prevalence of other micronutrient deficiencies in Sierra Leone are sparse. In children 6-59 months of age, there are no representative estimates of the prevalence or severity of vitamin A or iron deficiencies, and in women of reproductive age, there are no representative estimates of the prevalence of iodine, vitamin A, iron, folate, or vitamin B_{12} deficiencies.

1.3. Programs to combat micronutrient deficiencies in Sierra Leone

Over the past two decades, Sierra Leone's government has implemented various programs to combat micronutrient malnutrition, including salt iodization, biannual vitamin A supplementation for children 6-59 months of age, iron supplementation for pregnant women, and fortification of vegetable oil and wheat flour.

Since 1994, the Government has mandated that all salt imported to Sierra Leone be iodized at 35ppm [9], and since the passage of this legislation, the proportion of adequately iodized salt has steadily increased. Sierra Leone's 2010 standards (SLS 30: 2010) state that salt collected at the retail level "is expected to be" iodized at 15 to 50 ppm [10]. The MICS 2000, Iodine Deficiency Survey 2003, DHS 2008, and MICS 2010 determined the coverage of iodized salt using rapid test kits. Comparing their coverage results shows nearly a four-fold increase in the coverage of iodized salt, from 23% in 2000 to 83% in 2010.

Biannual vitamin A supplementation of children 6-59 months of age began in 1999, and in 2012 it was integrated into the biannual *Maternal and Child Health Weeks* [11]. According to recent estimates, over 90% of children 6-59 months of age were covered by single-dose vitamin A supplementation in 2011 and 2012 [11, 12]. On a routine basis, multi-vitamin syrup for children is available at primary health units as part of the government's Free Health Care Initiative.

Sierra Leone's public health system has provided iron-folate tablets and anti-helminth drugs to pregnant women to combat anemia. According to the 2013 DHS, 94% and 72% of women with a live birth in the past five years received iron tablets and anti-helminth treatment, respectively, during their last pregnancy [3].

Specially formulated foods (fortified with micronutrients) for infants and young children are available in Sierra Leone, but not widely accessible due to the lack of purchasing power. Ready to use therapeutic food (RUTF), for example, is not commercially available because it is a therapeutic food provided as part of programs treating severe acute malnutrition in children. In contrast, infant formula with added iron is commercially available in Sierra Leone, but is not universally supplied by the government's health system.

In 2010, a National Fortification Alliance was established, and the fortification of vegetable oil with vitamin A and of wheat flour with iron, zinc, vitamin D and some B-complex vitamins (including folic acid) has recently become mandatory. The implementation of the mandatory fortification had not commenced at the time of the survey.[1]

1.4. Rationale for the survey

The 2013 Sierra Leone Micronutrient Survey (SLMS) provides for the first time a comprehensive picture of micronutrient deficiencies in Sierra Leonean children 6-59 months of age, non-pregnant women, and pregnant women. With respect to iodine status, the SLMS expands upon the information collected as part of the 1992 and 2003 iodine deficiency surveys.

Because nutritional deficiencies are suggested to be one of the leading causes of mortality and morbidity in Sierra Leone [13], an up-to-date and thorough investigation of the micronutrient status of vulnerable groups is warranted. Information collected by the SLMS will enable the government and international agencies to monitor the impact of national nutrition programs (e.g. salt iodization and vitamin A supplementation) and to plan future nutrition interventions.

1.5. Primary objectives and indicators

From a nationwide sample of households and household members, the SLMS collected data about 1) households, 2) children 0-59 months of age, 3) non-pregnant women of child-bearing age (15-49 years of age), and 4) pregnant women. The SLMS has eight primary objectives, including the determination of:

1. The proportion of households using salt which is sufficiently iodized to maintain elimination of iodine deficiency disease (i.e. ≥15 ppm potassium iodate as per international standards) by quantitative measurement of salt iodine content.
2. The prevalence and severity of anemia among children 6-59 months of age, non-pregnant women and pregnant women by measuring hemoglobin concentration in whole blood.
3. The prevalence of iron deficiency among children 6-59 months of age and non-pregnant women by measuring plasma ferritin. Ferritin concentrations were adjusted for inflammation [14] .
4. The prevalence of iron deficiency anemia (i.e. concurrent anemia and iron deficiency) among children 6-59 months of age and non-pregnant women using hemoglobin and ferritin concentrations.

[1] Sierra Leone Standards on Fortified Wheat Flours (2011), SLS 39, SLS 40 and SLS 41

5. The prevalence of vitamin A deficiency among children 6-59 months of age and non-pregnant women by measuring retinol-binding protein (RBP) in plasma[2]. RBP levels were adjusted for inflammation [15].
6. The prevalence of folate and vitamin B_{12} deficiencies among non-pregnant women by measuring concentrations of both biomarkers in plasma.
7. The prevalence of iodine deficiency in both non-pregnant women and pregnant women by measuring urinary iodine content.
8. The prevalence of malaria among children 6-59 months of age, non-pregnant women and pregnant women using a rapid diagnostic test for *P. falciparum* infection.

1.6. Secondary objectives and indicators

The SLMS also assessed variables that may potentially influence or cause various types of micronutrient deficiencies, including socio-economic status, household food consumption patterns, individual food consumption patterns, infant feeding practices, and intake of micronutrient supplements.

2. METHODOLOGY

2.1. Survey design and sampling procedure

The SLMS was a stratified cross-sectional national survey, designed to produce estimates of priority micronutrient indicators in children 6-59 months of age and non-pregnant women for two strata – urban and rural. Based on *a priori* sample size calculations, the SLMS required the selection of approximately 1,440 households to achieve the desired precision for estimates of outcomes in households, children, and women. (see below for more detail and APPENDIX 1 for a table of minimum sample sizes for each target group and outcome and estimates of the final precision expected from sample size of 1,440 households.)

The sampling frame for the SLMS was based on data from the 2004 Sierra Leone Population Census. Two-stage sampling was conducted, with the census enumeration area (EA) serving as the primary sampling unit selected during the first stage of sampling and the household serving as the secondary sampling unit selected during the second stage of sampling.

Specifically, within the urban and rural strata, 30 EAs were selected with probability proportional to population size. In total, 60 EAs (2 strata $\times$ 30 EAs) were selected for the survey sample (see APPENDIX 2 for list of selected EAs). Based on a required total sample size of 1,440 households, 24 households were randomly selected from an updated listing of households within each of the 60 selected EAs.

[2] A subsample from both children and non-pregnant women was analyzed for plasma retinol to ensure comparability between retinol and RBP (see Annex 4).

2.2. Sample size determination

The sample size required for each stratum was based on assumptions about the estimated prevalence, the desired precision, and the expected intra-class correlation coefficients for the outcomes and subgroups in which these outcomes would be measured. Data from previous surveys (where available) were used to make these assumptions and calculate the design effect for each indicator, taking into account an expected response of 94% (including refusals) at the household level, and an individual response of 80%.

Fisher's formula for estimating the minimum sample size for descriptive studies of a dichotomous outcome was used as follows: $n = \frac{Z^2{}_{\alpha/2} P(1-P)}{d^2} * DEFF * \frac{1}{RR}$

Where;
$Z_{\alpha/2}$ = Standard errors from mean corresponding to the 95% confidence level
P = Assumed prevalence
d = Desired ½ confidence interval
DEFF = Design effect
RR = Total response rate (household and individual combined) expressed as a decimal

2.3. Study populations

Table 2 below lists the inclusion criteria for enrollment into the survey for each target group included in SLMS. Of note, some selected households did not contain women or children that met the inclusion criteria, and in these cases, only household information was collected. From within each household where eligible individuals were present, one child and one non-pregnant woman 15-49 years of age were randomly selected using a Kish table following the completion of the household roster [16]. The child's mother or caregiver was automatically enrolled in the SLMS if she was not the already randomly selected non-pregnant woman in that household. This step was taken to ensure data collection from mother-child pairs. All pregnant women within a selected household, regardless of their age or stage of pregnancy, were recruited for participation in the SLMS.

To ensure sufficient sample size and to minimize the potential sampling bias, households were visited three times before being listed as absent. Following the random selection of women and children from the household, subsequent three visit were made (if necessary) to interview all selected individuals.

2.4. Ethical considerations

The SLMS protocol was approved by the Office of the Sierra Leone Ethics and Scientific Review Committee, Directorate of Training, Non-Communicable Diseases and Research, Connaught Hospital, Ministry of Health and Sanitation (see APPENDIX 3 for approval letter).

Table 2. Inclusion criteria by target population group

Target population	Inclusion criteria
Households	• Household head or other adult member gives oral consent for survey data collection • Members currently reside in Sierra Leone
Children 0-59 months	• Age 0-59 months at the time of survey data collection (not yet reached fifth birthday) • Randomly selected among all children 0-59 months in the household • Caregiver or household head provides written informed consent on behalf of the child • Currently resides in selected household, as defined by adults in household
Non-pregnant women 15-49 years of age	• Age 15-49 years of age at the time of survey data collection • Currently non-pregnant by self-report • Randomly selected from among all non-pregnant women in the household or the mother of a randomly selected child • Gives written informed consent for survey data collection • Currently resides in selected household, as defined by other adults living in the household
Pregnant women (any age)	• Currently pregnant by self-report • Gives written informed consent for survey data collection • Currently resides in selected household, as defined by other adults living in the household

In addition to ethical approval, the household head or, in his/her absence, the spouse or another adult household member was asked to provide oral consent for participation in the interview. For blood sampling, adult women were asked to provide written informed consent and for children, the caregiver was asked for written consent on the child's behalf. If a woman or a child's caregiver was unable to read and write, the consent form was read out to her or him and a thumbprint or fingerprint was taken in lieu of a signature. Respondents were told that they were free to withdraw from participation in the survey at any time, even after written consent had been given.

Survey respondents diagnosed with severe anemia or malaria during survey data collection were given a referral slip for diagnosis and treatment at the local health facility. To avoid injury and undue stress on the mother or caretaker, no blood was taken from children younger than 6 months.

Confidentiality of information from survey respondents was assiduously maintained throughout data collection, processing and analysis.

2.5. Field work and data collection

2.5.1. Training of survey teams

One week prior to the start of the SLMS, all field workers (supervisors, team leaders, interviewers, phlebotomists, and lab technicians) were trained on proper data and specimen collection procedures. More trainees were recruited than were needed for the survey to ensure that only the best performing individuals would be selected for actual data collection.

The training consisted of two days of theoretical training and one day of role play to familiarize field workers with the survey procedures, instruments, and equipment. As part of the role play, phlebotomists drew blood specimens from field workers, and laboratory technicians practiced processing and labeling samples. At the end of the classroom training, a written test was administered to team members. The best performing and most experienced interviewers were hired as team leaders (see Appendix 4).

Following classroom training, two days of field testing were undertaken in two enumeration areas (EAs) in the Western Region (one urban and peri-urban) which were not included in the SLMS. Corrections to team members were made during field testing, and each completed questionnaire was reviewed by the trainers. Feedback was provided to the interviewers and team leaders on their completion of questionnaires. Ultimately, field workers were selected based on their performance on the written test and during field testing.

2.5.2. Household listing and community sensitization

One to two weeks prior to the arrival of the survey teams in each selected EA, Statistics Sierra Leone updated the lists of households in each EA, and from each list, households were randomly selected for participation in the SLMS. As part of the household listing process, Statistics Sierra Leone personnel met with local leaders, such as village heads and elders, to inform them of survey objectives and activities.

2.5.3. Field work

Data collection was conducted between 11th November and 2nd December 2013. Each of the eight teams was comprised of one team leader, two interviewers, one phlebotomist, and one driver. Each team was responsible for data collection in 6-8 EAs.

Survey teams conducted interviews at selected households. They administered the household questionnaire first, followed by the child and women questionnaires. Individuals in the household who met the eligibility criteria were then selected for recruitment. Questionnaires were administered in either Krio, Themne, or English, depending on the language preferred by the interviewee. To determine an individual's age, two local events calendars were made: one for children <5 years old and one for individuals ≥5 years old. At the end of the household questionnaire, the interviewer asked the respondent to provide a small specimen of salt for quantitative testing of iodine.

Selected women and children were asked to bring a labeled blood collection form to a central location in the EA where the team phlebotomist was stationed. A labeled urine beaker was given to each selected woman, and she was instructed to bring the urine specimen with her to the phlebotomy site as well. The first four women in each EA were given two urine beakers, and instructed to bring the second beaker on the second day so that urinary iodine concentration could be measured in two separate urine specimens obtained about 24 hours apart.

From each selected child and non-pregnant woman, the team phlebotomist collected blood in an EDTA-coated tube by venipuncture and used this blood to assess hemoglobin concentration and malaria status. The remainder of the blood specimen was forwarded to a central laboratory for processing. For pregnant women, only hemoglobin concentration and malaria status were measured on fingerstick blood; no additional blood specimen was collected. Phlebotomists referred women and children with malaria and/or severe anemia (i.e. hemoglobin <70 g/L for children, <80g/L for women) to a community health worker who, along with personnel at the nearest health facility, provided treatment and further diagnosis. Malaria was treated according to the National Malaria Treatment Guidelines [17]. Blood was not collected in a fasting state as this was unnecessary since no biomarkers sensitive to fasting state measured.

In order to compensate respondents for the time spent and the salt specimen donated, participating households were provided with 3-4 bars of soap and a 500g packet of iodized salt. At the end of each day, the team leader reviewed and collated the questionnaires. Interviewers were notified of any errors/omissions and instructed to correct and complete the questionnaire if possible.

2.5.4. Cold chain and processing of blood and urine samples

The blood and urine specimens collected by phlebotomists were temporarily stored in cold boxes at 2-8°C until processed within 24 hours. Cold boxes were refilled with frozen ice packs daily and were equipped with thermometers.

Each phlebotomist completed a specimen transport log which recorded the identification numbers of specimens collected on that day and the temperature prior to transport of the specimens to the regional laboratories for processing. Laboratory technicians were also requested to record the temperature of the specimens upon arrival. Phlebotomists and laboratory technicians were instructed to maintain a temperature in the cold box at ~4°C and to notify the team leader if temperatures in the cold box were below +2°C or above +8°C.

Following the receipt of specimens at the regional laboratories, specimens were temporarily stored in refrigerators at ~4°C until centrifuged and pipetted into separate aliquots in labeled plasma vials. Once prepared, the aliquots were stored in freezers at -15 to -20°C.

Once the field work was completed, specimens were shipped frozen (using -30°C ice packs) from the regional laboratories to the Lakka Public Health Reference Laboratory (PHRL), which served as the central laboratory for the SLMS. Specimens were sorted and stored at the Lakka PHRL laboratory at -20°C until shipped with dry ice to laboratories in Germany, Ghana, and the United States for testing. While the shipments to Ghana and the United States arrived frozen, the shipment to Germany thawed just prior to delivery. All analytes tested by the laboratory in Germany except soluble transferrin receptor (sTfR) are stable and do not degrade with brief thawing when using EDTA-coated tubes to prepare the plasma. Because sTfR is sensitive to freeze-thaw cycles, and preliminary tests showed very low values, sTfR was excluded from the analysis as a marker of iron status.

2.6. Biological testing methods

2.6.1. Malaria measurement

The malaria parasite most common in Sierra Leone is *P. falciparum*; it is responsible for all severe cases of malaria and 95% of uncomplicated cases [18]. Because there is only a small presence of other malaria species, the assessment of malaria infection was done on-site using a univalent rapid diagnositic kit testing for only *P. falciparum* antigens (Paracheck Pf™, Orchid Biomedical systems, Goa, India).

2.6.2. Anemia

Hemoglobin status was measured on-site using a HemoCue™ portable hemoglobinometer (Hb201+, HemoCue AB, Ängelholm, Sweden). Quality control of the HemoCue devices was done daily using both low and medium concentration liquid control specimens which were kept in cold boxes throughout the duration of the field work.

2.6.3. Iodine concentration in household salt

Laboratory technicians at Sierra Leone's Standards Bureau quantitatively measured the iodine concentration of each household salt specimen using the colorimetric method on the iCheck Iodine™ analyzers (Bioanalyt GmbH, Teltow, Germany)[19]. As a quality control measure, every 10^{th} specimen was reanalyzed, and non-concordant values reassessed. Overall coefficient of variation was well below 5% between two technical replicates.

2.6.4. Iron, vitamin A, and acute phase proteins

Plasma ferritin and RBP were used to assess individuals' iron and vitamin A status, respectively. Plasma ferritin is a biomarker of iron status recommended by the WHO for population based surveys [20, 21]. While the WHO's recommended biomarker for vitamin A status is plasma retinol, measuring RBP is cheaper, can be done with smaller quantities of plasma, and the results are highly correlated with plasma retinol [22].

Plasma ferritin and RBP were analyzed using an enzyme linked immunosorbent assay (ELISA) technique by the VitMin Laboratory, Germany [22, 23]. The VitMin Laboratory participates

regularly and performs well in inter-laboratory comparisons, such as the VITAL-EQA from the CDC.

Because RBP is not a WHO-recommended biomarker for assessment of vitamin A status, plasma specimens from non-pregnant women were analyzed for retinol using high-performance liquid chromatography (HPLC) at the ARS-Western Human Nutrition Research Center at the United States Department of Agriculture, Davis, USA. Insufficient plasma volumes were available to measure retinol in children. Comparisons of retinol and RBP values are presented in APPENDIX 6.

Because plasma ferritin levels can be elevated during inflammation, the acute phase proteins alpha-1-acid-glycoprotein (AGP) and C-reactive protein (CRP) were also measured. These values, measured by ELISA, were then used to correct the ferritin values according to the correction factors developed by Thurnham [14]. RBP is depressed in the presence of inflammation. The Thurnham method for adjusting serum retinol values was applied to the RBP concentrations to adjust for spurious depression of RBP concentrations in the presence of inflammation [15].

2.6.5. Plasma folate and vitamin B_{12}

Plasma folate and vitamin B_{12} concentrations were assessed using the Cobas e411 electrochemiluminescensce analyzer (Roche Diagnostics USA) at Western Human Nutrition Research Center (Davis, USA). The laboratory participated and performed well in the CDC external quality assurance program Vital-EQA just prior to the analysis of the SLMS samples. Over concerns of that ebola virus may be present in some samples, all samples were heated to 60° C for 60 minutes. This same heating procedure was conducted on test samples with known values and no deterioration in folate or vitamin B_{12} was observed.

2.6.6. Urinary iodine

The WHO recommends measuring iodine in urine for population-based surveys [24]. 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 ammonium persulfate/Sandell-Kolthoff reaction method [25] conducted at the newly-established Iodine Global Network laboratory in Accra, Ghana. Technicians assessed the concentration of each specimen twice, and the mean of both runs was used as the specimen concentration. Internal quality control materials labelled as low, medium and high were run with specimens. Results from an analytical run were rejected if the value from the internal quality control material was not within the acceptable range.

2.7. Data management and analysis

2.7.1. Data entry

Completed questionnaires were entered into a computer database at Helen Keller International's Sierra Leone office under the supervision of the data entry supervisor using CSPro v. 5.0. To reduce data entry errors, CSPro data-entry screens were programmed to accept only codes within a predetermined range specific to each variable. Data were double-entered, verified, and corrected on an on-going basis during the data entry.

Data entry did not include any individuals' names or identifying information to prevent identification of study subjects by dataset users. For laboratory data obtained in electronic form, unique individual identification numbers were used to match the interview information with laboratory testing results. Completed questionnaires and blood collection sheets were kept in a locked office to maintain confidentiality.

2.7.2. Data analysis

Data analysis was done using SPSS version 22 with the complex survey module. Standardized statistical weights for household variables were calculated to account for the unequal selection probability in the two strata.

Data analysis included calculation of proportions to derive the prevalence of nutrition and health outcomes and mean and median as average measures of continuous variables. These measures were calculated in aggregate (i.e. for the entire sample across both strata), for each stratum (i.e. urban/rural), region, educational status, language group, and by sex (for children only). Disaggregation by language group was used for outcomes where cultural practice or localized geographic conditions may play a contributory role. Apart from the dominant language groups (i.e. Krio, Themne, Mende) which are widely spoken in Sierra Leone, other language groups reside in localized geographic areas. Thus, disaggregation of key results by language group can be used to more finely identify the most vulnerable areas (see Map 1). Results are also presented by specific age sub-groups for pregnant women, non-pregnant women, and children. For pregnant women, only national estimates were generated.

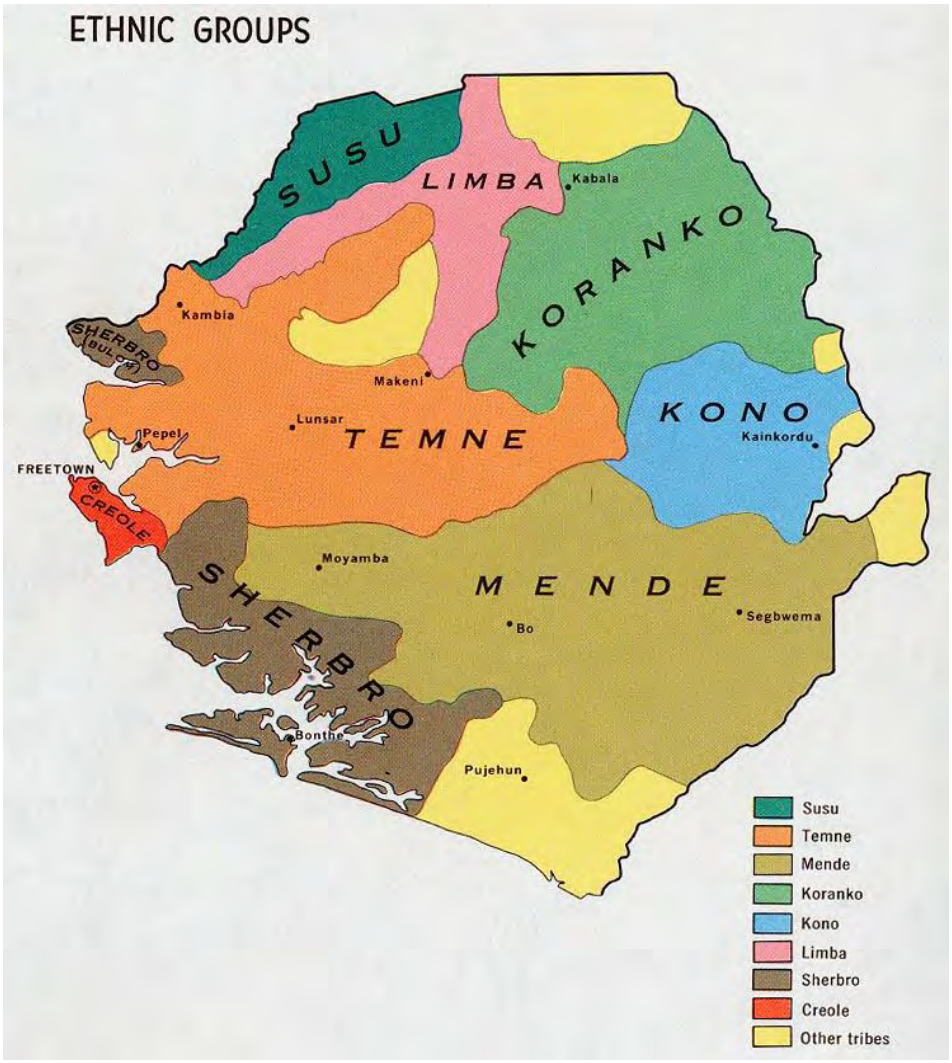
The statistical precision of all prevalence estimates were assessed using 95% confidence limits which were calculated accounting for the complex sampling used in this survey, including the cluster and stratified sampling (see appendix 6 for design effects for major outcomes). The statistical significance of differences between subgroups was assessed using Chi square using weighted analysis and adjusted for complex sampling.

For urinary iodine concentration (UIC), which was not normally distributed, the median UIC was calculated for each target group in order to judge population iodine status against WHO criteria. To judge the statistical precision of apparent differences among subgroups, a square root transformation of the UIC values created a variable which was normally distributed. ANOVA was then used to calculate p values for apparent differences in geometric means among subgroups.

These p values appropriately accounted for the statistical weighting and complex sampling. For comparisons of categorical data, the adjusted chi^2 test was applied.

To geographically present the coverage of adequately iodized salt, geographic analysis techniques were employed (see Section 3.2.5). Specifically, cluster-specific estimates of adequately iodized salt were linked to latitude and longitude coordinates (i.e. GPS points) for each EA, and inverse distance weighting was used to estimate the coverage of adequately iodized salt for all areas of Sierra Leone. Inverse distance weighting (IDW) assumes that the greater the distance from a point, the less similar the value of interest becomes. For the IDW procedure, a distance coefficient P, which specifies the rate of influence as distance from the point increases, was set to 5.0 due to the relatively large distance between many of the EAs selected for the SLMS. Geographic analysis was conducted using the interpolation function of Quantum GIS 2.6 (http://qgis.osgeo.org).

Map 1. Major ethnic and language groups in Sierra Leone (from [26])



2.7.3. Case definitions of deficiency

The cut-off values for each biomarker indicator used to determine nutritional status for each subject are presented in Table 3. For hemoglobin and urinary iodine concentration, multiple cut-offs are used to classify the severity of anemia and iodine deficiency, respectively. For other indicators, however, a single cut-off is used to identify deficiency or abnormality.

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

Indicator	Excess	Above requirement	Adequate	Mild	Moderate	Severe
Hemoglobin (g/L) *						
Children 6-59 months of age			≥ 110	100-109	70-99	< 70
Non-pregnant women			≥ 120	110-119	80-109	< 80
Pregnant women			≥ 110	100-109	70-99	< 70
Urinary Iodine Concentration (µg/L) †						
Non-pregnant non-lactating women	≥ 300	200-299	100-199	50-99	20-49	< 20
Non-pregnant lactating women	--	--	≥ 100	< 100 §	--	--
Pregnant women	≥ 500	250-499	150-249	< 150 §	--	--

	Cut-off defining deficiency or abnormality
Retinol-binding protein (µmol/L)	
Children 6-59 months of age	<0.7
Non-pregnant women	<0.7
Plasma ferritin (µg/L) ‡	
Children 6-59 months of age	< 12
Non-pregnant women	< 15
α1-acid-glycoprotein (g/L)	
Children 6-59 months of age	>1.0
Non-pregnant women	>1.0
C-reactive protein (mg/L)	
Children 6-59 months of age	>5
Non-pregnant women	>5
Plasma Folate (ηmol/L)	
Non-pregnant women	<10
Plasma B_{12} (pmol/L)	
Non-pregnant women	<150

* Hemoglobin values were adjusted for altitude and smoking according to standard recommendations [8]

† A population's iodine status is judged according to the median urinary iodine concentration obtained from spot urine specimens. No attempt is made to determine individuals' iodine status

‡ The laboratory testing results were adjusted for sub-clinical inflammation using appropriate algorithms [14]

§ Urinary iodine concentrations <100 µg/L and <150 µg/L for non-pregnant lactating women and pregnant women are classified as "insufficient"

2.7.4. Calculation of wealth index and socio-economic status

A wealth index was calculated using characteristics of the dwelling, water and sanitation facilities, and ownership of durable goods analyzed using the principal component analysis method commonly employed by UNICEF MICS, the World Bank, and the World Food Programme [27, 28]. The wealth index was calculated for each household and split into quintiles on unweighted data to permit the cross-tabulation of various nutrition indicators by wealth in report tables.

3. RESULTS

3.1. Response rates for households, children, and women

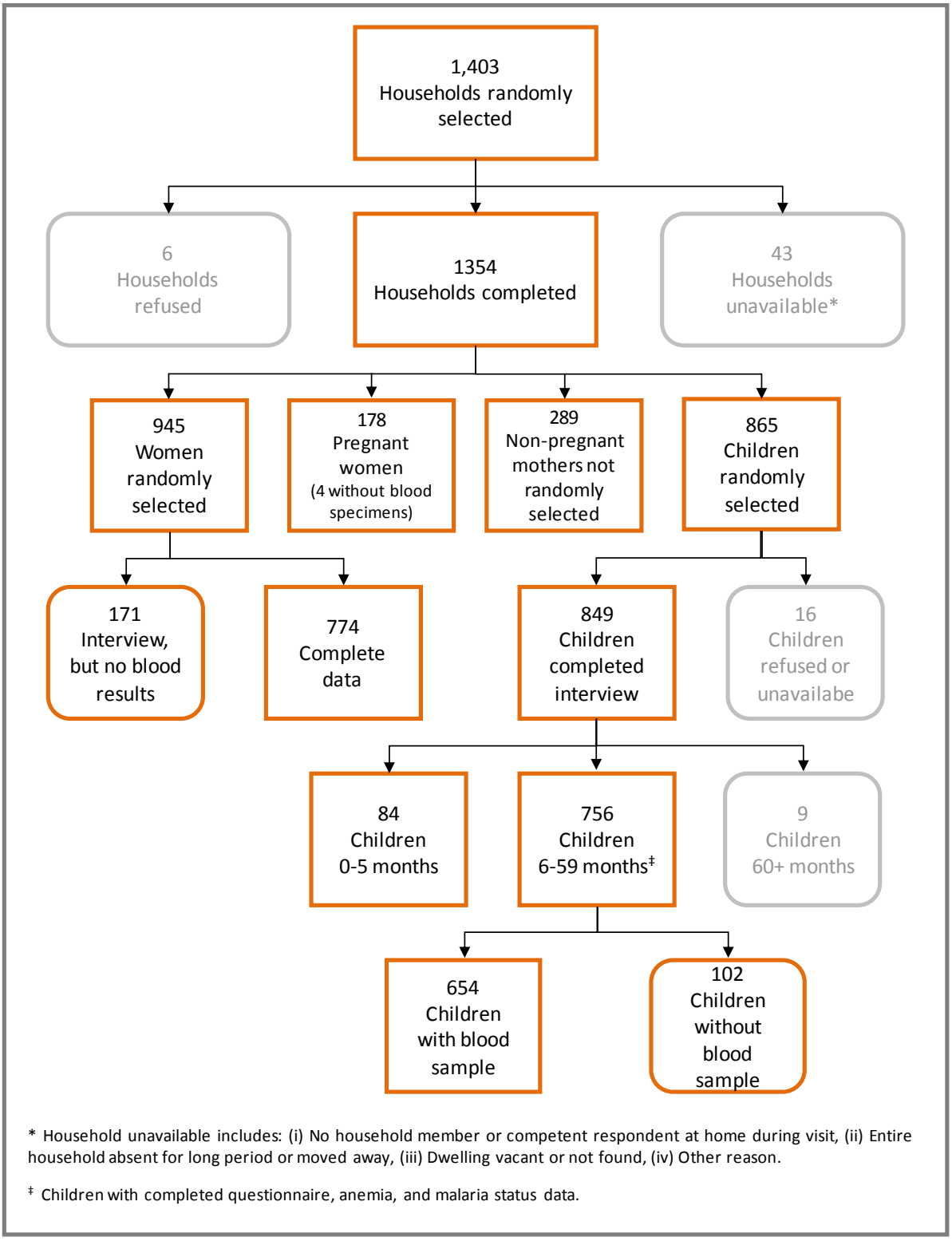
Figure 1 below illustrates the number of households, children and women selected and participating in SLMS data collection. Of the 1,403 households randomly selected, 1,359 (96.9%) consented to participate in the survey and completed the household interview. Few households refused to participate; most household non-participation was due to all the households' members being away for extended periods of time and or the teams' inability to locate a selected household's dwelling (see Table A7-1 in appendix 6 for details).

From participating households, 945 non-pregnant women 15-49 years of age were randomly selected for inclusion into the survey. Of these women, more than 80% completed the interview and provided a blood sample; the remainder completed the interview, but refused blood collection. In addition to the randomly selected non-pregnant women, 289 non-pregnant women were selected because they were the mother of a randomly selected child; data from these women are not shown in this report.

From participating households, 865 children were randomly selected. The parents of about 2% refused any survey data collection. Interviews were completed with a parent of the remaining children. About 1% of interviewed children were 60 months of age or older and excluded from analysis. Of the 90% of children who were 6 months of age or older and eligible to provide a blood specimen, almost 90% consented and had blood drawn.

From participating households, 178 eligible pregnant women were asked to participate in the study, and the large majority completed the questionnaire and consented to fingerstick blood collection for the measurement of hemoglobin and malaria. Three pregnant women completed the questionnaire but refused the blood sample, and one was not found at home.

Figure 1. Flow diagram for participation of households, women, and children, Sierra Leone, 2013



* Household unavailable includes: (i) No household member or competent respondent at home during visit, (ii) Entire household absent for long period or moved away, (iii) Dwelling vacant or not found, (iv) Other reason.

‡ Children with completed questionnaire, anemia, and malaria status data.

3.2. Household characteristics

3.2.1. Demographic characteristics

Of the households selected, nearly three-quarters had a male household head, a similar proportion to that found in the 2013 DHS [3]. Nearly 40% of households were located in urban areas; with the highest proportion of households located in the North Region, and the smallest proportion the West Region (see Table 4).

Table 4. Distribution of various demographic variables for participating households, Sierra Leone 2013.

	Survey Sample			Sierra Leone Population
Characteristic	n	% [a]	(95% CI) [b]	%
Head of Household Sex				
Male	979	72.7	(69.2, 75.9)	72.0 [c]
Female	384	27.3	(24.1, 30.8)	28.0 [c]
Residence				
Urban	674	39.6	(38.7, 40.5)	36.4 [c]
Rural	689	60.4	(59.5, 61.3)	63.6 [c]
Region				
East	307	22.7	(13.4, 35.9)	25.9 [d]
North	433	33.4	(22.1, 46.9)	31.6 [d]
South	338	25.7	(15.8, 39.0)	22.2 [d]
West	285	18.2	(10.8, 28.9)	20.0 [d]
TOTAL RESPONDING HOUSEHOLDS	1363	100	--	

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] Sierra Leone DHS 2013
[d] Population estimates provided by Statistics Sierra Leone

On average, households contained about seven members, with nearly 70% of household containing 3-8 members (see Table 5). The median number of household members was only 5.5, showing the skewed nature of the distribution of household size toward the one-fifth of households which had ≥10 members. Approximately 80% of households contained 0-3 women 15-49 years old, and 90% of households contained 0-2 children 0-59 months.

Only 40% of household heads ever attended school or pre-school. Of these, the majority stopped school in primary, junior secondary, or senior secondary school levels; <10% of household heads attended vocational school, college, or university (see Table 6).

Table 5. Distribution of household composition participating households, Sierra Leone 2013.

Characteristic	n	% [a]	(95% CI) [b]
Average household size			
Mean	1363	6.8	(6.45, 7.21)
Median	1363	5.5	N/A
Number of household members			
1	27	1.9	(1.2, 2.9)
2	56	4.3	(3.1, 5.9)
3	116	8.5	(7.1, 10.1)
4	168	12.3	(10.3, 14.6)
5	214	15.8	(13.6, 18.4)
6	185	14.2	(12.2, 16.4)
7	144	10.4	(8.9, 12.2)
8	103	7.5	(6.1, 9.1)
9	91	6.6	(5.2, 8.3)
10+	259	18.6	(15.6, 22.0)
Number of women 15-49 years of age in households			
0	216	16.3	(13.9, 19.0)
1	617	45.6	(42.0, 49.3)
2	306	22.4	(19.8, 25.2)
3	114	8.3	(6.7, 10.1)
4	55	3.7	(2.7, 5.0)
5	31	2.1	(1.4, 3.0)
6	24	1.7	(1.0, 2.8)
Number of children 0-59 months in households			
0	479	34.6	(31.6, 37.7)
1	549	40.0	(36.8, 43.3)
2	246	18.4	(16.3, 20.8)
3	67	5.2	(4.2, 6.6)
4	16	1.3	(0.7, 2.2)
5+	6	0.4	(0.2, 1.0)

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 weighted for unequal probability of selection.

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

Table 6. Educational level of household head of participating households, Sierra Leone 2013.

Characteristic	n	% [a]	(95% CI)[b]
Head of household ever attended school or preschool			
Yes	582	40.9	(36.4, 45.5)
No	775	59.1	(54.5, 63.6)
Highest level of school attended by household head			
None	775	59.3	(54.7, 63.7)
Kindergarten	1	0.1	(0.0, 0.7)
Primary	148	11.1	(9.4, 13.2)
JSS – Junior Secondary School	119	8.5	(7.0, 10.2)
SSS – Senior Secondary School	184	12.8	(10.3, 15.8)
Vocational, commercial, nursing, technical, or teaching	22	1.4	(1.0, 2.2)
Tertiary, college, or university	103	6.7	(4.9, 9.2)
TOTAL RESPONDING HOUSEHOLDS	1357	100	--

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.

About one-fifth of household heads self-identified as Christian and four-fifths as Muslim; only two household heads identified themselves as following traditional religions or no religion (see Table 7). Two thirds of household heads reported that Mende or Themne was their first language.

Table 7. Distribution of religion and language for participating households, Sierra Leone 2013.

Characteristic	n	% [a]	(95% CI) [b]
Religion of household head			
Christian	284	20.7	(15.3, 27.4)
Muslim	1076	79.1	(72.5, 84.5)
Traditional	1	0.1	(0.0, 0.6)
No religion	1	0.1	(0.0, 0.6)
First language of household head			
Mende	469	35.8	(25.6, 47.4)
Themne	421	30.0	(21.0, 40.9)
Limba	90	7.0	(3.2, 14.7)
Krio	25	1.7	(0.8, 3.7)
Mandingo	55	3.7	(2.5, 5.5)
Loko	43	3.3	(1.1, 10.0)
Sherbro	21	1.3	(0.5, 3.2)
Kono	58	4.4	(1.5, 11.8)
Fullah	66	4.2	(2.7, 6.5)
Koranko	55	4.6	(1.4, 14.5)
Susu	30	2.2	(0.6, 8.0)
Other [c]	25	1.7	(1.0, 3.1)
TOTAL RESPONDING HOUSEHOLDS	1358	100	--

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] Other languages include Arabic, Congolese, Ghanaian, Gissi, Gula, Kissi, Maraka, Vai, Yalunka, Yolof, and Yoroba.

3.2.2. Agricultural activities and livestock ownership

A majority of households owned agricultural land and some livestock (see Table 8). Of the households that owned livestock, about half owned fowl. Goats and sheep were less-commonly owned. Ownership of animals apart from fowl, goats, and sheep was uncommon. Overall, the number of animals owned was quite small; the median number of tropical livestock units [29] for all households was only 0.02. In urban households, the median was 0, and in rural households, the median was 0.05 ($p<0.001$ for difference, median test).

Table 8. Proportion of livestock and agriculture variables for participating households, Sierra Leone 2013.

Characteristic	n	%[a]	(95% CI)[b]
Member of household owns any agricultural land			
Yes	741	59.0	(53.9, 64.0)
No	618	41.0	(36.0, 46.1)
If own land, median amount (in hectares)	564	1.22	Interquartile range (0.41 – 2.84)
Household owns any livestock			
Yes	774	59.8	(55.1, 64.2)
No	589	40.2	(35.8, 44.9)
Household owns livestock, specific [c]			
Cattle, cows, bulls	16	1.3	(0.6, 2.8)
Horses, donkeys, mules	2	0.2	(0.0, 0.7)
Goats	214	18.3	(14.0, 23.7)
Sheep	140	11.7	(8.3, 16.4)
Rabbits	1	0.1	(0.0, 0.7)
Pigs	10	0.9	(0.3, 2.1)
Fowl (Chickens, geese, ducks, or turkeys)	718	55.5	(50.5, 60.4)
Rodents to breed	3	0.3	(0.1, 1.2)
Birds to sell	3	0.2	(0.1, 0.8)
TOTAL RESPONDING HOUSEHOLDS	1359	100	--

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] Question only asked to households responding "Yes" to livestock ownership

3.2.3. Cooking fuel

Cooking was done in virtually all households with natural fuels 96% of which was wood or charcoal (see Table 9).

Table 9. Distribution of cooking variables for participating households, Sierra Leone 2013.

Characteristic	n	% [a]	(95% CI)[b]
Type of fuel used for cooking			
Electricity	0	0	--
Liquefied petroleum gas (LPG)	2	0.1	(0.0, 0.5)
Natural gas	0	0	--
Kerosene	0	0	--
Biogas	1	0.1	(0.0, 0.4)
Coal, lignite	52	3.3	(1.6, 6.7)
Charcoal	329	20.0	(15.3, 25.6)
Wood	973	76.2	(69.6, 81.8)
Straw, shrubs, or grass	3	0.2	(0.1, 0.7)
Animal dung	0	0	--
Agricultural crop residue	0	0	--
No food cooked in household	2	0.1	(0.0, 0.5)
TOTAL RESPONDING HOUSEHOLDS	1362	100	--

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] Question only asked to households cooking with stove type = open fire, open stove, or other

3.2.4. Water and sanitation

About 75% of households had an improved source of water for drinking (see Table 10) [30]. Less than 15% of households treat their water to make it safe to drink; however, the majority of these households already consume water from an improved source. As a result, the proportion of households actually drinking "safe" water (either from an improved source or adequately treated at home) is quite high.

On the other hand, less than 40% of households have improved sanitation (see Table 10), consisting of either a flush (or pour flush) toilet or pit latrine with slab that is not shared with other households. Overall, 40.5% of households had a pit latrine without a slab, 29.4% had a pit latrine with a slab, and 15.4% had practiced open defecation in the bush or field. Among households with some sanitation facility (those not practicing open defecation), 25.1% shared their facility with persons outside their household.

Table 10. Distribution of water and sanitation variables for participating households, Sierra Leone 2013.

Characteristic	n	% [a]	(95% CI) [b]
Main source of water for drinking [c]			
Improved source	1043	75.2	(64.9, 83.3)
Unimproved source	312	24.8	(16.7, 35.1)
Treat water to make safe to drink			
Yes	200	14.1	(10.3, 18.9)
No	1150	85.9	(81.1, 89.7)
Drink safe water [d]			
Yes	1065	76.5	(66.3, 84.4)
No	291	23.5	(15.6, 33.7)
Household sanitation [e]			
Improved	560	37.8	(31.4, 44.8)
Unimproved	789	62.2	(55.2, 68.6)
TOTAL RESPONDING HOUSEHOLDS	1355	100	--

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] Improved source = water from piped system, tube well or borehole, protected well, protected spring, rainwater collection, or bottled water. Unimproved source = water from unprotected well, unprotected spring, tanker truck or cart, surface water or other.

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

[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, no facility, bush, field, burying in back yard

Less than 10% of households had a fixed sink or basin for handwashing (see Table 11). In most of the remaining households, handwashing facilities could not readily be assessed because there was no fixed place for handwashing or because handwashing was done outside the house or compound. In households where a handwashing place was observed by survey teams, the more than 50% of households had no water or soap at that handwashing place.

Table 11. Distribution of handwashing variables for participating households, Sierra Leone 2013.

Characteristic	n	% [a]	(95% CI) [b]
Location of handwashing site			
Sink or fixed basin (observed)	129	8.7	(5.6, 13.4)
Hands washed anywhere around dwelling (observed)	310	22.7	(16.7, 30.1)
Not in dwelling / plot / yard (not observed)	729	54.5	(44.5, 64.1)
Permission to see handwashing area not given	23	1.5	(0.7, 3.2)
No handwashing place	162	12.5	(7.4, 20.4)
Water is available at observed handwashing place [c]			
Yes	173	39.6	(28.7, 51.6)
No	256	60.4	(48.4, 71.3)
Soap seen at handwashing site			
Bar soap	179	38.3	(29.6, 47.8)
Detergent	39	8.3	(4.8, 13.9)
Liquid soap	30	7.8	(1.6, 30.6)
Ash / mud / sand	6	1.6	(0.6, 4.5)
None	219	51.2	(40.0, 62.2)
TOTAL RESPONDING HOUSEHOLDS	1353	100	--

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] Data available only if handwashing place observed

3.2.5. Salt iodization

The report shows that most participating households had salt at the time of the survey (see Table 12). Of these, nearly 9 in 10 did not have the salt in its original package. Field workers noted that some households purchased salt in single-use packets, which likely accounts for the nearly 14% of household not possessing salt.

Table 12. Presence of salt and salt packaging for participating households, Sierra Leone 2013.

Characteristic	n	% [a]	(95% CI) [b]
Salt in household			
Yes	1160	86.1	(82.2, 89.2)
No	191	13.9	(10.8, 17.8)
Salt packaging is labeled as iodized/fortified			
Yes, original package says fortified	55	4.7	(3.0, 7.1)
Original package not mentioning iodization	77	6.4	(3.9, 10.2)
Salt not in original package	998	87.0	(82.3, 90.6)
Packaging undetermined for other reason	22	2.0	(1.1, 3.6)
TOTAL RESPONDING HOUSEHOLDS	1351	100	--

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.

Table 13. Proportion of salt specimens testing with iodine concentration ≥15 ppm quantitative assessment in participating households, Sierra Leone 2013.

Characteristic	n	% [a]	(95% CI)[b]	P value [c]
Residence				
Urban	475	88.0	(81.3, 92.5)	<0.05
Rural	448	76.2	(64.5, 84.9)	
Region				
East	204	89.3	(84.5, 92.7)	<0.05
North	262	68.7	(53.3, 80.8)	
South	236	84.4	(65.3, 94.0)	
West	221	88.3	(78.7, 93.9)	
First language of household head				
Mende	325	90.6	(86.6, 93.6)	<0.05
Themne	252	68.8	(53.1, 81.1)	
Limba	68	84.6	(78.8, 89.0)	
Krio	20	85.5	(63.5, 95.2)	
Mandingo	38	77.8	(63.0, 87.8)	
Loko	33	80.7	(70.2, 88.2)	
Sherbro	15	83.8	(64.3, 93.7)	
Kono	48	100.0	--	
Fullah	46	83.9	(61.9, 94.4)	
Koranko	39	73.8	(30.5, 94.8)	
Susu	13	39.8	(9.1, 81.3)	
Other	21	94.1	(66.1, 99.2)	
Wealth Quintile				
Lowest	159	73.6	(56.6, 85.7)	<0.01
Second	163	75.0	(61.4, 84.9)	
Middle	172	80.0	(71.2, 86.6)	
Fourth	180	83.1	(74.6, 89.1)	
Highest	223	94.0	(89.9, 96.4)	
ALL HOUSEHOLDS	923	80.7	(73.1, 86.5)	

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.

[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

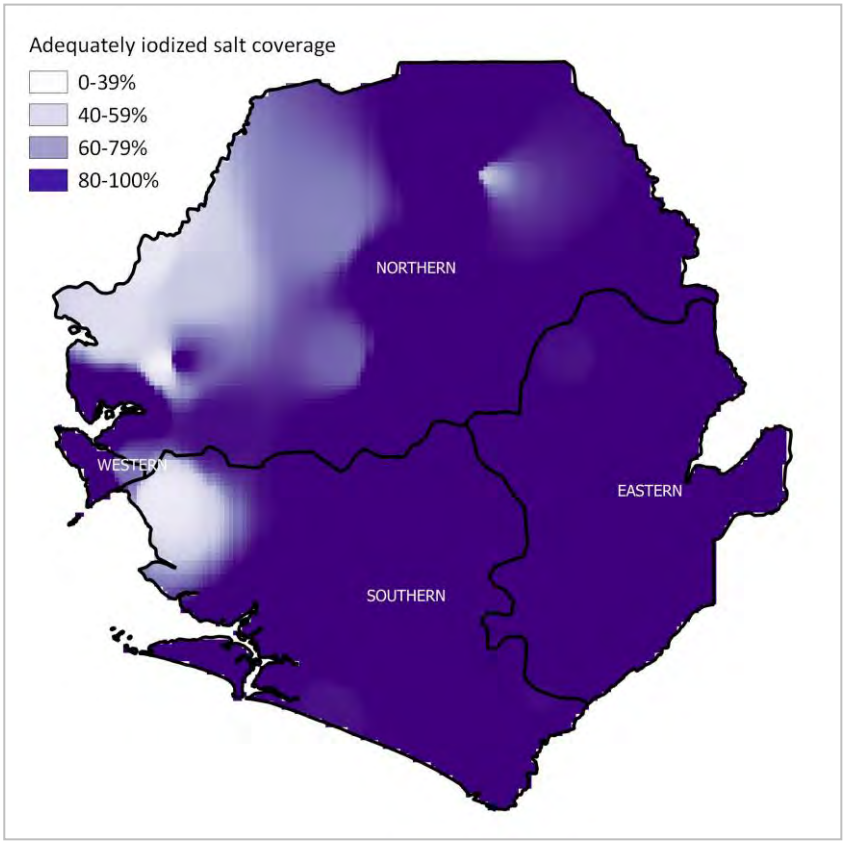
There was a sufficient quantity of salt for the quantitative analysis of iodine concentration in 1,128 specimens (see Table 13). Overall, a high proportion of salt specimens had iodine concentrations ≥15 ppm [3]. According to the WHO, adequately iodized salt consumed by more than 90% of households is one indication of the sustainable elimination of iodine deficiency disorders [24]. Specifically, almost 90% of salt in urban areas and more than 75% of salt in rural areas was adequately iodized. The lowest coverage of adequately iodized salt

[3] While the SLMS uses the ≥15 ppm threshold to define "adequacy" of iodization, Sierra Leone's 2010 iodized salt standard (SLS 30) defines adequacy as 15-50 ppm at the retail level.

was observed in the North region. Adequately iodized salt was found in about 91% of household where Mende is the first language, but only 69% of households where Themne is the first language. Variations between other language groups are observed, with 100% and only 40% of Kono-speaking and Susu-speaking households consuming iodized salt, respectively. Salt obtained from wealthier households was more likely to be adequately iodized than salt from poorer households (see Table 13).

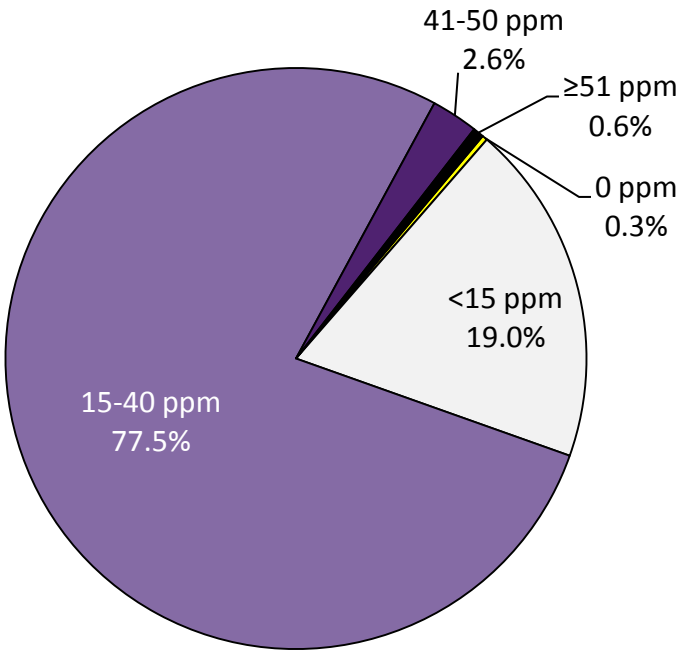
Map 2 visually presents the geographic coverage of adequately iodized salt, and illustrates that the western areas of the Northern and Southern regions have the lowest coverage of adequately iodized salt, whereas other areas of Sierra Leone all have >80% coverage of adequately iodized salt. Relatively low coverage is also observed in the rural areas southeast of Koinadugu the Northern region.

Map 2. Coverage of adequately iodized (≥15 ppm iodine) salt, Sierra Leone, 2013



Almost 20% of salt specimens were iodized at a concentration of less than 15 ppm (see Figure 2). The majority of specimens were iodized at a level recommended by WHO (15-40 ppm), with only a small proportion of salt specimens (2.6%) with between 40-50 ppm, the highest concentrations expected by Sierra Leone's iodization standards. The highest iodine concentration was 103 ppm.

Figure 2. Weighted distribution of household salt iodine concentrations, Sierra Leone, 2013



3.2.6. Household consumption of vegetable oil and wheat flour

Only 49% of households included in the survey sample reported using commercially-produced vegetable oil (see Table 14). Nearly 80% of urban households used commercial vegetable oil compared to less than 30% of rural households. In addition, more than 90% of household in the Western Area used commercial vegetable oil compared to about 40% of households in other regions. This proportion also increased sharply with increasing wealth, with only about 9% of the poorest households using commercially-produced vegetable oil. Among households reporting using commercial vegetable oil, the mean average amount of oil consumed per adult male equivalent per day was almost 20 grams, and the amount of oil consumed did not differ with statistical significance by urban versus rural residence or wealth. Consumption of commercially-produced oil in the Western Area, on the other hand, was significantly higher than in other regions.

Table 14. Proportions of households using commercially-produced vegetable oil and, among those using, the average amount consumed per adult male equivalent per day (in grams), Sierra Leone 2013.

Characteristic	n	%[a]	(95% CI)[b]	P value	Geometric mean [c]	P value
Residence						
Urban	509	78.7	(68.4, 86.3)	<0.001	21.5	0.14
Rural	181	28.7	(19.2, 40.6)		16.6	
Region						
East	120	37.3	(22.1, 55.6)	<0.001	20.8	< 0.05
North	191	41.5	(28.2, 56.2)		14.1	
South	127	38.2	(23.8, 55.1)		18.1	
West	252	91.6	(83.7, 95.8)		26.2	
Household language						
Mende	178	36.9	(26.1, 49.3)	<0.01	21.1	0.29
Themne	235	52.8	(38.7, 66.5)		17.4	
Limba	60	67.9	(51.6, 86.3)		21.1	
Krio	22	88.1	(72.2, 95.5)		33.7	
Mandingo	37	67.9	(50.1, 81.6)		23.1	
Loko	31	71.2	(55.4, 83.1)		18.6	
Sherbro	9	14.9	(24.0, 62.2)		15.6	
Kono	24	43.5	(16.2, 75.4)		19.1	
Fullah	50	80.9	(67.3, 89.7)		20.8	
Koranko	14	21.7	(8.1, 46.6)		11.6	
Susu	13	40.4	(10.0, 80.5)		18.1	
Other	16	61.5	28.4, 86.5)		22.2	
Wealth Quintile						
Lowest	22	8.5	(4.4, 15.9)	<0.001	19.5	0.08
Second	75	29.2	(20.9, 39.3)		12.2	
Middle	151	56.0	(47.4, 64.3)		19.7	
Fourth	187	72.6	(64.6, 79.3)		19.2	
Highest	238	92.7	(87.7, 95.8)		24.0	
ALL HOUSEHOLDS	690	49.1	(41.8, 56.3)		19.6	

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] Mean calculated only for those household reporting purchasing edible oil

The largest number of households, albeit still a minority, reported that the most common form in which wheat flour was consumed was bread (see Table 15). Bread consumption was more common in urban households, in households in the Western Area and in wealthier households. Among households reporting that bread was the most common form of wheat flour consumed, the average consumption per adult male equivalent was more than 70 grams per day.

Table 15. Most common wheat flour product consumed in participating households, Sierra Leone 2013.

Characteristic	n	%[a]	(95% CI)[b]
Wheat flour product consumed most often by household			
Bread	657	43.8	(37.6, 50.2)
Pancakes	152	12.0	(7.9, 17.8)
Doughnuts	264	21.0	(16.3, 26.7)
Other	136	10.6	(7.0, 15.7)
Unknown	152	12.6	(9.0, 17.2)
ALL HOUSEHOLDS	1361	100	--

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.

Table 16. Proportions of households using bread and, among those using, average amount consumed per adult male equivalent per day (in grams), Sierra Leone 2013.

Characteristic	n	%[a]	(95% CI)[b]	P value	Geometric mean[c]	P value
Residence						
Urban	473	73.7	(66.3, 79.9)	<0.001	89.0	<0.01
Rural	172	30.8	(21.5, 41.9)		47.5	
Region						
East	114	38.1	(24.8, 53.4)	<0.001	68.4	<0.001
North	174	41.9	(31.8, 52.7)		54.5	
South	125	41.1	(24.9, 59.5)		45.7	
West	232	84.7	(77.1, 90.1)		117.6	
Household language						
Mende	164	38.3	(28.2, 49.6)	<0.001	48.4	<0.001
Themne	214	51.4	(39.9, 62.8)		73.1	
Limba	47	56.2	(38.3, 72.5)		63.1	
Krio	21	87.7	(74.6, 94.6)		78.9	
Mandingo	44	78.3	(63.2, 88.3)		120.1	
Loko	23	57.5	(43.0, 70.9)		82.4	
Sherbro	11	53.7	(23.7, 81.2)		68.0	
Kono	26	54.7	(28.7, 78.3)		68.3	
Fullah	53	81.8	(68.9, 90.1)		148.6	
Koranko	13	21.2	(10.0, 39.6)		63.4	
Susu	12	49.1	(31.4, 67.1)		96.1	
Other	15	54.3	(26.9, 79.3)		100.1	
Wealth Quintile						
Lowest	32	16.0	(9.6, 25.3)	<0.001	28.0	<0.001
Second	71	28.7	(20.6, 38.4)		41.3	
Middle	141	53.7	(44.8, 62.3)		57.9	
Fourth	168	66.7	(58.1, 74.4)		71.0	
Highest	216	82.8	(76.2, 87.8)		122.4	
ALL HOUSEHOLDS	645	49.4	(43.0, 55.9)		71.4	

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] Mean calculated only for those household reporting purchasing edible oil, values are geometric means

3.3. Preschool children

3.3.1. Characteristics

Table 17 describes the demographic characteristics of children participating in the SLMS. Nearly half (46.3 %) of the children enrolled in the SLMS were below 2 years of age. The survey sample includes slightly more girls than boys, and nearly two thirds resided in rural areas of Sierra Leone. Nearly 70% of children had mothers who never attended school.

Table 17. Description of sampled pre-school age children (0 – 59 months), Sierra Leone 2013.

	Survey Sample			Sierra Leone Population
Characteristic	n	% [a]	(95% CI) [b]	% [c]
Age Group (in months)				
0-5	83	9.6	(7.8, 11.8)	--
6-11	125	14.9	(12.3, 18.0)	--
12-23	182	21.8	(18.8, 25.2)	--
24-35	141	16.7	(13.4, 20.7)	--
36-47	177	20.0	(17.0, 23.5)	--
48-59	131	16.9	(13.6, 20.9)	--
Sex				
Male	391	47.3	(43.4, 51.2)	49.4
Female	448	52.7	(48.8, 56.6)	50.6
Residence				
Urban	397	39.1	(35.8, 42.4)	24.4
Rural	442	60.9	(57.6, 64.2)	75.6
Region				
East	177	20.7	(11.8, 33.8)	23.6
North	268	35.2	(23.3, 49.3)	41.0
South	213	26.5	(15.9, 40.6)	26.6
West	181	17.6	(10.4, 28.3)	11.8
Mother's education				
Never attended school	477	68.0	(62.8, 72.8)	--
Completed primary school or less	99	12.7	(10.2, 15.8)	--
Some or completed secondary+	170	19.3	(15.4, 23.8)	--
TOTAL	839	100.0	--	

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 weighted for unequal probability of selection.

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

[c] Sierra Leone DHS 2013

3.3.2. Low birth weight

Mothers and caretakers reported that nearly 70% of participating children were weighed at birth (see Table 8-1, APPENDIX 8). Of these, nearly 50% had their birthweight recorded on health cards. Of the children without a recorded birthweight, mothers of only 17.4% could recall the child's birthweight. Among children with either recorded or recalled birthweights, 5.0% weighed less than 2.5 kg, the threshold for low birthweight (see Table 8-2, APPENDIX 8). The prevalence of low birthweight in the survey sample did not statistically significantly differ by mother's age at birth, child's sex, urban vs. rural residence, mother's education, or household wealth; however, the regions of Sierra Leone had significantly different prevalence rates of low birthweight. The prevalence of birth weight calculated separately for children with birthweight recorded on health cards and birthweights recalled by the mother were similar; 4.8% versus 6.5%, respectively (data not shown).

3.3.3. Recent illness and treatment

Almost one-third of children had diarrhea in the two weeks prior to the survey, and about 6% of children had diarrhea with blood (see Table 18). Fever was very common; almost three-quarters of children had a caregiver-reported fever in the past two weeks. About 10% of children had lower respiratory infections. A large majority of children had elevation of at least one marker of inflammation. Although a small number were in the incubation phase with only elevated CRP, more than 40% of children were in the early convalescent phase with elevation of both CPR and AGP, and nearly 30% were in the late convalescent phase with only elevated AGP.

For children with reported fever in the past 2 weeks, nearly half were taken for health care and were reported to have been tested for malaria (see Table 19). More than 80% of these children were reported to be positive for malaria infection.

More than half of children 6-59 months of age who were tested for *P. falciparum* infection as a part of survey data collection were positive (see Table 20). There was virtually no difference in malaria infection prevalence by child's sex; however, malaria infection increased progressively with age and is more common in rural children, children in the Northern Region, and children whose mothers have less education. The prevalence of malaria infection also declined with increasing household wealth.

Table 18. Proportion of preschool age children with caregiver-reported diarrhea, fever, cough and measured inflammation, Sierra Leone 2013.

Characteristic	n	% [a]	(95% CI) [b]
Diarrhea in the past 2 weeks			
Yes	238	30.0	(26.4, 34.0)
No	600	70.0	(66.0, 73.6)
Diarrhea with blood in the past 2 weeks			
Yes	41	5.6	(4.0, 7.9)
No	796	94.4	(92.1, 96.0)
Fever in the past 2 weeks			
Yes	593	72.4	(68.1, 76.3)
No	243	27.6	(23.7, 31.9)
Lower respiratory infection [c]			
Yes	80	10.5	(7.9, 13.9)
No	750	89.5	(86.1, 92.1)
Inflammation [d]			
None	209	27.7	(23.3, 32.6)
Incubation (elevated CRP only)	16	2.8	(1.6, 4.8)
Early convalescence (elevated CRP and AGP)	254	41.2	(36.3, 46.3)
Late convalescence (elevated AGP only)	188	28.3	(24.4, 32.6)
TOTAL RESPONDING	838	100	--

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] LRI defined as cough, fever, and difficulty breathing due to problem in chest

[d] CRP=C-reactive protein, AGP=alpha1-acid-glucoprotein

Table 19. Distribution of treatment of fever variables in children 0-59 months, Sierra Leone 2013.

Characteristic	n	% [a]	(95% CI) [b]
Malaria test given if child was ill with fever			
Yes	266	48.6	(43.1, 54.1)
No	317	51.4	(45.9, 56.9)
Malaria status if child was ill with fever and tested for malaria			
Positive	217	82.4	(75.2, 87.8)
Negative	44	17.6	(12.2, 24.8)
TOTAL RESPONDING	583	100	--

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.

Table 20. Proportion testing positive on malaria rapid diagnostic test for *P. falciparum* in children 6-59 months of age, by various characteristics, Sierra Leone 2013.

Characteristic	n	Malaria %[a, b]	(95% CI)[c]	P value [d]
Age Group (in months)				
6-11	43	38.5	(27.9, 50.3)	<0.001
12-23	72	45.0	(35.2, 55.2)	
24-35	66	51.8	(39.3, 64.2)	
36-47	100	62.4	(52.7, 71.2)	
48-59	74	65.8	(53.4, 76.4)	
Sex				
Male	171	53.0	(44.8, 61.1)	0.849
Female	186	52.1	(44.1, 60.0)	
Residence				
Urban	124	40.4	(31.3, 50.2)	<0.01
Rural	233	59.9	(50.9, 68.3)	
Region				
East	87	54.3	(43.0, 65.2)	<0.001
North	144	67.2	(55.8, 77.0)	
South	94	49.7	(38.2, 61.2)	
West	32	26.8	(17.6, 38.5)	
Mother's Education				
Never attended school	218	55.3	(46.7, 63.5)	<0.01
Completed primary school or less	46	57.0	(45.3, 68.1)	
Some or completed secondary+	44	35.4	(25.8, 46.3)	
Wealth Quintile				
Lowest	93	57.5	(43.1, 70.8)	<0.001
Second	80	60.4	(49.4, 70.5)	
Middle	83	63.8	(53.6, 72.8)	
Fourth	71	48.5	(39.3, 57.8)	
Highest	25	23.8	(14.1, 37.3)	
ALL CHILDREN	357	52.6	(46.0, 59.0)	--

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data. Total sample size = 723.

[a] Percentages weighted for unequal probability of selection.

[b] Malaria %= % of children identified as malaria positive using rapid diagnostic tests for *plasmodium falciparum*

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

[d] 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

3.3.4. Infant and young child feeding indicators

Table 21 presents several of the standard infant and young child feeding indicators recommended by WHO and UNICEF [31]. For children 0-23 months, two-thirds of mothers reported initiating breastfeeding in the first hour after the child's birth; however, less than one-half of children 0-6 months old were reported to be exclusively breastfed the day prior

to the interview. Continued breastfeeding was nearly universal among children 12-15 months of age.

Table 21. Proportion of children with various infant and young child feeding indicators in children 0-23 months of age, Sierra Leone 2013.

Characteristic	n	%[a]	(95% CI)[b]
Early initiation of breastfeeding [c]			
Initiated breastfeeding in first hour after birth	211	66.0	(58.6, 72.7)
Initiated breastfeeding in 1-12 hours after birth	74	22.8	(16.8, 30.3)
Initiated breastfeeding in >12 hours after birth	34	11.1	(7.1, 17.1)
Exclusive breastfeeding under 6 months [d]			
Exclusively breastfed the day before the interview	36	41.9	(29.4, 55.4)
Continued breastfeeding at 1 year [e]			
Breastfed the day before the interview	53	89.3	(80.5, 94.4)
Introduction of solid, semi-solid or soft foods [f]			
Eating complementary food the day before the interview	24	42.4	(28.3, 57.9)
Minimum dietary diversity [g]			
Adequate dietary diversity the day before the interview	102	35.2	(27.8, 43.3)
Minimum meal frequency [g]			
Adequate meal frequency the day before the interview	51	25.9	(19.2, 33.9)
Minimum acceptable diet [g]			
Acceptable diet the day before the interview	26	13.0	(8.2, 20.0)

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 weighted for unequal probability of selection.

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

[c] Results presented for all children <24 months of age

[d] Results presented for all children <6 months of age

[e] Results presented for children 12-15 months of age

[f] Results presented for children 6-8 months of age

[g] Results presented for children 6-23 months of age

Even though children older than 6 months of age need more energy and nutrients than breast milk alone can provide, less than one-half of children 6-8 months had received complementary foods the day before the survey. For children 6-23 months of age, only about one-third of children had a sufficiently diverse diet, and less than one-quarter ate with sufficient frequency. Within this age group, few children had a minimally acceptable diet, an indicator combining diversity and frequency. See Table A8-3 - Table A8-9 in APPENDIX 8 for subgroup analyses of these feeding indicators by age group, sex, urban vs rural residence, region, mother's education and household wealth

The infant and child feeding index was also calculated from the survey data using a recently proposed method [32], which combines multiple infant and young child feeding (IYCF) practices into a single composite IYCF indicator. This indicator is comprised of exclusive breastfeeding in children aged under six months and a score for continued breastfeeding,

adequate dietary diversity, and adequate meal frequency in older children. Only 16.5% of 324 children less than 24 months of age had "good" feeding practices as defined by exclusive breastfeeding or a score of 6.

3.3.5. Consumption of vitamins and supplements

Relatively few children had consumed RUTF or infant formula with iron the day prior to the survey (see Table 22). In the six months prior to the survey, almost 40% of children were given iron tablets or syrup, and about one-quarter were given multivitamins. Nearly 82% of children had received a vitamin A capsule within the 6 months prior to survey data collection[4]. In addition, nearly 62% of children received deworming medication (e.g. Albendazole) during this 6-month time period.

Table 22. Proportion of children 6-59 months of age consuming RUTF, vitamins and mineral supplements, Sierra Leone, 2013.

Characteristic	n	% [a]	(95% CI) [b]
Consumed Ready-to-use Therapeutic Food (RUTF)			
Yes	46	6.0	(4.0, 9.1)
No	710	94.0	(90.9, 96.0)
Consumed infant formula with added iron			
Yes	59	6.6	(4.6, 9.3)
No	659	88.7	(85.5, 91.3)
Don't know	37	4.7	(3.2, 6.8)
Given iron tablets or syrup in past six months			
Yes	333	40.5	(34.6, 46.6)
No	403	57.2	(50.3, 63.8)
Don't know if it was iron	16	2.4	(0.8, 6.6)
Given multi-vitamins in past six months			
Yes	194	24.2	(17.9, 31.9)
No	512	71.2	(63.6, 77.8)
Don't know if it was iron	36	4.5	(2.7, 7.5)
Was given a vitamin A capsule in past six months [c]			
Yes	520	81.5	(75.8, 86.2)
No	81	13.3	(9.7, 18.0)
Don't know	30	5.2	(2.6, 9.9)
Deworming medication given during last health week [d]			
Yes	345	61.4	(55.0, 64.6)
No	164	33.8	(28.1, 40.0)
Don't know	24	4.8	(2.7, 8.4)

Note: The n's are un-weighted numerators for 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] Includes only children 12-59 months of age.

[d] Includes only children 18-59 months of age.

[4] The Mother and Child Health Week preceding the SLMS (by approximately 5 months) was undertaken in June 2013.

3.3.6. Anemia, iron deficiency, and iron deficiency anemia

More than 75% of children were anemic (see Table 23). About 5% of anemia in children is classified as severe, whereas 46% and 25% are classified as moderate and mild, respectively (see Table A8-10 in APPENDIX 8). According to WHO, a prevalence of anemia ≥40% is considered a severe public health problem [8]. Anemia prevalence did not statistically significantly differ by child's sex, but there were significant differences in anemia prevalence by age, urban vs. rural residency, region, mother's education, and household wealth. Anemia prevalence appears to decrease as child's age and mother's education level increase. Anemia is more common in rural areas and in the North and East regions. Although the prevalence of anemia is substantially lower among children in the wealthiest households, it still exceeds 50%.

Only 5% of children are iron deficient and only about 4% of children have iron deficiency anemia. As a result, the comparisons of the prevalence of iron deficiency and iron deficiency anemia among population subgroups may lack statistical power. Only age is statistically significantly associated with iron deficiency anemia. Figure 3 illustrates the overlap between anemia and iron deficiency in children 6-59 months of age.

Figure 3. Venn diagram showing overlap between anemia and iron deficiency in children 6-59 months of age, Sierra Leone, 2013

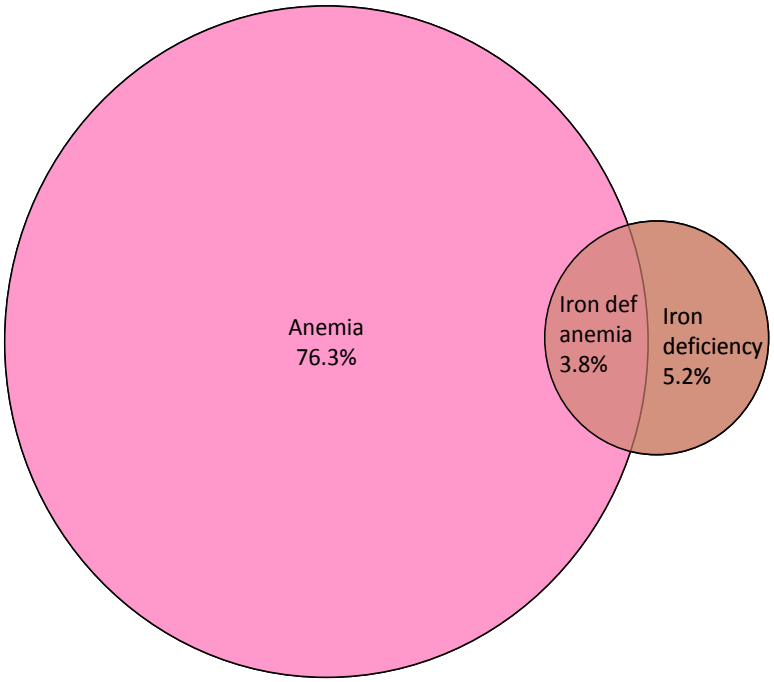


Table 23. Anemia, iron deficiency, and iron deficiency anemia in pre-school age children 6-59 months of age, Sierra Leone 2013.

	Anemia				Iron deficiency				Iron deficiency anemia			
Characteristic	n	% [a, b]	(95% CI)[c]	P value [d]	n	% [a, e]	(95% CI)[c]	P value [d]	n	% [a, f]	(95% CI)[c]	P value [d]
Age Group (in months)												
6-11	102	88.1	(76.9, 94.3)	<0.001	6	6.6	(3.0, 13.7)	<0.001	6	6.6	(3.0, 13.7)	<0.001
12-23	132	73.7	(64.4, 81.3)		12	8.8	(3.9, 18.8)		10	4.8	(2.2, 10.0)	
24-35	95	76.9	(69.4, 83.0)		7	6.4	(2.9, 13.4)		6	4.5	(2.0, 9.9)	
36-47	120	76.5	(68.6, 82.9)		6	3.6	(1.6, 8.2)		6	3.6	(1.5, 8.0)	
48-59	83	68.9	(60.0, 76.6)		0	--	--		0	--	--	
Sex												
Male	261	78.3	(71.9, 83.6)	0.331	18	7.3	(3.9, 13.0)	0.050	15	4.6	(2.4, 8.4)	0.367
Female	271	74.5	(68.5, 79.7)		13	3.2	(1.8, 5.5)		13	3.1	(1.8, 5.3)	
Residence												
Urban	220	67.7	(60.9, 73.9)	<0.01	11	4.6	(2.2, 9.2)	0.659	9	3.0	(1.6, 5.6)	0.403
Rural	312	81.6	(75.1, 86.7)		20	5.6	(3.2, 9.6)		19	4.3	(2.5, 7.2)	
Region												
East	124	82.7	(75.7, 88.0)	<0.001	7	5.7	(2.5, 12.5)	0.385	7	5.5	(2.4, 12.2)	0.430
North	184	83.2	(73.7, 89.7)		14	7.2	(3.7, 13.6)		12	4.4	(2.4, 8.0)	
South	139	74.3	(65.8, 81.3)		5	2.4	(0.9, 6.6)		5	2.4	(0.8, 6.4)	
West	85	58.4	(51.8, 64.8)		5	4.8	(1.5, 14.1)		4	2.7	(1.1, 6.4)	
Mother's Education												
Never attended school	328	81.3	(75.7, 85.8)	<0.001	18	5.7	(3.2, 10.1)	0.685	15	3.5	(2.0, 6.3)	0.536
Comp. primary school or less	65	79.6	(67.3, 88.1)		6	6.5	(2.7, 14.6)		6	6.3	(2.7, 14.2)	
Some or comp. secondary+	84	63.7	(55.0, 71.7)		4	3.8	(1.3, 10.4)		4	3.7	(1.3, 10.1)	
Wealth Quintile												
Lowest	126	79.4	(69.7, 86.6)	<0.001	10	7.4	(3.1, 16.7)	0.400	9	4.4	(2.0, 9.6)	0.932
Second	115	83.1	(75.2, 88.8)		3	2.8	(0.9, 8.3)		3	2.7	(0.9, 8.2)	
Middle	102	81.0	(71.0, 88.1)		8	7.6	(3.4, 16.2)		6	4.6	(1.8, 11.3)	
Fourth	109	77.0	(69.3, 83.2)		5	3.8	(1.5, 9.3)		5	3.7	(1.5, 9.0)	
Highest	65	52.2	(43.2, 61.2)		5	4.3	(1.8, 9.8)		5	4.1	(1.7, 9.6)	
ALL CHILDREN	532	76.3	(71.8, 80.4)		31	5.2	(3.3, 8.1)		28	3.8	(2.5, 5.8)	

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data. Total sample size: anemia=710, ID=654, IDA=668.

[a] Percentages weighted for unequal probability of selection.

[b] Anemia defined as hemoglobin < 110 g/L adjusted for altitude.

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

[d] 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

[e] ID= Iron deficiency defined as plasma ferritin < 12 µg/l, values are adjusted for inflammation according to Thurnham

[f] IDA= Iron deficiency anemia, defined as low Hb (< 110 g/L) with low plasma ferritin (< 12.0 µg/L).

Significant differences in anemia prevalence were not found between children eating iron-fortified foods the day before the survey or taking iron supplements or multivitamins containing iron in the 6 months prior to the survey compared to those not consuming iron-fortified foods or taking these supplements (see Table 24). Only consumption of RUTF the day before the interview was associated with a reduced prevalence of anemia; however, relatively few children had eaten it.

Table 24. Anemia in pre-school age children 6-59 months of age, by RUTF and vitamins and mineral supplement indicators , Sierra Leone 2013.

Characteristic	n	Anemia %[a, b]	(95% CI)[c]	P value [d]
Consumed iron-fortified foods yesterday				
Yes	35	68.8	(54.6, 80.2)	0.20
No	497	77.0	(72.2, 81.1)	
Consumed RUTF yesterday				
Yes	23	57.1	(44.1, 69.3)	<0.01
No	509	77.6	(72.9, 81.7)	
Consumed iron tablets or syrup in past six months				
Yes	225	75.0	(69.4, 79.8)	0.39
No	293	76.8	(70.6, 82.1)	
Not sure	12	86.8	(72.5, 94.3)	
Consumed multivitamins in past six months				
Yes	145	79.2	(71.4, 85.2)	0.64
No	352	75.0	(69.8, 79.7)	
Not sure	24	76.0	(52.3, 90.2)	
ALL CHILDREN	532	76.5	--	

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data. Total sample size=710.

[a] Percentages weighted for unequal probability of selection.

[b] Anemia defined as hemoglobin < 110 g/L adjusted for altitude.

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

[d] 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

No significant difference in anemia prevalence was found by deworming status or recently having bloody diarrhea, fever, or lower respiratory infection (see Table 25). Children with a positive malaria rapid tests or any type of diarrhea in the 2 weeks prior to the survey had significantly higher prevalence rates of anemia, and children with no inflammation had a lower prevalence of anemia.

Table 25. Anemia in pre-school age children 6-59 months of age, by infection-related characteristics and vitamin A status, Sierra Leone 2013.

Characteristic	n	Anemia % [a, b]	(95% CI) [c]	P value [d]
Malaria status [e]				
Positive	311	88.2	(83.3, 91.8)	<0.001
Negative	228	63.0	(57.0, 68.6)	
Received deworming medication in past six months				
Yes	264	72.4	(66.8, 77.4)	0.48
No	150	77.4	(67.9, 84.7)	
Don't know	16	67.5	(44.8, 84.2)	
Child had any type of diarrhea in the past 2 weeks				
Yes	162	80.9	(74.6, 86.0)	<0.05
No	369	74.2	(69.0, 78.8)	
Child had diarrhea with blood in the past 2 weeks				
Yes	33	88.5	(73.0, 95.7)	0.237
No	128	78.9	(70.8, 85.3)	
Child had a fever in the past 2 weeks				
Yes	393	76.3	(71.6, 80.5)	0.952
No	136	76.1	(67.0, 83.3)	
Child had lower respiratory infection				
Yes	60	79.2	(63.7, 89.1)	0.651
No	466	75.9	(70.9, 80.3)	
Inflammation				
None	119	58.6	(49.2, 67.3)	<0.001
Incubation (elevated CRP only)	12	84.3	(55.4, 95.9)	
Early convalescence (elevated CRP and AGP)	219	87.7	(80.7, 92.4)	
Late convalescence (elevated AGP only)	136	77.0	(69.5, 83.1)	
Vitamin A deficient				
Yes (RBP<0.7 µmol/L)	148	83.9	(74.5, 90.4)	<0.05
No (RBP≥0.7 µmol/L)	338	73.5	(68.1, 78.3)	
ALL CHILDREN	539	77.5	--	

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data. Total sample size=710.

[a] Percentages weighted for unequal probability of selection.

[b] Anemia defined as hemoglobin < 110 g/L adjusted for altitude.

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

[d] 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

[e] Positive malaria status identified using rapid diagnostic tests during SLMS data collection

[f] Includes only children 12-59 months of age

3.3.7. Vitamin A deficiency

Nationally, 17% of children had vitamin A deficiency, denoting a moderate public health problem according to WHO classifications [33]. No statistically significant differences by child age, sex, urban vs. rural residence, mother's education, household wealth, or vitamin A supplementation in the past 6 months.

Table 26. Proportion of children 6-59 months of age with vitamin A deficiency, by various characteristics, Sierra Leone 2013.

Characteristic	n	Vitamin A deficiency %[a, b]	(95% CI)[c]	P value [d]
Age Group (in months)				
6-11	16	15.8	(9.1, 26.0)	0.385
12-23	22	14.0	(9.4, 20.2)	
24-35	24	18.7	(10.8, 30.5)	
36-47	25	15.5	(9.9, 23.4)	
48-59	25	24.1	(15.3, 35.8)	
Sex				
Male	47	15.4	(11.0, 21.1)	0.269
Female	65	19.4	(14.4, 25.5)	
Residence				
Urban	43	15.6	(11.1, 21.4)	0.439
Rural	69	18.5	(13.7, 24.4)	
Region				
East	25	16.0	(10.8, 23.0)	0.310
North	46	21.7	(16.0, 28.8)	
South	26	15.8	(9.4, 25.3)	
West	15	12.9	(7.0, 22.6)	
Mother's Education				
Never attended school	67	17.5	(13.3, 22.6)	0.334
Completed primary school or less	15	20.4	(10.9, 34.9)	
Some or completed secondary+	13	11.8	(6.8, 19.8)	
Wealth Quintile				
Lowest	20	12.2	(7.0, 20.4)	0.185
Second	28	23.6	(16.1, 33.3)	
Middle	28	22.9	(14.8, 33.6)	
Fourth	23	16.7	(10.0, 26.4)	
Highest	13	14.0	(6.7, 27.1)	
Vitamin A supplement receive in past 6 months				
Yes	93	17.5	(13.7, 22.0)	0.844
No	14	15.9	(8.7, 27.2)	
Not sure/don't know	5	21.6	(8.0, 46.5)	
ALL CHILDREN	112	17.4	(13.9, 21.6)	--

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data. Total sample size=654.

[a] Percentages weighted for unequal probability of selection.

[b] Vitamin A deficiency (VAD) defined as retinol binding protein (RBP) <0.70 µmol/L; RBP concentrations adjusted for inflammation.

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

[d] 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

3.4. All Women

3.4.1. Pregnancy and birth history

Table 27 below shows the distribution of pregnancy related variables among all women, both non-pregnant and pregnant, who were randomly selected for the survey sample. More than 50% of the responding women had 3 or more pregnancies and delivered 3 or more children. Almost one-third were breastfeeding at the time of survey data collection.

Table 27. Distribution of pregnancy and birth variables in randomly selected non-pregnant women 15 - 49 years of age and pregnant women

Characteristic	n	% [a]	(95% CI)[b]
Currently Pregnant			
Yes	178	8.6	(7.3, 10.0)
No	945	91.4	(90.0, 92.7)
Currently lactating			
Yes	254	30.3	(26.0, 35.1)
No	638	65.8	(60.9, 70.4)
Don't know	30	3.9	(2.2, 7.0)
Number of pregnancies			
0	167	17.7	(14.6, 21.2)
1	192	20.7	(17.0, 24.9)
2	174	17.3	(14.9, 20.1)
3	142	14.4	(12.3, 16.7)
4	131	14.0	(11.8, 16.6)
5	99	9.5	(7.7, 11.7)
6	63	7.2	(5.6, 9.2)
7+	155	16.8	(13.9, 20.2)
Number of births (live and still)			
0	35	2.4	(1.7, 3.5)
1	211	23.1	(19.1, 27.7)
2	169	17.3	(14.6, 20.4)
3	130	15.0	(12.4, 18.1)
4	120	12.7	(10.5, 15.4)
5	90	9.2	(7.2, 11.5)
6	63	6.8	(5.2, 8.9)
7+	138	15.8	(13.0, 19.2)
TOTAL RESPONDING	1123	100	--

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 salt and vegetable oil

Only about one-quarter of non-pregnant women had heard of fortified vegetable oil, and few knew of any benefits from its consumption (see Table 28). Similar results are seen for familiarity with iodized salt and knowledge of its benefits.

Table 28. Extent of knowledge about and use of fortified foods in all women (non-pregnant 15 - 49 years and pregnant)

Characteristic	n	% [a]	(95% CI) [b]
Have heard of fortified vegetable oil			
Yes	289	26.1	(19.5, 34.1)
No	802	73.9	(65.9, 80.5)
Reported benefits of fortified vegetable oil [c]			
Prevents blindness	13	4.5	(2.4, 8.1)
Reduces mortality	3	1.0	(0.3, 3.3)
Prevents vitamin deficiency	6	1.5	(0.5, 4.1)
Improves health status	56	19.3	(13.0, 27.7)
Don't know any benefit	211	74.9	(65.9, 82.3)
Have heard of iodized salt			
Yes	310	27.3	(22.6, 32.6)
No	809	72.7	(67.4, 77.4)
Reported benefits of iodized salt [c]			
Prevents goiter	47	13.7	(8.9, 20.5)
Improves intelligence	2	0.7	(0.1, 3.4)
Prevents iodine deficiency	4	1.3	(0.3, 4.5)
Improves health status	64	19.9	(14.2, 27.2)
Don't know any benefit	190	64.6	(56.1, 72.3)
TOTAL RESPONDING	1091	100.0	--

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 weighted for unequal probability of selection.

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

[c] Benefits of fortified vegetable oil and salt only asked of women who had heard of fortified flour previously. Respondents could report more than one benefit.

3.5. Non-pregnant women of reproductive age

3.5.1. Characteristics

Non-pregnant women included in the survey sample were disproportionately young compared to the age distribution in the general population. More than one-half had never attended school, and more than two-thirds were illiterate. Two-thirds were married at the time of data collection. One-third of women had no job outside the home; however, almost one-quarter had a skilled or professional job. Smoking was relatively uncommon among non-pregnant women.

Table 29. Description of sampled non-pregnant women (15 - 49 years), Sierra Leone 2013.

	Survey Sample			DHS 2013 sample
Characteristic	n	% [a]	(95% CI) [b]	% [c]
Age Group (in years)				
15-19	186	22.2	(18.9, 25.8)	23.3
20-24	178	20.5	(17.3, 24.1)	16.1
25-29	165	17.1	(14.2, 20.6)	17.1
30-34	131	13.0	(10.7, 15.7)	13.7
35-39	117	12.1	(9.7, 15.1)	13.6
40-44	82	8.9	(6.7, 11.8)	8.2
45-49	57	6.2	(4.5, 8.4)	8.1
Residence				
Urban	482	44.6	(40.5, 48.8)	35.6
Rural	463	55.4	(51.2, 59.5)	64.4
Province				
East	181	17.8	(9.9, 29.9)	21.1
North	289	35.2	(23.5, 49.1)	37.8
South	240	24.2	(14.5, 37.5)	21.1
West	235	22.8	(13.7, 35.5)	19.4
Woman's Education				
Never attended school	524	55.4	(49.6, 61.1)	55.8
Completed primary school or less	106	11.3	(9.3, 13.6)	14.0
Some or completed secondary+	315	33.3	(27.9, 39.2)	30.2
Woman's Literacy				
Illiterate	646	68.0	(62.2, 73.3)	61.8
Partly or fully literate	296	32.0	(26.7, 37.8)	38.2
Marital Status				
Never married, never lived with man	243	29.1	(24.3, 34.3)	28.4
Currently married or living with man	659	66.6	(61.6, 71.2)	65.4
Divorced or separated	27	2.7	(1.6, 4.4)	3.6
Widowed	16	1.7	(1.0, 2.8)	2.5
Occupation				
No job	307	33.2	(27.4, 39.6)	--
Agriculture or unskilled labor	328	37.7	(31.8, 44.0)	--
Skilled labor or professional	251	23.1	(19.1, 27.6)	--
Student	52	6.0	(3.8, 9.3)	--
Cigarette Smoking				
Smokes cigarettes	43	4.4	(3.1, 6.3)	
Does not smoke	902	95.6	(93.7, 96.9)	91.8
TOTAL	945	100.0	--	

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 weighted for unequal probability of selection.

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

[c] Frequency distribution from 2013 DHS.

3.5.2. Dietary diversity and consumption of vitamins and supplements

Most non-pregnant women had consumed foods from 4-6 food groups in the 24 hours prior to their survey interview (see Table 30). One-quarter had taken iron supplementation and more than one-third had taken folic acid tablets in the prior 6 months. A smaller proportion reported having taken multivitamins during this time period. Almost two-thirds of women had taken iron or folic acid supplements for more than 3 months during their most recent pregnancy, and almost one-half had received vitamin A supplementation after their most recent delivery.

Table 30. Food and vitamin supplement consumption in non-pregnant women 15 - 49 years, Sierra Leone 2013.

Characteristic	n	% [a]	(95% CI) [b]
Number of food groups consumed (out of 9 possible)			
2	13	1.5	(0.9, 2.6)
3	77	9.0	(6.4, 12.6)
4	195	21.2	(17.4, 25.7)
5	289	30.1	(26.1, 34.4)
6	248	26.1	(21.8, 30.8)
7	96	10.5	(7.9, 13.7)
8	13	1.5	(0.7, 3.0)
9	2	0.1	(0.0, 0.4)
Mean number of food groups	933	5.1	(4.9, 5.2)
Consumed iron tablets or syrup in past six months			
Yes	246	24.9	(20.9, 29.4)
No	677	75.1	(70.6, 79.1)
Consumed folic acid tablets in past six months			
Yes	328	35.7	(31.1, 40.6)
No	596	64.3	(59.4, 68.9)
Consumed multi-vitamin supplements in past six months			
Yes	186	18.7	(14.5, 23.9)
No	733	78.8	(73.7, 83.1)
Not sure it was multi-vitamins	26	2.5	(1.5, 4.0)
Consumed iron or folic acid supplements during last pregnancy for 90 days or more			
Yes	525	65.8	(59.4, 71.7)
No	233	30.8	(25.3, 36.9)
Don't know	29	3.4	(2.0, 5.7)
Consumed vitamin A capsule after last delivery [c]			
Yes	382	48.3	(42.2, 54.5)
No	358	45.6	(40.1, 51.2)
ALL NON-PREGNANT WOMEN	933	100	--

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] Does not include women who have never been pregnant.

3.5.3. Malaria

As shown in Table 31, approximately 35% of non-pregnant women tested positive for *P. falciparum* malaria infection at the time of the survey. The prevalence of malaria did not differ significantly by age or educational status. It was significantly lower in urban areas. The Western Area, which includes Sierra Leone's capital Freetown, had the lowest prevalence of malaria. Although just not statistically significant, there is some suggestion that malaria infection has a lower prevalence in women in the wealthiest households, when compared to the women living in poorer households.

Table 31. *P. falciparum* infection in non-pregnant women 15 - 49 years, Sierra Leone 2013.

Characteristic	n	%pf [a, b]	(95% CI)[c]	P Value[d]
Age Group (in years)				
15-19	63	40.2	(31.6, 49.6)	0.586
20-24	53	33.6	(25.3, 43.1)	
25-29	38	34.0	(21.9, 48.8)	
30-34	38	36.9	(24.9, 50.9)	
35-39	26	29.6	(20.1, 41.3)	
40-44	20	27.0	(17.9, 38.6)	
45-49	10	26.6	(14.8, 43.2)	
Residence				
Urban	105	28.6	(22.7, 35.3)	<0.05
Rural	161	40.2	(32.9, 48.0)	
Province				
East	67	40.5	(30.9, 50.8)	<0.01
North	101	42.3	(31.7, 53.6)	
South	65	34.5	(28.1, 41.4)	
West	33	20.1	(14.4, 27.3)	
Women's Education				
Never attended school	164	35.8	(28.1, 44.2)	0.561
Completed primary school or less	31	40.3	(28.9, 52.8)	
Some or completed secondary+	71	32.1	(25.2, 39.9)	
Wealth Quintile				
Lowest	68	45.4	(33.6, 57.7)	0.056
Second	51	32.2	(23.9, 41.7)	
Middle	57	40.3	(30.9, 50.4)	
Fourth	52	33.7	(24.0, 45.0)	
Highest	34	26.1	(19.4, 34.2)	
ALL NON-PREGNANT WOMEN	266	35.1	(30.1, 40.4)	--

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data. Total sample size=833

[a] Percentages weighted for unequal probability of selection.

[b] %pf= % of women identified as malaria positive using rapid diagnostic tests for *P. falciparum*

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

[d] 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

3.5.4. Anemia, iron deficiency, and iron deficiency anemia

Nearly 45% of non-pregnant women are anemic (see Table 32). Only 1% of non-pregnant were severely anaemia, whereas moderate and mild anemia was present in 20% and 25% of women, respectively (see Table A9-1 in APPENDIX 9). Similar to children, iron deficiency is uncommon, and the overlap between anemia and iron deficiency is quite small: only about 8% of non-pregnant women are iron deficient, and only 6% of women have concurrent anemia and iron deficiency. No significant differences in the prevalence of anemia, iron deficiency, or iron deficiency anemia were observed by age, urban vs. rural residence, region, educational status, or household wealth.

Although not statistically significant, it appeared that women who had taken iron or folic acid supplementation in the prior 6 months may have a slightly lower prevalence of anemia; however, it also appears that these women have a slightly higher prevalence of iron deficiency (see Table 33). Women who tested positive for malaria had a substantially higher prevalence of anemia, but their prevalence of iron deficiency was about the same as women who tested negative. Women in early convalescent phase, with elevation of both CRP and AGP, had a substantially elevated prevalence of anemia compared to other women, and women in late convalescence had a lower prevalence of anemia. On the other hand, neither iron deficiency nor iron deficiency anemia were statistically significantly associated with markers of inflammation.

Table 32. Anemia, iron deficiency, and iron deficiency anemia in non-pregnant women (15 - 49 years), Sierra Leone 2013.

		Anemia [b]			Iron deficiency [e]				Iron deficiency anemia [f]			
Characteristic	n	%[a]	(95% CI)[c]	P value[d]	n	%[a]	(95% CI)[c]	P value[d]	n	%[a]	(95% CI)[c]	P value[d]
Age group (in years)												
15-19	81	46.0	(36.6, 55.7)	0.263	17	10.3	(5.6, 18.2)	0.595	14	7.5	(3.6, 14.7)	0.703
20-24	68	41.0	(32.2, 50.4)		15	10.2	(5.6, 17.7)		9	5.4	(2.6, 11.1)	
25-29	64	38.0	(30.0, 46.7)		10	5.5	(2.7, 10.9)		9	4.7	(2.2, 9.7)	
30-34	52	47.3	(37.0, 57.7)		9	9.8	(4.9, 18.7)		8	8.1	(3.7, 16.6)	
35-39	51	49.6	(37.3, 62.0)		6	8.7	(3.4, 20.6)		6	8.2	(3.2, 19.7)	
40-44	33	45.9	(32.7, 59.7)		5	5.8	(2.4, 13.2)		3	3.4	(1.1, 10.4)	
45-49	31	60.4	(44.4, 74.4)		2	3.2	(0.8, 12.6)		2	3.0	(0.7, 11.7)	
Residence												
Urban	184	42.9	(36.4, 49.6)	0.474	28	7.8	(5.0, 12.0)	0.719	22	5.6	(3.5, 8.9)	0.644
Rural	206	46.2	(39.7, 52.9)		37	8.7	(5.8, 12.9)		30	6.5	(4.1, 10.3)	
Province												
East	86	46.0	(34.3, 58.2)	0.481	16	9.9	(5.6, 17.1)	0.706	11	5.6	(2.7, 11.2)	0.978
North	130	48.5	(39.4, 57.7)		17	7.0	(3.7, 12.9)		16	6.5	(3.3, 12.5)	
South	102	43.5	(34.8, 52.5)		16	7.5	(4.5, 12.3)		14	5.8	(3.2, 10.4)	
West	72	39.2	(34.1, 44.7)		16	9.9	(5.8, 16.3)		11	6.4	(3.6, 11.2)	
Woman's education												
Never attended school	229	46.2	(40.1, 52.5)	0.630	36	7.9	(5.4, 11.5)	0.384	31	6.5	(4.2, 10.0)	0.789
Comp. PS or less	48	45.6	(32.6, 59.2)		6	4.9	(2.2, 10.8)		6	4.5	(2.0, 9.9)	
Some or comp. SS+	113	41.9	(35.6, 48.5)		23	10.1	(5.9, 16.8)		15	6.1	(3.0, 11.7)	
Wealth quintile												
Lowest	86	50.9	(41.6, 60.1)		9	4.6	(2.2, 9.2)		8	3.9	(1.8, 8.2)	0.703
Second	78	44.9	(35.5, 54.6)		13	8.6	(4.7, 15.3)		12	7.6	(4.0, 14.2)	
Middle	78	44.0	(33.5, 55.0)		14	9.0	(5.1, 15.6)		11	6.8	(3.4, 13.0)	
Fourth	76	44.5	(34.4, 55.1)		15	12.2	(6.7, 21.3)		11	7.0	(3.5, 13.6)	
Highest	60	38.5	(32.3, 45.1)	0.485	13	7.8	(4.5, 13.3)	0.309	9	5.6	(2.8, 11.1)	
ALL NON-PREGNANT WOMEN	390	44.8	(40.1, 49.5)	--	65	8.3	(6.2, 11.1)	--	52	6.1	(4.4, 8.6)	--

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. Total sample size: anemia=871, ID=774, IDA=827

[b] Anemia defined as hemoglobin < 120 g/L adjusted for altitude and smoking.

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

[d] 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

[e] Iron deficiency defined as plasma ferritin < 15.0 µg/l, values are adjusted for inflammation according to Thurnahm

[f] Iron deficiency anemia defined as low Hb (< 120 g/L) with low plasma ferritin (< 15.0µg/L).

Table 33. Anemia, iron deficiency, and iron deficiency anemia in non-pregnant women (15 - 49 years) by supplement consumption and malaria status, Sierra Leone 2013.

	Anemia [b]				Iron deficiency [e]				Iron deficiency anemia [f]			
Characteristic	n	%[a]	(95% CI)[c]	P value[d]	n	%[a]	(95% CI)[c]	P value[d]	n	%[a]	(95% CI)[c]	P value[d]
Consumed iron tablets or syrup in past six months												
Yes	89	40.9	(33.3, 48.9)	0.23	21	11.3	(6.9, 18.0)	0.21	18	8.3	(5.0, 13.6)	0.285
No	295	46.5	(40.9, 52.2)		43	7.5	(5.0, 11.1)		34	5.6	(3.5, 8.8)	
Consumed folic acid tablet in past six months												
Yes	124	40.5	(33.7, 47.7)	0.16	28	11.1	(7.4, 16.2)	0.09	24	7.8	(5.3, 11.4)	0.213
No	259	47.5	(40.9, 54.1)		36	7.0	(4.7, 10.4)		28	5.4	(3.4, 8.7)	
Folate status												
Deficient (<10 ηmol/L)	282	46.1	(40.6, 51.7)	0.218	54	9.1	(6.6, 12.5)	0.135	43	6.9	(4.8, 9.7)	0.278
Sufficient (≥10ηmol/L)	58	39.1	(29.8, 49.4)		7	5.0	(2.2, 11.1)		5	4.1	(1.5, 10.4)	
Consumed multi-vitamin tablets or syrup in past six months												
Yes	72	42.4	(34.9, 50.2)	0.47	13	11.2	(6.8, 17.9)	0.17	11	7.2	(4.2, 12.0)	0.510
No	308	45.3	(40.3, 50.5)		50	7.7	(5.5, 10.8)		39	5.9	(4.0, 8.7)	
Malaria status[g]												
Positive	149	54.4	(46.5, 62.1)	<0.01	25	8.6	(4.9, 14.7)	0.97	18	6.0	(2.8, 12.3)	0.843
Negative	221	39.3	(33.8, 45.1)		39	8.5	(6.0, 11.9)		33	6.5	(4.5, 9.3)	
Inflammation [h]												
None	257	45.6	(40.2, 51.2)	< 0.05	50	8.3	(5.9, 11.4)	0.55	41	6.6	(4.6, 9.2)	0.66
Incubation	25	41.3	(27.0, 57.2)		7	12.0	(4.9, 26.5)		5	8.9	(3.0, 23.1)	
Early convalescence	45	58.5	(47.3, 68.9)		3	4.6	(1.5, 13.9)		2	3.5	(0.9, 12.4)	
Late convalescence	17	27.6	(15.6, 43.9)		5	9.9	(3.7, 24.1)		4	8.6	(2.9, 23.2)	
ALL NON-PREGNANT WOMEN	390	44.8	(40.1, 49.5)	--	65	8.3	(6.2, 11.1)	--	52	6.1	(4.4, 8.6)	--

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. Total sample size: anemia=871, ID=774, IDA=827

[b] Anemia defined as hemoglobin < 120 g/L adjusted for altitude and smoking.

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

[d] 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

[e] ID= Iron deficiency defined as plasma ferritin < 15.0 µg/l, values adjusted for inflammation according to Thurnham

[f] IDA= Iron deficiency anemia, defined as low Hb (< 120 g/L) with low plasma ferritin (< 15.0µg/L).

[g] Malaria status identified using rapid diagnostic tests during SLMS data collection

[h] Incubation=CRP only; early convalescence=CRP and AGP; late convalescence=AGP only

3.5.5. Vitamin A deficiency

Only 1.8% of non-pregnant women had vitamin A deficiency. Due to such a low prevalence of small number of vitamin A-deficient women, there were no statistically significant differences in the prevalence of vitamin A deficiency by age, urban vs. rural residence, region, or household wealth (see Table 34).

Table 34. Vitamin A deficiency in non-pregnant women (15 - 49 years), Sierra Leone 2013.

Characteristic	n	%[a, b]	(95% CI)[c]	P value[d]
Age Group (in years)				
15-19	5	2.5	(0.9, 6.6)	0.878
20-24	4	2.1	(0.7, 6.7)	
25-29	2	1.0	(0.2, 4.1)	
30-34	2	2.2	(0.4, 10.7)	
35-39	3	2.4	(0.7, 7.4)	
40-44	2	1.8	(0.4, 7.6)	
45-49	0	--	--	
Residence				
Urban	11	2.2	(1.2, 4.0)	0.523
Rural	7	1.5	(0.6, 3.8)	
Province				
East	3	2.2	(0.5, 8.4)	0.859
North	8	2.2	(1.0, 4.4)	
South	4	1.6	(0.5, 5.1)	
West	3	1.2	(0.4, 3.7)	
Women's Education				
Never attended school	10	1.8	(0.9, 3.5)	0.271
Completed primary school or less	3	3.7	(1.1, 11.7)	
Some or completed secondary+	5	1.2	(0.5, 2.9)	
Wealth Quintile				
Lowest	4	2.6	(0.9, 7.0)	0.781
Second	2	1.1	(0.3, 4.2)	
Middle	5	1.8	(0.8, 4.5)	
Fourth	4	2.4	(0.8, 6.9)	
Highest	3	1.5	(0.5, 4.5)	
ALL NON-PREGNANT WOMEN	18	1.8	(1.1, 3.1)	--

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data. Total sample size=817

[a] Percentages weighted for unequal probability of selection.

[b] Vitamin A deficiency defined as retinol binding protein (RBP) <0.70 μmol/L; RBP concentrations adjusted for inflammation.

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

[d] 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

3.5.6. Folate deficiency

Almost four out of five of non-pregnant women were folate deficient. No significant difference was observed in the deficiency prevalence by urban/rural residence, region, educational attainment, or household wealth. Nor was there a statistically significant difference in the prevalence of folate deficiency between women who reported taking folate supplements in the past 6 months and those who did not. Significant differences were observed by age subgroup, with a marked decrease in folate deficiency in women ≥ 35 years of age (see Table 35).

Table 35. Plasma folate deficiency in non-pregnant women (15 - 49 years), Sierra Leone 2013.

Characteristic	n	Folate deficiency %[a, b]	(95% CI)[c]	P Value[d]
Age Group (in years)				
15-19	125	84.2	(74.8, 90.5)	<0.05
20-24	121	82.0	(73.5, 88.1)	
25-29	117	87.2	(79.3, 92.4)	
30-34	76	80.7	(69.6, 88.5)	
35-39	68	71.2	(59.2, 80.9)	
40-44	51	73.0	(59.4, 83.4)	
45-49	32	61.9	(39.5, 80.1)	
Residence				
Urban	328	82.3	(77.4, 86.3)	0.185
Rural	280	76.6	(68.2, 83.4)	
Region				
East	135	79.8	(61.2, 90.8)	0.180
North	180	75.7	(67.2, 82.6)	
South	163	88.2	(81.4, 92.8)	
West	130	74.9	(67.3, 81.2)	
Women's Education				
Never attended school	337	78.1	(71.3, 83.7)	0.679
Completed primary school or less	69	78.0	(65.3, 87.0)	
Some or completed secondary+	202	81.4	(74.7, 86.6)	
Wealth Quintile				
Lowest	106	77.0	(62.0, 87.3)	0.948
Second	114	80.8	(72.5, 87.1)	
Middle	121	78.1	(65.0, 87.2)	
Fourth	126	80.5	(72.8, 86.5)	
Highest	126	78.1	(69.6, 84.7)	
Consumed folic acid supplements in past 6 months				
Yes	208	77.7	(69.8, 84.0)	0.416
No	388	80.3	(75.5, 84.3)	
ALL NON-PREGNANT WOMEN	608	79.2	(74.1, 83.5)	

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data. Total sample size=766

[a] Percentages weighted for unequal probability of selection.

[b] Folate deficiency defined as plasma folate <10 nmol/L.

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

[d] 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

3.5.7. B12 deficiency

Contrary to folate deficiency, less that 1% of women were found to be deficient in vitamin B_{12}. Possibly due to such a low prevalence and small number of vitamin B_{12}-deficient women, there were no statistically significant differences in the prevalence of B_{12} deficiency by age, urban vs. rural residence, region, household wealth, or educational attainment (see Table 36).

Table 36. Plasma vitamin B12 deficiency in non-pregnant women (15 - 49 years), Sierra Leone 2013.

Characteristic	n	Vitamin B_{12} deficiency %[a, b]	(95% CI)[c]	P Value[d]
Age Group (in years)				
15-19	0	0	--	0.373
20-24	1	0.7	(0.1, 4.8)	
25-29	0	0	--	
30-34	0	0	--	
35-39	0	0	--	
40-44	1	2.1	(0.3, 13.6)	
45-49	1	1.7	(0.2, 11.8)	
Residence				
Urban	1	0.3	(0.0, 2.2)	0.443
Rural	3	0.7	(0.2, 2.3)	
Region				
East	1	1.0	(0.2, 6.3)	0.747
North	1	0.3	(0.0, 1.9)	
South	1	0.4	(0.1, 3.0)	
West	1	0.6	(0.1, 4.5)	
Women's Education				
Never attended school	3	0.7	(0.2, 2.2)	0.694
Completed primary school or less	0	0	--	
Some or completed secondary+	1	0.4	(0.1, 3.0)	
Wealth Quintile				
Lowest	1	0.5	(0.1, 3.4)	0.487
Second	2	1.4	(0.3, 5.9)	
Middle	0	0	--	
Fourth	0	0	--	
Highest	1	0.7	(0.1, 4.8)	
ALL NON-PREGNANT WOMEN	4	0.5	(0.2, 1.4)	

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data. Total sample size=768

[a] Percentages weighted for unequal probability of selection.

[b] Vitamin B12 Deficiency (B_{12}D) defined as plasma B_{12} <150pmol/L.

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

[d] 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

3.5.8. Iodine deficiency

Overall, the median urinary iodine in nearly all subgroups of non-pregnant women (both lactating and non-lactating) was substantially above the cut-off of 100 µg/L which defines an iodine sufficient population (see **Table 37** and **Table 38**). The only subgroup with a median below 100 µg/L was non-pregnant lactating women residing in households where adequately iodized salt was not found.

Table A9-2 and Table A9-3 in APPENDIX 9 show the proportion of iodine deficiency – according to WHO cut-offs – for non-pregnant non-lactating women and non-pregnant lactating women, respectively.

Note that because distribution of urinary iodine concentration is rarely normally distributed and because the iodine concentration from a single spot urine specimen is not indicative of an individual's iodine status, it is inappropriate to calculate proportions of individuals below a cutoff to estimate the "prevalence" of iodine deficiency in a population. Thus, these results must be used with utmost caution. They are presented in this report only to be compatible with the WHO Vitamin and Mineral Nutrition Information System (http://www.who.int/vmnis/en/), which despite this methodological drawback has shown to be an important source of data on micronutrient deficiencies worldwide.

Table 37. Median urinary iodine in non-pregnant non-lactating women (15 - 49 years), Sierra Leone 2013.

Characteristic	n	Median urinary iodine (µg/L)	ANOVA p value [b]
Age (in years)			
15-19	110	252.8	<0.05
20-24	103	189.5	
25-29	88	164.8	
30-34	78	204.3	
35-39	73	207.9	
40-44	63	192.2	
45-49	40	174.8	
Residence			
Urban	328	224.2	<0.001
Rural	243	174.8	
Province			
East	105	190.5	0.26
North	167	192.9	
South	143	184.7	
West	156	222.8	
Women's education			
Never attended school	303	174.8	<0.001
Completed primary school or less	56	205.8	
Some or completed secondary+	211	235.2	
Wealth quintile			
Lowest	91	173.0	<0.001
Second	84	167.7	
Middle	116	195.6	
Fourth	120	205.8	
Highest	142	253.3	
Adequately iodized salt in household [a]			
Yes	401	217.2	<0.001
No	88	122.8	
ALL NON-PREGNANT NON-LACTATING WOMEN	571	203.3	--

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data. Total sample size=571

[a] Adequately iodized salt ≥ 15 ppm

[b] ANOVA p value for differences in weighted geometric mean; a p value <0.05 indicates that the geometric mean in at least one subgroup is statistically significantly different from the values in the other subgroups

Table 38. Median urinary iodine in non-pregnant *lactating* women (15 - 49 years), Sierra Leone 2013.

Characteristic	n	Median urinary iodine (μg/L)	ANOVA p value [b]
Age (in years)			
15-19	46	190.8	<0.05
20-24	45	211.5	
25-29	51	140.6	
30-34	30	140.4	
35-39	22	125.1	
40-44	9	330.1	
45-49	5	171.6	
Residence			
Urban	81	210.1	0.38
Rural	139	165.0	
Province			
East	59	187.9	<0.05
North	80	140.6	
South	55	185.5	
West	26	220.8	
Women's education			
Never attended school	140	168.7	0.68
Completed primary school or less	33	164.8	
Some or completed secondary+	47	205.8	
Wealth quintile			
Lowest	63	140.4	0.62
Second	51	172.0	
Middle	44	203.3	
Fourth	34	175.6	
Highest	27	194.2	
Adequately iodized salt in household [a]			
Yes	143	196.8	<0.001
No	39	75.6	
ALL NON-PREGNANT LACTATING WOMEN	220	175.6	--

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data. Total sample size=220

[a] Adequately iodized salt ≥ 15 ppm

[b] ANOVA p value for differences in weighted geometric mean; a p value <0.05 indicates that the geometric mean in at least one subgroup is statistically significantly different from the values in the other subgroups

3.6. Pregnant women

3.6.1. Characteristics

Most pregnant women included in the survey sample were young. More than one-half had never attended school, and almost 4 in 5 were illiterate. A large majority were currently married or living with a man. More than one-third had no job outside the home. Relatively

few pregnant women smoked cigarettes. No age restriction was used for the recruitment of pregnant women, and the age range of pregnant women survey was 15 to 42 years.

Table 39. Description of pregnant women, Sierra Leone 2013.

	Survey Sample		
Characteristic	n	% [a]	(95% CI) [b]
Age (in years)			
15-24	106	61.3	(54.6, 67.7)
25-34	57	32.8	(26.4, 40.0)
35+	10	5.8	(3.4, 9.9)
Residence			
Urban	70	41.1	(33.2, 49.6)
Rural	108	58.9	(50.4, 66.8)
Province			
East	37	20.7	(10.6, 36.6)
North	56	31.0	(19.0, 46.4)
South	43	23.9	(13.2, 39.3)
West	42	24.4	(13.6, 39.9)
Woman's education			
Never attended school	94	52.5	(43.6, 61.3)
Completed primary school or less	37	20.7	(14.0, 29.5)
Some or completed secondary+	47	26.8	(20.5, 34.3)
Woman's literacy			
Illiterate	142	79.4	(72.0, 85.2)
Partly or fully literate	36	20.6	(14.8, 28.0)
Marital status			
Never married, never lived with man	20	11.3	(7.2, 17.3)
Currently married or living with man	158	88.7	(82.7, 92.8)
Divorced or separated	0	0	-
Widowed	0	0	-
Occupation			
No job	67	38.0	(30.7, 45.8v
Agriculture or unskilled labor	65	35.7	(27.7, 44)
Skilled labor or professional	44	25.2	(18.1, 34.0)
Student	2	1.1	(0.1, 7.7)
Cigarette smoking			
Smokes cigarettes	9	5.2	(2.9, 9.1)
Does not smoke	169	94.8	(90.9, 97.1)
TOTAL	178	100	--

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] Population estimates for 2013 provided by Statistic Sierra Leone

3.6.2. Dietary diversity and consumption of vitamins and supplements

As with non-pregnant women, most pregnant women had consumed foods from 4-6 food groups in the past 24 hours (see Table 40). Almost one-half had taken iron supplementation and one-half had taken folic acid tables in the prior 6 months. More than one-quarter reported having taken multivitamins during this time period. Almost two-thirds of women had taken iron or folic acid supplements for more than 3 months during their previous pregnancy, and one-third had received vitamin A supplementation after their most recent delivery.

Table 40. Food and vitamin supplement consumption in pregnant women, Sierra Leone 2013.

Characteristic	n	% [a]	(95% CI) [b]
Number of food groups consumed (out of 9 possible)			
2	2	1.2	(1.3, 4.5)
3	14	8.0	(4.6, 13.7)
4	30	17.1	(11.7, 24.3)
5	54	31.1	(24.7, 38.4)
6	43	24.8	(18.8, 32.0)
7	27	15.4	(10.6, 21.8)
8	3	1.7	(1.5, 5.3)
9	1	0.6	(0.1, 4.3)
Mean number of food groups	174	5.3	(5.0, 5.5)
Consumed iron tablets or syrup in past six months			
Yes	76	43.9	(35.2, 52.9)
No	99	56.0	(47.1, 64.8)
Consumed folic acid tablets in past six months			
Yes	88	50.9	(41.3, 60.4)
No	86	49.1	(39.6, 58.7)
Consumed multi-vitamin supplements in past six months			
Yes	48	27.0	(19.8, 35.9)
No	123	69.0	(60.0, 76.7)
Not sure it was multi-vitamins	7	3.9	(1.9, 8.0)
Consumed iron or folic acid supplements during last pregnancy for 90 days or more			
Yes	97	60.9	(52.9, 68,4)
No	63	39.1	(31.6, 47.1)
Not sure it was iron and folate	9	5.3	(2.4, 11.3)
Consumed vitamin A capsule after last delivery [c]			
Yes	52	33.5	(25.1, 43.0)
No	92	59.5	(49.9, 68.4)
Not sure it was vitamin A	11	7.0	(3.1, 15.3)
TOTAL RESPONDING	174	100	--

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] Does not include women who have never been pregnant.

3.6.3. Malaria

Nearly 30% of pregnant women surveyed tested positive for *P. falciparum* malaria parasitemia. The prevalence of malaria infection was higher, albeit without statistical significance, in younger pregnant women and statistically significantly higher in women in rural areas. There was no significant difference in the prevalence of malaria infection by education or household wealth.

Table 41. *P. falciparum* infection in pregnant women, Sierra Leone 2013.

Characteristic	n	%Malaria [a, b]	(95% CI)[c]	P Value[d]
Age (in years)				
15-24	35	34.2	(26.4, 42.9)	0.073
25-34	11	20.3	(11.9, 32.5)	
35-49	1	9.6	(1.3, 47.2)	
Residence				
Urban	14	20.6	(13.1, 30.9)	<0.05
Rural	35	34.3	(26.7, 42.9)	
Women's education				
Never attended school	26	29.3	(21.8, 38.1)	0.740
Completed primary school or less	9	23.9	(13.4, 39.1)	
Some or completed secondary+	14	30.9	(19.0, 46.0)	
Wealth quintile				
Lowest	7	21.9	(11.0, 38.7)	0.305
Second	17	41.3	(25.4, 59.4)	
Middle	6	20.2	(9.6, 37.8)	
Fourth	9	25.4	(13.9, 41.9)	
Highest	8	30.2	(15.8, 49.8)	
ALL PREGNANT WOMEN	49	28.6	(22.9, 35.0)	--

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data. Total sample size=170

[a] Percentages weighted for unequal probability of selection.

[b] %Malaria= % of women identified as malaria positive using rapid diagnostic tests for *P. falciparum*

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

[d] 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

3.6.4. Anemia

More than two-thirds of pregnant women were anemic. There was no statistically significant difference in the prevalence of anemia by age, urban vs. rural residence, region, educational level, or household wealth (see Table 41). Only four (weighted proportion = 2.3%) pregnant women had severe anemia (see Table A9-4 in APPENDIX 9).

Table 42. Anemia in pregnant women, Sierra Leone 2013.

Characteristic	n	Anemia %[a, b]	(95% CI)[c]	P Value[d]
Age (in years)				
15-24	77	73.2	(64.8, 80.2)	0.215
25-34	36	66.4	(54.3, 76.7)	
35-49	5	50.4	(21.9, 78.6)	
Residence				
Urban	45	66.2	(54.4, 76.2)	0.351
Rural	77	72.6	(63.4, 80.3)	
Region				
East	21	59.5	(44.9, 72.7)	0.184
North	43	78.1	(62.9, 88.2)	
South	27	64.4	(51.5, 75.5)	
West	31	73.7	(59.5, 84.2)	
Women's education				
Never attended school	66	72.4	(62.0, 80.9)	0.735
Completed primary school or less	25	67.8	(51.8, 80.4)	
Some or completed secondary+	31	67.0	(53.7, 78.1)	
Wealth quintile				
Lowest	20	62.5	(42.4, 79.0)	0.652
Second	31	75.6	(57.6, 87.6)	
Middle	24	77.3	(57.3, 89.6)	
Fourth	24	64.9	(48.3, 78.6)	
Highest	19	70.1	(52.6, 83.2)	
ALL PREGNANT WOMEN	122	70.0	(62.9, 76.3)	--

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data. Total sample size=174.

[a] Percentages weighted for unequal probability of selection.

[b] Anemia defined as hemoglobin < 110 g/L adjusted for altitude and smoking.

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

[d] 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

The prevalence of anemia was not statistically different in pregnant women who had taken iron, folic acid, or multivitamin supplements in the prior 6 months than in women who had not (see Table 43). Pregnant women with malaria infection had a higher prevalence of anemia than women without malaria infection.

Table 43. Anemia in pregnant women by supplement consumption and malaria status, Sierra Leone 2013.

Characteristic	n	Anemia %[a, b]	(95% CI)[c]	P Value[d]
Took iron tablets or syrup in past six months				
Yes	50	65.9	(53.2, 76.6)	0.383
No	70	72.7	(63.0, 80.7)	
Took folic acid tablet in past six months				
Yes	58	68.0	(57.1, 77.2)	0.563
No	62	72.1	(61.7, 80.6)	
Took multivitamin tablets or syrup in past six months				
Yes	31	64.1	(49.3, 76.6)	0.360
No	85	71.5	(62.6, 79.0)	
Malaria infection[e]				
Positive	43	87.6	(75.3, 94.2)	<0.01
Negative	78	64.4	(55.7, 72.3)	
ALL PREGNANT WOMEN	120	69.9	--	

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data. Total sample size=174.

[a] Percentages weighted for unequal probability of selection.

[b] Anemia defined as hemoglobin < 110 g/L adjusted for altitude and smoking.

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

[d] 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

[e] Malaria status identified using rapid diagnostic tests during SLMS data collection

3.6.5. Iodine deficiency

The overall median urinary iodine concentration in pregnant women was above the cut-off of 150 µg/L defining an iodine sufficient population. Unlike non-pregnant women, several subgroups of pregnant women fell below the cut-off. Pregnant women 25-34, women living in rural areas, women living in the Northern region, women who had never attended school, and women in the poorest and richest wealth quintiles were iodine deficient. Among the 13.5% of pregnant women whose household salt was not adequately iodized, a substantial level of iodine deficiency is indicated by a much lower median urinary iodine level.

Table A9-5 in APPENDIX 9 shows the proportion of iodine deficiency – according to WHO cut-offs – for pregnant women. As previously noted in Section 3.5.8, it is inappropriate to calculate proportions of individuals below a cutoff to estimate the "prevalence" of iodine deficiency in a population as urinary iodine concentration is rarely normally distributed and because a single spot urine specimen is not indicative of an individual's iodine status. Nonetheless, the prevalence figures are presented in this report only to be compatible with the WHO Vitamin and Mineral Nutrition Information System (http://www.who.int/vmnis/en/), which despite this methodological drawback has shown to be an important source of data on micronutrient deficiencies worldwide.

Table 44. Median urinary iodine in pregnant women, Sierra Leone 2013.

Characteristic	n	Median urinary iodine (µg/L)	ANOVA p value [b]
Age Group (in years)			
15-24	93	183.2	< 0.05
25-34	50	137.3	
35+	8	209.0	
Residence			
Urban	57	179.4	0.33
Rural	97	148.3	
Province			
East	32	201.7	0.29
North	52	138.1	
South	39	150.5	
West	31	207.2	
Women's Education			
Never attended school	82	142.0	0.12
Completed primary school or less	31	168.3	
Some or completed secondary or more	41	195.1	
Wealth Quintile			
Lowest	28	136.5	0.57
Second	38	175.8	
Middle	29	189.0	
Fourth	31	178.6	
Highest	22	134.6	
Adequately iodized salt in household [a]			
Yes	109	180.6	< 0.01
No	21	100.8	
ALL PREGNANT WOMEN	154	175.8	

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data. Total sample size=154

[a] Adequately iodized salt ≥ 15 ppm

[b] ANOVA p value for differences in weighted geometric mean; a p value <0.05 indicates that the geometric mean in at least one subgroup is statistically significantly different from the values in the other subgroups

4. DISCUSSION AND CONCLUSIONS

The data collected by the SLMS provides a picture of the health and nutritional status of women and children in Sierra Leone. At the household level, the SLMS found that, while most household have access to safe drinking water (either from a safe source or by treating water from an unsafe source), household sanitation is largely inadequate. Hygiene practices are also hampered by inadequate handwashing facilities and lack of soap in the household. According to a recent multi-country analysis, safe drinking water *alone* is not associated with a lower diarrhea prevalence in children [34], but a combination of safe drinking water and adequate sanitation is associated with lower diarrhea prevalence. With this understanding, the positive health impacts of safe drinking water in Sierra Leone may be masked by poor household sanitation and hygiene.

The majority of salt in Sierra Leone is adequately iodized as per international standards, and the high median urinary iodine concentration in non-pregnant women demonstrates an absence of iodine deficiency in this group. In addition, women from households with adequately iodized salt have higher median urinary iodine concentrations, demonstrating a correlation between consumption of iodized salt and iodine sufficiency. Nonetheless, median urinary iodine concentrations are both below and above levels of adequacy in certain population groups. The coverage of iodized salt is relatively low in the Northern Region and the coastal areas of Moyamba where traditional sea salt harvesting is still practiced. Extending the coverage of iodized salt to all regions and specific target groups can improve iodine intake. For example, the low coverage of adequately iodized salt by Susu-speaking households may be due to the fact that the Susu reside primarily in coastal areas and consume locally-harvested salt [35], which is likely not iodized and contains little natural iodine.

The SLMS assessed consumption of vegetable oil and bread, in tandem with individual micronutrient status, to determine if large-scale food fortification may be a viable approach in Sierra Leone. Commercially-produced vegetable oil was consumed in relatively few rural and poor households; however, in those households in which it was consumed, the average amount consumed per person does not differ substantially by residence or wealth. Thus, although commercially-produced oil may be a viable fortification vehicle, it would provide widespread benefit primarily to individuals in wealthier households and those living in urban areas. While few women were vitamin A deficient and may, at present, not require vitamin A-fortified oil, oil fortification can potentially address vitamin A deficiency in children in these households. Moreover, regular consumption of vitamin A-fortified oil may augment the vitamin A intake of children between biannual supplementation.

Like commercially-produced vegetable oil, bread is consumed in relatively few poor and rural households. However, unlike oil, bread is consumed in smaller quantities in poor and rural households which report consuming bread, and thus wheat flour fortification would disproportionately benefit wealthier and urban residents even more than would oil fortification. The SLMS found only a small prevalence of iron deficiency anemia and B_{12}

deficiency, and thus fortification with iron and B_{12} may not be merited to address these deficiencies and would likely not reduce anemia. A high prevalence of folate deficiency in both urban and rural areas warrants considerable attention, and wheat flour fortification with folic acid should be strongly considered to reduce folate deficiency in urban areas where bread is regularly consumed. In rural areas, other strategies may have to be considered. Such strategies could include increased coverage of folate supplements and promotion of foods rich in folate, such as dark leafy greens.

The SLMS shows that child feeding practices need to be improved. While about 89% of women initiate breastfeeding in the first 12 hours after birth, exclusive breastfeeding of infants 0-6 months old is not sufficiently widespread with only 42% of children exclusively breastfed. Complementary feeding practices are also poor, with a high prevalence of inadequate dietary diversity and inadequate frequency of feeding; only 14% of children 6-23 months have minimum acceptable diet. A recent multi-country analysis has shown that dietary diversity has the potential to improve linear growth [36]. Although no anthropometric measures were collected as part of the SLMS, the 2013 DHS [3] identified a high prevalence of wasting (9%) and stunting (38%), which may be attributable in part to poor feeding practices and high disease burden. While Sierra Leone's 2014 National Nutrition Survey [37] identified a lower prevalence of wasting (5%) and stunting (29%), the findings nonetheless illustrate an unsatisfactory situation related to child growth.

Anemia in all populations groups included in the SLMS exceeds 40%, and is thus classified as a severe public health problem according to WHO classifications [8]. Moreover, the prevalence of anemia in these groups has not changed substantially since 2008. In that year, the DHS found an anemia prevalence in children less than 5 years of age of 75.9% and in adult women of 45.2% [7]. However, compared to these DHS results, the distribution of anemia among children in the Sierra Leone population has become less equitable. In 2008, the difference in prevalence in young children between urban and rural households was 4.4 percentage points (urban: 72.7, rural: 77.1); it is now 13.9 percentage points (urban: 67.7, rural: 81.6). In addition, in the 2008 DHS, the difference between the highest region-specific anemia prevalence and the lowest was 7.2 percentage points; in the SLMS, this difference is 24.8 percentage points. The difference in the prevalence of anemia between children whose mothers had no education and those whose mothers had secondary education or higher was 6.7 percentage points in the 2006 DHS and 17.6 percentage points in the SLMS. And since 2006, the prevalence of anemia in children in the highest wealth quintile has declined, while in other wealth quintiles it has remained about the same.

Despite the general assumption that iron deficiency accounts for approximately half of the anemia prevalence worldwide and in most populations [21], iron deficiency was relatively uncommon in non-pregnant women or young children in Sierra Leone, nor was it associated with anemia. In non-pregnant women, folate and B_{12} deficiencies were also not associated with anemia. Rather, anemia in children and women was associated with malaria, inflammation, diarrhea (in children only) and vitamin A deficiency (in children only). While

the anemia prevalence in women and children significantly varied by inflammation status, the anemia prevalence in nearly all inflammation subgroups was >40%, suggesting that other factors besides inflammation are contributing to anemia.

Further investigation of a collinear relationship between anemia and malaria is required; however, malaria does not account for all anemia found. Although considerably lower than in malaria-*positive* individuals, the prevalence of anemia among malaria-*negative* pregnant women, non-pregnant women, and children was still 64%, 39%, and 63%, respectively; these prevalence rates are considered a severe or moderate public health problem [8]. Moreover, further analysis of the association between folate deficiency, anemia, and hemoglobinopathies should be explored. As folate supplements are often prescribed to patients with sickle cell disease to support erythropoiesis [38, 39], further elucidation of the relationships of these disorders in Sierra Leone may identify approaches to addressing anemia. Thus, there are likely other important causes of anemia in addition to iron deficiency and malaria. Helminth infections, which were widespread in Sierra Leone [40], can cause considerable blood loss and anemia; however, anemia due to helminth infection results from iron deficiency which is not common in Sierra Leone children. Moreover, the intensity of helminth infections in Sierra Leone has been reduced in recent years following routine mass distribution of anti-helminth drugs [41-43]. Due to the low prevalence of iron deficiency and iron deficiency anemia, helminth infection is not likely to be a major cause of anemia in Sierra Leone. Anemia of chronic inflammation [44] and hemoglobinopathies offer potential explanations [45]. While no previous representative data on subclinical inflammation is available, a previous study of genetic blood disorders in Sierra Leone [46] showed that 22% of participants tested positive for sickle cell hemoglobin (HbS).

Nearly all women were sufficient in vitamin A. On the other hand, the prevalence of vitamin A deficiency was much higher in young children; this represents a moderate public health problem [33]. As the SLMS was implemented six months following the previous *Maternal and Child Health Week* (June 2013) where vitamin A supplements were provided to children 6-59 months, the vitamin A deficiency findings likely represent the underlying deficiency in children; previous population-based studies have shown that vitamin A status returns to its baseline prevalence between 4-6 months following mass supplementation [47, 48]. Approximately 80% of caretakers could recall that their children 6-59 months of age had received vitamin A supplements as part of the last national health week. Notably, post-event coverage surveys in 2011 and 2012 have found that approximately 92% of children 6-59 months were supplemented with vitamin A after *Maternal and Child Health Weeks* [11, 12]. As a result, vitamin A supplements can be assumed to reach at least some of the population groups at greatest risk; supplementation is likely the most suitable approach in the short term whereas food diversification is a sustainable long-term approach to tackle this public health problem in Sierra Leonean children. Nonetheless, in the absence of suitable alternative approaches, supplementation efforts should be continued.

Contrary to the vitamin A coverage results, the coverage of deworming medication (i.e. albendazole) among children 18-59 months was only about 60%, similar to the 58% coverage reported by the 2013 DHS [3]. Despite these findings, a post-event coverage survey from January 2013 found a higher coverage (87%) of deworming medication following Sierra Leone's *Maternal and Child Health Week* [49], suggesting that the coverage of deworming medication may be higher than that observed by the SLMS.

Women's education status is generally poor in Sierra Leone, and associated with multiple deficiencies. Urinary iodine concentrations of pregnant, non-pregnant lactating, and non-pregnant non-lactating women with no education were all significantly lower in women with primary or secondary education. Moreover, a progressive pattern was observed, with urinary iodine concentrations increasing with educational attainment in women. In children, the prevalence of malaria and anemia was higher among children of mothers with less education. Maternal education has been previously associated with maternal and child health practices in Sierra Leone [50], and maternal education has been consistently identified as risk factor for child malnutrition [51].

5. RECOMMENDATIONS

Carry out situation analysis to increase iodized salt coverage: Because the coverage of adequately iodized salt varied by region and ethnic group in Sierra Leone, there may be certain geographic or ethnographic factors which influence the distribution and consumption of iodized salt in Sierra Leone. Using the results from SLMS, it is recommended that a situational analysis of iodized salt be conducted to identify approaches to increase the coverage, access, and acceptability of iodized salt in areas and communities where iodized salt is currently uncommon. Consumption of locally-harvested salt by coastal communities, in particular, may be a barrier to acceptability and affordability of iodized salt.

Continue monitoring of iodine intake and status: The SLMS found that iodine status for pregnant women is within the optimal range of recommended UIC. For non-pregnant non-lactating women, median UICs tend to be above adequacy, albeit not in the category of excessive intakes. That said, in some geographic areas in the North, UICs tend to be lower than in other regions albeit not in deficient ranges. Thus, although the current situation is satisfactory overall, salt intake and iodine intake should continue to be regularly monitored. Similarily, regular monitoring of median UICs should continue in order to ensure that salt iodization levels can be adapted if is consistent evidence of iodine intakes above recommended levels. Future iodine intake assessments should also investigate iodine intake from sources other than table salt, e.g. industrially processed foods, such as bouillon cubes, tomato purée concentrate or other commonly consumed products that contain salt.

Investigate causes of anemia: The SLMS results suggest that a large proportion of anemia in children and women is caused by factors other than iron deficiency. Malaria is very common in both children and adult women, particularly affecting the rural and poor population and

those living in the Northern region, and likely contributes substantially to anemia prevalence. However, anemia has multiple causes and SLMS results suggest that other factors play a major role in contributing to anemia. For this reason, a thorough investigation into the etiology of anemia in Sierra Leone is necessary before a comprehensive prevention and control strategy can be formulated. To elucidate the causes of anemia in Sierra Leone, it is recommended that the potential contributing factors over and above those measured as part of the SLMS be investigated, including hemoglobinopathies: sickle cell disease and alpha-thalassemia. Previous studies in Sierra Leone found that the prevalence of sickle cell trait (HbAS) ranged from 22% [46] to 29% [52] and varied by ethnic group. The remaining blood pellets from SLMS blood specimens collected from non-pregnant women and children are available and should be assessed for hemoglobinopathies, including sickle cell (HbSS, HbAS and HbSC) and alpha-thalassemia in order to identify additional determinants of anemia in Sierra Leone. In addition, given the increasingly unequal distribution of anemia in Sierra Leonean children, any investigation of the causes of anemia and potential interventions should identify those factors which disproportionately affect poorer and rural households.

Following a thorough investigation of the etiology of anemia, large-scale programs to address the factors associated with anemia should be developed. Due to differing severity of anemia by residence, region, age, education, and wealth quintile, programs should be tailored and targeted at specific population groups.

Reduce vitamin A deficiency in children via supplementation and by promoting dietary diversification: Existing programs of vitamin A supplementation are directly addressing deficiency in young children in Sierra Leone and should be maintained and expanded to reach universal coverage. One novel strategy to increase coverage was introduced by the MoHS through a routine maternal and child health “six-month contact point” in 2013 [53].

In addition to biannual supplementation of vitamin A, increasing the regular vitamin A intake in children is also warranted and promoting vitamin A-rich foods through dietary diversification is a key strategy. While the fortification of commercially-produced vegetable oil with vitamin A is another option to reduce vitamin A deficiency, the consumption of vegetable oil is only about 4-5 grams in children and disproportionately reaches the less poor and urban households. Therefore adequately fortified vegetable oil may fail to reach a high proportion of children at greatest risk. Biofortification approaches should also be considered; vitamin A-biofortified orange-fleshed sweet potatoes have been identified as suitable approach to reduce vitamin A deficiency in Sierra Leone [54]. To ensure sufficient and regular intake of vitamin A, implementing multiple programs to reduce vitamin A deficiency in children will be the most appropriate.

Strengthen efforts to combat malaria: Targeted programs to reduce the exposure to malaria should be continued and strengthened. Reducing the prevalence of malaria will help

reduce mortality and morbidity associated with malaria directly, and will likely result in a decline in the prevalence of anemia among children and women.

Improve infant and young child feeding practices: Inappropriate feeding practices of infants and young children may contribute to high prevalence of vitamin A deficiency and anemia. Exclusive breastfeeding in the first 6 months of life should be promoted and supported to ensure adequate nutrition and protect infants from gastrointestinal infections. The consumption of healthy, diversified diets in the complementary feeding period (6-23 months) should also be promoted to consistently improve the diversity and quality of diet for young children. Adequate feeding habits and good hygiene and sanitation practices can be promoted via nutrition education delivered during biannual *Maternal and Child Health Weeks* and routine outreach by Sierra Leone's health system. In addition, tailor-made interventions can be employed to further stress the importance of beneficial breastfeeding practices and adequate diet for young children.

Strengthen community-based interventions to protect children from environmental causes of subclinical inflammation: The SLMS found high levels of recent diarrhea and inflammation in children 6-59 months, as well as poor household-level sanitation conditions. The association between household sanitation and diarrhea, and sanitation and infection have been identified elsewhere and may contribute to the high diarrhea and anemia prevalence found by the SLMS. In order to protect children from diarrheal diseases and environmental causes of subclinical infection, community-based interventions, such as improving water access, household sanitation, and hygiene practices (e.g. handwashing) should be strengthened.

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APPENDIX 1. A PRIORI SAMPLE SIZE CALCULATIONS

Sample sizes for households (HH), Pre-SAC, non-pregnant women and pregnant women, and the expected precision with this minimum sample size (assuming a 94% household response rate)

Target group	Indicator	Design effect*	Individual response rate (%)	Subjects with data in 1 stratum *	Subjects with data in 2 strata*	Estimated Prevalence (%)*	Precision 1 stratum (%)	Precision 2 strata (%)
HH	Iodized Salt	3.0	94.0†	677	1,354	50.0	± 6.5	**± 4.6**
Pre-school age children	Anemia	2.0	80.0	488	976	75.9	± 5.4	**± 3.8**
	Iron def.	2.0	80.0	488	976	50.0	± 6.1	**± 4.3**
	Vit. A deficiency	1.5	80.0	488	976	50.0	± 5.4	**± 3.8**
Non-pregnant women	Anemia	1.3	80.0	515	1,030	45.2	± 4.9	**± 3.5**
	Iron deficiency	2.0	80.0	515	1,030	50.0	± 6.1	**± 4.3**
	Vit. A deficiency	2.0	80.0	515	1,030	10.0	± 3.7	**± 2.6**
	Folate deficiency	2.0	80.0	515	1,030	50.0	± 6.1	**± 4.3**
	Vit B_{12}deficiency	2.0	80.0	515	1,030	50.0	± 6.1	**± 4.3**
	Iodine deficiency	2.0	80.0	515	1,030	33.7	± 5.8	**± 4.1**
Pregnant women	Anemia	1.5	80.0	74	148	62.0	± 13.5	**± 9.6**

* estimated prevalence and design effect are from most recently available data or, if data not available, a 50% deficiency prevalence was assumed, resulting in the largest calculated sample size required;

† Household response rate

APPENDIX 2. LIST OF SELECTED ENUMERATION AREAS

	REGION	DISTRICT	CHIEFDOM	SECTION	EA CODE
Rural 1	Eastern	Kailahun	Dea	Sienga	11010405
2	Eastern	Kailahun	Mandu	Levuma Jeigbla	11100202
3	Eastern	Kenema	Dama	Dassama	12010308
4	Eastern	Kenema	Dodo	Korgay	12020602
5	Eastern	Kenema	Gaura	Joru	12030206
6	Eastern	Kono	Fiama	Dumbia	13010101
7	Eastern	Kono	Nimikoro	Jaiama	13090403
8	Northern	Bombali	Biriwa	Kamabai	21010503
9	Northern	Bombali	Bombali Sebora	Matotoka	21020406
10	Northern	Bombali	Makari Gbanti	Mangay	21070404
11	Northern	Kambia	Gbinle Dixing	Sanda	22020704
12	Northern	Kambia	Magbema	Kambia	22030318
13	Northern	Koinadugu	Mongo	Deldugu	23050201
14	Northern	Koinadugu	Nieni	Kalian	23070207
15	Northern	Port Loko	Bureh Kasseh Ma	Barmoi	24010102
16	Northern	Port Loko	Koya	Matene	24051207
17	Northern	Port Loko	Lokomasama	Kamasondo	24060307
18	Northern	Tonkolili	Gbonkolenken	Lower Massakong	25010102
19	Northern	Tonkolili	Kafe Simiria	Mayaso	25020602
20	Southern	Bo	Bumpe Ngao	Sewama	31050701
21	Southern	Bo	Komboya	Keisua	31090102
22	Southern	Bo	Valunia	Yarlenga	31140707
23	Southern	Bonthe	Kpanda Kemo	Taokunor	32060603
24	Southern	Bonthe	Nongoba Bullom	Hahun	32080703
25	Southern	Moyamba	Lower Banta	Ndendemoya	33110603
26	Southern	Moyamba	Ribbi	Upper Ribbi	33120903
27	Southern	Pujehun	Kpaka	Jassende Ngoleima	34030303
28	Southern	Pujehun	Makpele	Samagbe	34050223
29	Western	Western Area Rural	Koya Rural	Newton	41010501
30	Western	Western Area Rural	Waterloo Rural	Hastings Village A	41030321
Urban 1	Eastern	Kailahun	Njaluahun	Sei I	11111016
2	Eastern	Kenema	Kandu Leppiama	Karga	12050307
3	Eastern	Kenema	Nongowa	Kona Kpindibu	12120806
4	Eastern	Kenema	Kenema Town	Gbo Kakajama A-Shi	12911011
5	Eastern	Kono	Nimikoro	Bandafereh	13090205
6	Eastern	Kono	Koidu Town	Gbense-Moindekor	13910205
7	Northern	Bombali	Sella Limba	Kamakwie	21120111
8	Northern	Bombali	Makeni Town	Bombali Sebora - K	21910201
9	Northern	Kambia	Mambolo	Mambolo	22040202
10	Northern	Koinadugu	Wara Wara Yagal	Zone 3	23110305
11	Northern	Port Loko	Kaffu Bullom	Kasongha	24040207
12	Northern	Port Loko	Maforki	Kondato	24071006
13	Northern	Tonkolili	Kholifa Rowala	Bo Road	25050107
14	Southern	Bo	Boama	Lower Pataloo	31040405
15	Southern	Bo	Kakua	Samamie	31080616

	REGION	DISTRICT	CHIEFDOM	SECTION	EA CODE
16	Southern	Bo	Bo Town	West Ward-Njagboim	31912217
17	Southern	Bonthe	Bonthe Urban	Bonthe Town	32910110
18	Southern	Moyamba	Fakunya	To - Ndambalenga	33041003
19	Southern	Pujehun	Panga Kabonde		34051052
20	Western	Western Area Rural	York Rural	Goderich-Adonkia/M	41040203
21	Western	Western Area Rural	York Rural	Sattia/Tombo	41040610
22	Western	Western Area Urban	Central II	Sanders Brook	42020202
23	Western	Western Area Urban	East II	Coconut Farm/ Asho	42040214
24	Western	Western Area Urban	East III	Allen Town I	42050117
25	Western	Western Area Urban	East III	Kissy Mental	42051208
26	Western	Western Area Urban	East III	Kissy Mess Mess	42051315
27	Western	Western Area Urban	East III	Mayenkineh	42051815
28	Western	Western Area Urban	East III	Rokupa	42052307
29	Western	Western Area Urban	West III	Murray Town	42080810
30	Western	Western Area Urban	West III	Wilberforce	42081012

APPENDIX 3. ETHICAL APPROVAL

Nut

GOVERNMENT OF SIERRA LEONE
Office of the Sierra Leone Ethics and Scientific Review Committee
Directorate of Training, Non-Communicable Diseases and Research
Connaught Hospital
Ministry of Health and Sanitation

2nd August, 2013

Col. Dr. Foday Sahr
34 Military Hospital
Republic of Sierra Leone Military Forces
Wilberforce

Dear Dr. Sahr

Sierra Leone Micronutrient Survey 2013

This letter refers to the above proposed survey submitted for review.

The Committee hereby grants Ethical and Scientific clearance for this survey to be conducted.

The Committee stipulates as follows: that,

1. It must be notified in advance, if you decide to amend the research design and/or methodology at any time during the conduct of the survey.
2. It must be informed if for any reason, the survey is terminated prematurely.
3. On the conclusion of the survey, you submit a report or any publication based on the study.

Yours sincerely

Professor Hector G. Morgan
Chairman, SLESRC

RECEIVED
12 AUG 2013

Email: *hgmorg2007@yahoo.com / williettav@yahoo.com*

APPENDIX 4. TEAMS, TEAM MEMBERS, AND SUPERVISORS

Position*	Team and Location	Position*	Team and Location
	Team 1, Kenema		**Team 2, Kenema, Yengema**
TL	Ibrahim Kabba	TL	Momodu Massaquoi
I	Vivian Alvin Williams	I	Kadie Kandeh
I	Sannah M. Stevens	I	John Turay
P	Joseph Lahai	P	George Mbayo
	Team 3, Pujehun, Kailahun		**Team 4, Moyamba, PL, Kambia**
TL	Jusufu Paye	TL	Momoh K Sandy
I	Alimamy R. Wurie	I	Francess Boima
I	Kumba Saata Feika	I	Edmond I. Kamara
P	Anthony Domawa	P	Sahr Foday Jr
	Team 5, Bombali, Koinadudgu		**Team 6, Tonoklili, Bonthe**
TL	James Ngembeh	TL	Joseph S. Rogers
I	Francess Tarawalie	I	Umu Jalloh
I	Alie Turay	I	Thaimu Adekalie Kamara
I	Emmanuel Morie Amara	P	Philip George Pessima
P	Beah Joe Johannes Lebby		
	Team 7, WA, Port Loko		**Team 8 WA, Port Loko**
TL	Dr. Abbas Conteh	TL	Dr. Dauda Koroma
I	Steven Jibao Bundeh	I	Anita Kargbo
I	Zainab Susan Dumbuya	I	Emmanuel Pyne-Bailey
I	Komba Lebbie	I	Ericka King
P	Michel Miattia	P	Mohamed J Kamara

*TL=Team Leader, I=Interview, P=Phlebotomist

Supervisors

Regina Khaasanova
Francis A. Berewah
Hamjatu Khazali
Emauel Nyorkor
Mariam Bangura
Hannah Yankson

APPENDIX 5. DESIGN EFFECTS OF MAJOR OUTCOMES

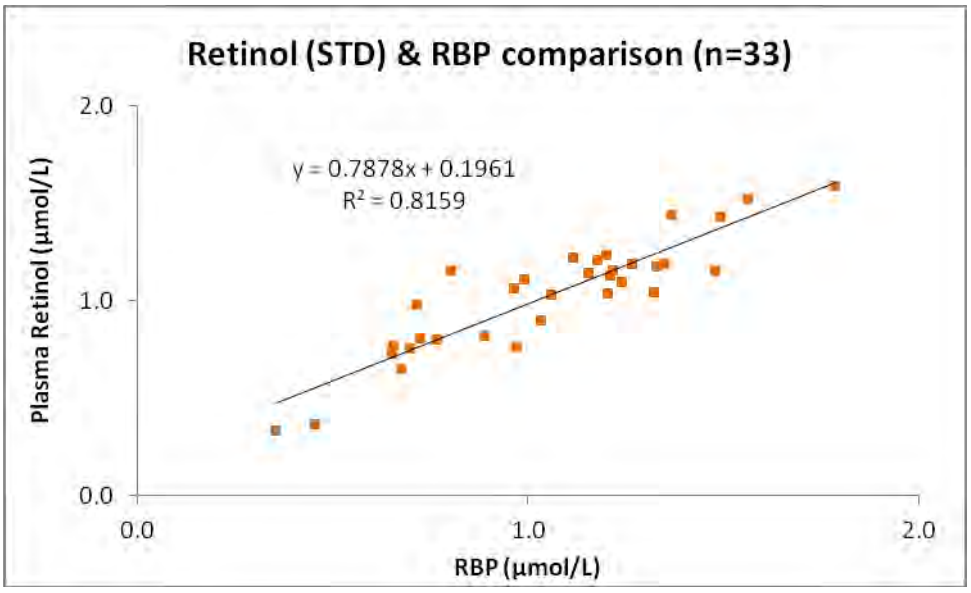
Variable	Number in analysis	Design effect
Households		
Improved water source	1355	15.6
Improved sanitation	1349	6.5
Water at handwashing place	429	6.0
If salt in original package, labeled iodized	132	2.6
Salt iodized >15 ppm	1128	8.1
Household uses vegetable oil	1278	6.8
Household uses bread	1201	5.1
Children		
Low birth weight	351	1.7
Had diarrhea in past 2 weeks	838	1.4
Had fever in past 2 weeks	836	1.8
Had lower respiratory infection in past 2 weeks	830	1.9
Positive malaria rapid test kit	723	3.1
Early initiation of breastfeeding	319	1.8
Exclusive breastfeeding	77	1.4
Minimum dietary diversity	281	1.9
Minimum meal frequency	196	1.4
Minimum acceptable diet	207	1.5
Good infant and child feeding index	324	1.1
Took iron supplementation in past 6 months	836	2.7
Took vitamin A supplement in past 6 months	839	2.2
Anemia	710	1.8
Iron deficiency	654	1.8
Non-pregnant women		
Heard of fortified vegetable oil	1091	7.6
Heard of iodized salt	1119	3.5
Took folic acid supplement in past 6 months	924	2.2
Took iron supplement in past 6 months	923	2.2
Positive malaria rapid test kit	833	2.4
Anemia	871	2.0
Iron deficiency	774	1.5
Vitamin A deficiency	817	1.0
Folate deficiency	766	2.5
Vitamin B12 deficiency	768	1.1
Pregnant women		
Took folic acid supplement in past 6 months	174	1.6
Took iron supplement in past 6 months	175	1.4
Positive malaria rapid test kit	170	0.8
Anemia	174	0.9

APPENDIX 6. COMPARISON OF PLASMA RETINOL AND RETINOL BINDING PROTEIN

Because RBP is not a WHO-recommended biomarker for the assessment of vitamin A status, extra plasma specimens from children and non-pregnant women were analyzed for plasma retinol as a comparison and validations of RBP measurements. Plasma retinol was analyzed using HPLC by the ARS-Western Human Nutrition Research Center at the United States Department of Agriculture, Davis, USA, and RBP was measured using the ELISA technique at the VitMin Lab, Freiburg, Germany. Unfortunately, the spare plasma volume available in samples from children was insufficient to obtain accurate measures using HPLC. A minimum of 100µL of plasma is required to assess serum retinol with HPLC, and the spare child samples contained approximately 20-60µL of plasma. Thus, comparisons between retinol and RBP are available for non-pregnant women only.

The figure below presents the correlation plot and regression equation comparing retinol and RBP. Using 33 cases with values <2µmol/L, we find a strong correlation between the RBP and serum retinol values (R^2=0.82). The estimated slope was 0.79, showing that RBP values were slightly lower than their serum retinol counterparts. The kappa coefficient was calculated for vitamin A deficiency in both RBP and retinol (<0.7µmol/L) and shows good agreement (0.631).

These results suggest that RBP are comparable to retinol in Sierra Leone. These findings are similar to other comparisons of RBP and retinol from Cameroon [55] and other countries [56].



APPENDIX 7. ADDITIONAL HOUSEHOLD TABLES

Table A7-1. Distribution of household interview results for households randomly selected for participation, Sierra Leone 2013.

	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]	
Characteristic	n	% [a]	n	% [a]	n	% [a]	n	% [a]	n	% [a]	n	% [a]
Residence												
Urban	666	96.9	5	0.7	6	0.9	2	0.3	2	0.3	6	0.9
Rural	686	96.1	9	1.3	11	1.5	4	0.6	1	0.1	3	0.4
Region												
East	307	97.4	0	--	4	1.4	1	0.4	0	--	3	0.9
North	431	96.1	5	1.2	6	1.3	2	0.5	3	0.6	2	0.3
South	336	95.2	6	1.9	6	1.9	3	0.8	0	--	1	0.3
West	278	97.6	3	1.0	1	0.3	0	--	0	--	3	1.1
ALL HOUSEHOLDS	1352	96.4	14	1.1	17	1.3	6	0.5	3	0.1	9	0.6

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] Other included dwelling destroyed or other reasons noted by interviewer

Table A7-2. Number and % of most often consumed breads in participating households, Sierra Leone 2013.

	Factory white bread		Factory brown bread		Other bread from bakery or factory		Home-made		Other	
Characteristic	n	% [a]	n	% [a]	n	% [a]	n	% [a]	n	% [a]
Residence										
Urban	7	1.5	33	7.1	405	87.7	17	3.7	0	--
Rural	3	1.8	11	6.5	129	76.3	21	12.4	5	3.0
Region										
East	1	1.2	17	14.1	85	79.7	4	5.0	0	--
North	1	0.5	1	0.5	146	82.5	20	12.9	5	3.6
South	1	1.1	16	12.8	93	76.2	12	9.9	0	--
West	7	3.0	10	5.4	210	90.8	2	0.8	0	--
First language of household head										
Mende	1	0.8	29	17.1	122	76.0	9	6.1	0	--
Themne	3	1.3	6	3.6	181	86.6	16	8.5	0	--
Limba	1	2.6	0	--	43	92.3	1	2.6	1	2.6
Krio	1	5.0	1	5.0	15	90.0	0	--	0	--
Mandingo	1	3.4	3	6.8	34	80.9	3	9.0	0	--
Loko	1	3.3	0	--	21	93.3	1	3.3	0	--
Sherbro	0	--	0	--	11	100.0	0	--	0	--
Kono	1	3.5	0	--	21	80.8	3	15.7	0	--
Other	1	0.9	5	5.0	85	82.5	5	6.3	4	5.4
Wealth Quintile										
Lowest	4	1.8	21	10.1	183	85.4	5	2.7	0	--
Second	2	1.1	10	6.4	149	88.2	7	4.3	0	--
Middle	2	1.8	7	4.9	121	86.7	9	6.7	0	--
Fourth	1	1.8	5	6.5	52	75.8	10	16.0	0	--
Highest	0	--	1	3.7	16	52.5	7	25.0	5	18.7
ALL HOUSEHOLDS	10	1.6	44	6.9	534	83.7	38	6.8	5	1.0

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 weighted for unequal probability of selection.

APPENDIX 8. ADDITIONAL CHILD TABLES

Table A8-1.Distribution of birth weight variables in pre-school age children, Sierra Leone 2013.

Characteristic	n	% [a]	(95% CI) [b]
Child weighed at birth			
Yes	599	69.3	(59.3, 77.7)
No	175	22.7	(15.4, 32.0)
Unknown	65	8.1	(5.5, 11.7)
Source of birthweight information [c]			
From health card	300	49.8	(41.9, 57.7)
From recall	299	50.2	(42.3, 58.1)
ALL CHILDREN	839	100	--

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] Method that birthweight was reported was only collected for children weighed at birth

Table A8-2.Proportion of children with low birth weight (<2.5 kg), Sierra Leone 2013

Characteristic	n	%[a]	(95% CI)[b]	P value[c]
Mother's age at birth				
<20	7	9.8	(4.1, 21.7)	
20-34	7	3.9	(1.5, 10.0)	0.213
35+	3	6.3	(2.4, 15.3)	
Mother's smoking status				
Smokes cigarettes or tobacco	0	0	--	0.378
Does not smoke	17	5.7	(3.1, 10.1)	
Sex				
Male	8	5.0	(2.0, 11.8)	0.983
Female	9	5.1	(2.3, 10.8)	
Residence				
Urban	8	6.3	(2.9, 13.0)	0.513
Rural	9	4.3	(1.8, 10.3)	
Region				
East	1	0.5	(0.1, 4.0)	
North	6	6.9	(2.6, 17.2)	<0.05
South	4	4.7	(1.4, 14.7)	
West	6	11.8	(5.1, 25.1)	
Mother's education				
Never attended school	8	4.1	(1.7, 9.8)	
Completed primary school or less	3	7.1	(1.4, 29.0)	0.477
Some or completed secondary+	6	8.3	(4.0, 16.5)	
Wealth quintile				
Lowest	3	5.6	(1.0, 25.5)	
Second	7	7.2	(3.4, 14.9)	
Middle	1	1.6	(0.2, 11.5)	0.665
Fourth	2	4.2	(1.0, 16.2)	
Highest	4	6.9	(2.5, 17.7)	
ALL CHILDREN	17	5.0	(2.7, 9.0)	

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 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

Table A8-3. Distribution of various times of breastfeeding initiation after birth, children < 24 months of age, Sierra Leone 2013. (WHO/UNICEF recommendations- Indicator #1: Early initiation of breastfeeding)

Characteristic	First hour			1-12 hours			> 12 hours			
	n	%[a]	(95% CI)[b]	n	%[a]	(95% CI)[b]	n	%[a]	(95% CI)[b]	P value
Age Group (in months)										
0-11	127	68.1	(59.2, 75.8)	36	21.8	(14.9, 30.6)	22	10.2	(6.2, 16.2)	0.743
12-23	84	63.3	(52.0, 73.3)	38	24.3	(16.3, 34.6)	12	12.4	(5.9, 24.2)	
Sex										
Male	101	66.4	(57.0, 74.7)	31	18.2	(11.6, 27.4)	21	15.3	(9.1, 24.7)	<0.05
Female	110	65.6	(55.9, 74.2)	43	27.2	(19.0, 37.4)	13	7.1	(4.0, 12.4)	
Residence										
Urban	81	57.7	(44.8, 69.7)	38	29.4	(20.0, 40.9)	21	12.9	(7.7, 20.9)	0.204
Rural	130	71.0	(62.0, 78.6)	36	19.0	(11.8, 29.0)	13	10.0	(4.9, 19.4)	
Region										
East	51	78.0	(66.4, 86.3)	10	14.8	(7.2, 27.9)	5	7.3	(3.2, 15.5)	0.110
North	75	63.9	(51.9, 74.4)	26	23.9	(14.5, 36.7)	11	12.2	(4.9, 27.0)	
South	47	75.2	(58.4, 86.7)	14	17.0	(6.9, 36.3)	6	7.8	(3.3, 17.5)	
West	38	47.3	(34.1, 60.8)	24	36.0	(23.1, 51.3)	12	16.7	(10.2, 26.4)	
Mother's Education										
Never attended school	112	63.9	(54.2, 72.6)	42	23.0	(15.5, 32.6)	17	13.2	(7.0, 23.3)	0.053
Comp. primary school or less	35	86.3	(74.1, 93.3)	5	8.9	(3.6, 20.5)	3	4.8	(1.5, 14.5)	
Some or comp. secondary+	53	61.8	(49.5, 72.8)	20	26.7	(17.6, 38.5)	12	11.4	(6.0, 20.7)	
Wealth Quintile										
Lowest	32	53.9	(37.4, 69.6)	19	30.9	(15.6, 51.9)	4	15.2	(4.9, 38.6)	
Second	64	81.0	(66.9, 90.0)	8	10.7	(4.0, 25.8)	6	8.2	(3.1, 20.1)	
Middle	48	82.5	(70.5, 90.3)	5	6.6	(2.5, 16.3)	6	10.9	(4.7, 23.4)	
Fourth	23	46.4	(31.5, 62.0)	22	42.5	(26.8, 59.9)	7	11.1	(4.8, 23.5)	
Highest	37	52.5	(37.5, 67.1)	19	34.8	(23.6, 48.1)	11	12.7	(6.5, 23.2)	<0.01
ALL CHILDREN	211	66.0	(58.6, 72.7)	74	22.8	(16.8, 30.3)	34	11.1	(7.1, 17.1)	

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.

Table A8-4. Proportion of children exclusively breastfed the day before the interview, children < 6 months of age, Sierra Leone 2013. (WHO/UNICEF recommendations- Indicator #2: Exclusive breastfeeding under 6 months)

Characteristic	n	%[a]	(95% CI)[b]	P value
Age (in months)				
0-1	12	48.0	(29.9, 66.6)	0.587
2-3	10	47.1	(23.6, 71.9)	
4-5	14	35.6	(18.8, 56.9)	
Sex				
Male	12	36.4	(19.7, 57.1)	0.466
Female	24	45.8	(29.7, 62.8)	
Residence				
Urban	12	26.9	(13.5, 46.6)	0.061
Rural	24	51.6	(33.9, 68.8)	
Region				
East	8	51.8	(18.6, 83.5)	0.157
North	16	42.2	(25.7, 60.5)	
South	10	61.0	(28.3, 86.1)	
West	2	12.5	(2.7, 42.7)	
Mother's Education				
Never attended school	21	50.0	(30.8, 69.2)	0.185
Completed primary school or less	3	21.7	(6.3, 53.1)	
Some or completed secondary+	10	35.7	(19.6, 55.9)	
Wealth Quintile				
Lowest	4	46.9	(17.9, 78.1)	
Second	17	66.3	(36.6, 87.0)	
Middle	8	40.3	(16.4, 69.9)	
Fourth	5	50.0	(20.6, 79.4)	
Highest	2	6.6	(1.6, 23.6)	<0.05
ALL CHILDREN	36	41.9	(29.4, 55.4)	

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.

Table A8-5. Proportion of children breastfed the day before the interview, children 12-15 months of age, Sierra Leone 2013. (WHO/UNICEF recommendations- Indicator #3: Continued breastfeeding at 1 year)

Characteristic	n	%[a]	(95% CI)[b]	P value
Sex				
Male	30	100.0	--	0.235
Female	21	97.5	(82.5, 99.7)	
Residence				
Urban	19	96.3	(75.2, 99.6)	0.123
Rural	32	100.0	--	
Region				
East	11	95.3	(70.0, 99.4)	0.664
North	16	100.0	--	
South	14	100.0	--	
West	10	100.0	--	
Mother's Education				
Never attended school	29	100.0	--	0.318
Completed primary school or less	8	100.0	--	
Some or completed secondary+	11	94.3	(64.4, 99.3)	
Wealth Quintile				
Lowest	9	100.0	--	
Second	17	100.0	--	
Middle	6	90.2	(49.2, 98.9)	
Fourth	10	100.0	--	
Highest	8	100.0	--	0.444
ALL CHILDREN	51	99.0	(92.7, 99.9)	

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.

Table A8-6. Proportion of children eating complementary food the day before the interview, children 6-8 months of age, Sierra Leone 2013. (WHO/UNICEF recommendations-Indicator #4: Introduction of solid, semi-solid or soft foods)

Characteristic	n	%[a]	(95% CI)[b]	P value
Sex				
Male	14	49.2	(27.9, 70.7)	0.420
Female	10	37.3	(20.7, 57.7)	
Residence				
Urban	5	20.0	(7.1, 44.9)	<0.05
Rural	19	51.7	(33.5, 69.5)	
Region				
East	7	49.0	(23.2, 75.4)	0.610
North	8	40.0	(17.5, 67.6)	
South	7	50.5	(26.6, 74.2)	
West	2	20.0	(4.3, 58.5)	
Mother's Education				
Never attended school	18	47.1	(30.5, 64.4)	0.289
Completed primary school or less	2	27.5	(5.3, 72.0)	
Some or completed secondary+	2	19.4	(4.0, 58.4)	
Wealth Quintile				
Lowest	5	56.3	(26.6, 82.0)	
Second	9	56.4	(30.1, 79.5)	
Middle	6	56.1	(23.7, 84.1)	
Fourth	1	6.9	(0.8, 39.8)	
Highest	3	23.1	(6.4, 56.7)	0.071
ALL CHILDREN	24	42.4	(28.3, 57.9)	

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.

Table A8-7. Proportion of children with minimum dietary diversity the day before the interview, children 6-23 months of age, Sierra Leone 2013. (WHO/UNICEF recommendations-Indicator #5: Minimum dietary diversity)

Characteristic	n	%[a]	(95% CI)[b]	P value
Age Group (in months)				
6-11	21	16.6	(10.2, 25.8)	< 0.001
12-23	81	48.4	(37.7, 59.3)	
Sex				
Male	55	38.1	(28.0, 49.3)	0.329
Female	47	32.4	(24.5, 41.5)	
Residence				
Urban	49	41.3	(31.8, 51.6)	0.197
Rural	53	31.5	(21.7, 43.3)	
Region				
East	19	32.9	(19.7, 49.5)	0.132
North	33	30.1	(19.3, 43.7)	
South	34	48.4	(33.5, 63.6)	
West	16	28.0	(19.2, 38.9)	
Mother's Education				
Never attended school	53	32.3	(23.3, 42.8)	0.277
Completed primary school or less	19	42.9	(27.2, 60.1)	
Some or completed secondary+	26	41.6	(30.7, 53.4)	
Wealth Quintile				
Lowest	15	22.5	(12.3, 37.6)	0.117
Second	25	38.8	(21.5, 59.6)	
Middle	20	35.1	(23.3, 49.1)	
Fourth	27	52.0	(36.9, 66.8)	
Highest	15	31.1	(17.9, 48.4)	
ALL CHILDREN	102	35.2	(27.8, 43.3)	

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

[a] Percentages weighted for unequal probability of selection.

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

Table A8-8. Distribution of children with minimum meal frequency the day before the interview, children 6-23 months of age, Sierra Leone 2013. (WHO/UNICEF recommendations-Indicator #6: Minimum meal frequency)

Characteristic	n	%[a]	(95% CI)[b]	P value
Age Group (in months)				
6-11	19	20.0	(11.9, 31.6)	0.245
12-23	26	29.2	(18.9, 42.2)	
Sex				
Male	27	28.4	(19.4, 39.4)	0.239
Female	18	20.5	(12.5, 31.7)	
Residence				
Urban	16	23.0	(13.2, 37.0)	0.780
Rural	29	25.1	(17.1, 35.4)	
Region				
East	16	40.2	(23.7, 59.2)	<0.05
North	18	23.8	(14.4, 36.7)	
South	9	18.5	(9.5, 33.1)	
West	2	9.9	(2.9, 28.8)	
Mother's Education				
Never attended school	28	25.9	(18.6, 35.0)	0.683
Completed primary school or less	5	17.5	(6.5, 39.5)	
Some or completed secondary+	10	25.9	(13.0, 45.0)	
Wealth Quintile				
Lowest	12	29.2	(18.4, 42.9)	0.735
Second	10	21.6	(9.8, 41.2)	
Middle	11	27.1	(13.8, 46.3)	
Fourth	10	29.0	(13.8, 50.9)	
Highest	2	13.0	(3.1, 40.9)	
ALL CHILDREN	45	24.4	(17.9, 32.4)	

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.

Table A8-9. Proportion of children with minimum acceptable diet the day before the interview, children 6-23 months of age, Sierra Leone 2013. (WHO/UNICEF recommendations-Indicator #7: Minimum acceptable diet)

Characteristic	n	%[a]	(95% CI)[b]	P value
Age Group (in months)				
6-11	9	10.6	(5.0, 20.8)	0.220
12-23	14	18.4	(9.8, 32.0)	
Sex				
Male	12	13.6	(7.0, 24.8)	0.824
Female	11	14.9	(8.1, 25.7)	
Residence				
Urban	10	17.0	(8.0, 32.4)	0.549
Rural	13	12.8	(6.8, 22.8)	
Region				
East	5	17.9	(4.7, 48.9)	0.893
North	10	14.3	(7.2, 26.4)	
South	6	14.3	(6.1, 29.9)	
West	2	9.9	(2.9, 28.8)	
Mother's Education				
Never attended school	13	14.2	(8.0, 23.9)	0.973
Completed primary school or less	4	15.3	(5.1, 37.9)	
Some or completed secondary+	5	15.7	(6.0, 35.2)	
Wealth Quintile				
Lowest	3	9.3	(2.7, 27.5)	0.604
Second	6	14.2	(5.7, 31.1)	
Middle	6	17.2	(7.1, 36.1)	
Fourth	7	23.3	(9.2, 47.7)	
Highest	1	7.6	(1.0, 39.3)	
ALL CHILDREN	23	14.3	(8.8, 22.3)	

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.

Table A8-10. Proportion of mild, moderate, and severe anemia in children 6-59 months of age, Sierra Leone 2013.

	Mild anemia				Moderate anemia				Severe anemia			
Characteristic	n	% [a, b]	(95% CI)[c]	P value [d]	n	% [a, b]	(95% CI)[c]	P value [d]	n	% [a, b]	(95% CI)[c]	P value [d]
Age Group (in months)												
6-11	33	24.5	(17.6, 33.0)	<0.001	61	54.2	(43.8, 64.3)	<0.001	8	9.4	(4.3, 19.3)	<0.001
12-23	48	23.8	(16.8, 32.6)		77	43.6	(34.7, 52.9)		7	6.3	(2.7, 14.1)	
24-35	38	29.6	(20.4, 40.8)		53	42.0	(32.6, 52.0)		4	5.3	(1.8, 14.2)	
36-47	43	26.7	(18.8, 36.5)		71	45.3	(36.2, 54.8)		6	4.4	(2.0, 9.4)	
48-59	28	21.5	(14.1, 31.4)		53	45.5	(35.1, 56.3)		2	1.9	(0.5, 7.6)	
Sex												
Male	98	27.5	(22.1, 33.6)	0.590	150	45.4	(39.5, 51.5)	0.590	13	5.4	(3.1, 9.3)	0.590
Female	92	23.0	(17.9, 29.1)		165	46.1	(38.5, 53.9)		14	5.4	(2.8, 9.9)	
Residence												
Urban	93	26.9	(21.9, 32.5)	<0.01	120	37.6	(30.9, 44.9)	<0.01	7	3.2	(1.3, 8.0)	<0.01
Rural	97	24.1	(18.3, 31.2)		195	50.7	(43.2, 58.3)		20	6.7	(3.8, 11.4)	
Region												
East	43	26.7	(17.9, 37.7)	<0.01	75	51.9	(41.2, 62.5)	<0.01	6	4.1	(1.4, 11.5)	<0.01
North	55	23.4	(16.4, 32.2)		117	52.3	(44.1, 60.4)		12	7.4	(3.5, 15.2)	
South	43	22.5	(15.3, 31.8)		88	45.3	(34.4, 56.7)		8	6.4	(3.2, 12.5)	
West	49	30.9	(22.2, 41.2)		35	26.1	(18.7, 35.1)		1	1.4	(0.2, 9.7)	
Mother's Education												
Never attended school	117	27.2	(21.5, 33.6)	<0.001	193	48.5	(41.4, 55.6)	<0.001	18	5.6	(3.3, 9.6)	<0.001
Comp. primary school or less	16	17.9	(10.4, 29.0)		43	50.2	(38.0, 62.4)		6	11.5	(5.1, 24.1)	
Some or comp. secondary+	37	25.5	(17.3, 36.0)		46	37.6	(27.6, 48.8)		1	0.6	(0.1, 4.5)	
Wealth Quintile												
Lowest	38	22.7	(16.1, 31.0)	<0.001	81	51.6	(41.4, 61.7)	<0.001	7	5.1	(2.5, 10.1)	<0.001
Second	30	20.3	(12.6, 31.1)		76	53.1	(41.8, 64.1)		9	9.7	(4.5, 19.4)	
Middle	31	23.7	(17.0, 32.0)		64	50.7	(41.6, 59.8)		7	6.5	(2.9, 14.1)	
Fourth	45	30.8	(22.8, 40.1)		60	42.0	(33.5, 50.9)		4	4.3	(1.5, 11.4)	
Highest	39	28.7	(20.6, 38.5)		26	23.5	(15.9, 33.4)		0	--	--	
ALL CHILDREN	190	25.2	(21.0, 29.9)	--	315	45.8	(40.4, 51.3)	--	27	5.4	(3.4, 8.5)	--

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data. Total sample size: anemia=710, ID=654, IDA=668.

[a] Percentages weighted for unequal probability of selection.

[b] Mild, moderate, and severe anemia defined as hemoglobin 100-109 g/L, 70-99 g/L, and <70 g/L, respectively; after adjusting hemoglobin for altitude.

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

[d] 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

APPENDIX 9. ADDITIONAL WOMAN TABLES

Table A9-1. Proportion of mild, moderate, and severe anemia in non-pregnant women (15-49 years), Sierra Leone 2013.

		Mild anemia [b]			Moderate anemia				Severe anemia			
Characteristic	n	%[a]	(95% CI)[c]	P value[d]	n	%[a]	(95% CI)[c]	P value[d]	n	%[a]	(95% CI)[c]	P value[d]
Age group (in years)												
15-19	37	23.1	(16.3, 31.7)	0.191	42	22.1	(15.3, 30.6)	0.191	2	0.8	(0.2, 3.6)	0.191
20-24	35	24.1	(16.6, 33.6)		30	15.4	(10.0, 23.0)		3	1.5	(0.4, 5.9)	
25-29	36	18.5	(12.0, 27.5)		28	19.5	(13.6, 27.2)		0	--	--	
30-34	31	31.0	(20.9, 43.3)		18	12.7	(7.5, 20.6)		3	3.6	(1.1, 11.4)	
35-39	25	21.1	(13.5, 31.4)		25	27.8	(18.3, 39.9)		1	0.7	(0.1, 4.7)	
40-44	20	27.0	(16.9, 40.2)		13	18.9	(8.3, 37.5)		0	--	--	
45-49	17	40.1	(24.9, 57.5)		13	18.9	(7.8, 38.9)		1	1.4	(0.2, 10.1)	
Residence												
Urban	95	23.1	(18.5, 28.3)	0.870	85	18.8	(13.3, 25.8)	0.870	4	1.1	(0.4, 3.0)	0.870
Rural	110	25.2	(20.7, 30.2)		90	20.0	(15.3, 25.7)		6	1.1	(0.4, 2.6)	
Province												
East	33	21.1	(14.8, 29.2)	0.165	51	23.8	(14.8, 36.0)	0.165	2	1.1	(0.3, 4.2)	0.165
North	63	22.4	(16.2, 30.1)		62	24.3	(18.2, 31.7)		5	1.8	(0.8, 4.2)	
South	60	26.5	(21.8, 31.8)		39	16.0	(10.2, 24.4)		3	0.9	(0.2, 4.3)	
West	49	27.3	(21.5, 34.0)		23	11.9	(7.3, 18.8)		0	--	--	
Woman's education												
Never attended school	122	24.8	(20.4, 29.8)	0.373	101	20.2	(16.3, 24.7)	0.373	6	1.2	(0.5, 2.7)	0.373
Comp. PS or less	19	18.0	(10.6, 28.9)		28	26.9	(16.9, 39.8)		1	0.8	(0.1, 5.4)	
Some or comp. SS+	64	25.4	(19.4, 32.5)		46	15.6	(10.7, 22.0)		3	0.9	(0.3, 2.9)	
Wealth quintile												
Lowest	47	28.5	(22.9, 34.9)	0.210	33	19.0	(13.0, 27.0)	0.210	6	3.3	(1.5, 7.3)	0.210
Second	32	19.4	(12.5, 29.0)		45	25.2	(18.0, 34.1)		1	0.3	(0.0, 2.0)	
Middle	38	21.9	(14.9, 31.0)		39	21.2	(15.1, 29.0)		1	0.9	(0.1, 6.2)	
Fourth	42	26.3	(20.3, 33.3)		32	17.0	(9.9, 27.5)		2	1.2	(0.3, 4.8)	
Highest	36	22.7	(16.3, 30.7)		24	15.8	(9.4, 25.5)		0	--	--	
ALL NON-PREGNANT WOMEN	205	24.2	(21.0, 27.8)	--	175	19.5	(15.8, 23.8)	--	10	1.1	(0.5, 2.1)	--

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. Total sample size: anemia=871, ID=774, IDA=827

[b] Mild, moderate, and severe anemia defined as hemoglobin 110-119 g/L, 80-109 g/L, and <80 g/L, respectively; after adjusting hemoglobin for altitude and smoking.

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

[d] 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

Table A9-2. Proportion of iodine deficiency in non-pregnant *non-lactating* women (15-49 years) by WHO categories, Sierra Leone 2013.

	Severe [a]		Moderate [a]		Mild [a]		Adequate [a]		Above requirement [a]		Excess [a]	
Characteristic	n	%	n	%	n	%	n	%	n	%	n	%
Age (in years)												
15-19	1	0.6	4	2.4	9	9.5	26	21.5	37	34.8	33	31.1
20-24	1	0.7	2	3.4	14	18.6	34	29.6	24	21.7	28	26.0
25-29	2	1.6	5	7.3	12	14.5	29	37.2	23	22.5	17	17.0
30-34	0	--	3	6.6	10	11.7	24	31.4	20	19.1	21	31.2
35-39	1	1.0	0	--	8	10.3	24	31.3	21	33.9	19	23.5
40-44	0	--	5	6.4	9	14.8	21	33.8	16	26.6	12	18.4
45-49	1	3.9	2	3.9	7	13.1	13	36.6	12	30.1	5	12.4
Residence												
Urban	1	0.2	7	1.5	32	10.7	97	27.1	99	29.1	92	31.4
Rural	7	2.2	15	6.9	41	16.4	78	33.9	57	24.4	45	16.3
Region												
East	1	0.8	6	7.9	15	13.8	36	33.9	21	17.9	26	25.7
North	5	2.5	8	5.0	30	18.1	47	25.6	42	26.3	35	22.6
South	2	0.9	5	3.2	16	12.3	46	34.8	43	26.0	31	22.8
West	0	--	3	1.3	12	8.6	46	29.8	50	34.2	45	26.1
Women's education												
Never attended school	7	2.0	15	5.9	54	18.0	90	31.8	70	22.4	67	19.9
Completed primary school or less	1	0.9	1	0.9	6	13.0	18	31.4	20	30.4	10	23.4
Some or completed secondary+	0	--	6	2.4	13	7.1	67	28.2	65	31.8	60	30.4
Wealth quintile												
Lowest	5	5.3	5	6.2	20	22.5	22	22.4	18	20.3	21	23.4
Second	1	0.8	4	6.4	14	13.4	34	43.2	14	20.4	17	15.8
Middle	2	1.1	7	6.6	13	10.4	38	34.1	31	23.3	25	24.5
Fourth	0	--	3	1.7	12	13.6	44	34.6	37	33.4	24	16.6
Highest	0	--	2	1.2	12	9.3	34	20.9	48	31.3	46	37.3
Adequately iodized salt in household [b]												
Yes	4	0.9	8	1.6	34	9.6	132	32.7	122	29.5	101	25.7
No	4	3.6	9	12.7	23	26.8	23	25.5	17	18.0	12	13.5
ALL NON PREGNANT NON LACTATING WOMEN	8	1.1	22	4.1	73	13.4	175	30.4	156	26.8	137	24.1

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] Iodine deficiency classified by urinary iodine concentration: Severe, <20µg/L; Moderate, 20-49 µg/L; Mild, 50-99 µg/L; Adequate, 100-199 µg/L; Above requirements, 200-299 µg/L; Excess, ≥300 µg/L. [b] Adequately iodized salt ≥ 15 ppm. Total sample size=571

Table A9-3. Proportion of iodine deficiency in non-pregnant *lactating* women (15-49 years) by WHO categories, Sierra Leone 2013.

	Insufficient [a]		Adequate [a]	
Characteristic	n	%	n	%
Age (in years)				
15-19	9	19.7	37	80.3
20-24	8	22.4	37	77.6
25-29	14	26.9	37	73.1
30-34	9	35.4	21	64.6
35-39	7	43.3	15	56.7
40-44	2	20.5	7	79.5
45-49	0	--	5	100.0
Residence				
Urban	15	24.7	66	75.3
Rural	37	26.1	102	73.9
Region				
East	8	12.0	51	88.0
North	26	34.3	54	65.7
South	16	29.5	39	70.5
West	2	7.6	24	92.4
Women's education				
Never attended school	35	27.1	105	72.9
Completed primary school or less	8	27.1	25	72.9
Some or completed secondary+	9	20.6	38	79.4
Wealth quintile				
Lowest	19	30.6	44	69.4
Second	14	31.5	37	68.5
Middle	9	19.0	35	81.0
Fourth	7	24.8	27	75.2
Highest	3	9.9	24	90.1
Adequately iodized salt in household [b]				
Yes	20	11.6	123	88.4
No	23	63.2	16	36.8
ALL NON PREGNANT LACTATING WOMEN	52	25.7	168	74.3

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] Iodine deficiency classified by urinary iodine concentration: Insufficient, <100µg/L; Adequate, ≥100 µg/L.

[b] Adequately iodized salt ≥ 15 ppm. Total sample size=251

Table A9-4. Proportion of mild, moderate, and severe anemia in pregnant women, Sierra Leone 2013.

		Mild anemia [b]			Moderate anemia				Severe anemia			
Characteristic	n	%[a]	(95% CI)[c]	P value[d]	n	%[a]	(95% CI)[c]	P value[d]	n	%[a]	(95% CI)[c]	P value[d]
Age group (in years)												
15-24	34	32.4	(25.0, 40.8)	0.537	40	38.0	(29.8, 46.9)	0.537	3	2.8	(0.9, 8.7)	0.537
25-34	13	24.0	(15.3, 35.6)		22	40.6	(28.7, 53.8)		1	1.8	(0.2, 12.7)	
35-49	1	9.6	(1.3, 47.2)		4	40.8	(15.8, 71.6)		0	--	--	
Residence												
Urban	19	27.9	(19.3, 38.6)	0.740	25	36.8	(26.7, 48.1)	0.740	1	1.5	(0.2, 10.7)	0.740
Rural	30	28.3	(21.2, 36.7)		44	41.5	(32.6, 51.0)		3	2.8	(0.9, 8.7)	
Province												
East	12	34.0	(20.6, 50.7)	0.289	7	19.9	(12.0, 31.2)	0.289	2	5.6	(1.3, 20.9)	0.289
North	18	32.8	(22.9, 44.5)		23	41.6	(31.1, 52.9)		2	3.7	(0.9, 14.0)	
South	9	21.6	(13.0, 33.6)		18	42.8	(28.8, 58.0)		0	--	--	
West	10	23.9	(15.9, 34.3)		21	49.7	(34.3, 65.2)		0	--	--	
Woman's education												
Never attended school	28	30.8	(21.9, 41.3)	0.808	35	38.4	(28.4, 49.4)	0.808	3	3.3	(1.1, 9.8)	0.808
Comp. PS or less	8	21.7	(11.4, 37.3)		17	46.0	(29.7, 63.3)		0	--	--	
Some or comp. SS+	13	28.2	(16.1, 44.4)		17	36.8	(25.1, 50.3)		1	2.1	(0.3, 14.3)	
Wealth quintile												
Lowest	9	28.1	(15.2, 46.0)	0.909	10	31.3	(16.6, 51.0)	0.909	1	3.1	(0.4, 21.2)	0.909
Second	11	26.8	(15.3, 42.7)		20	48.8	(31.6, 66.2)		0	--	--	
Middle	11	35.8	(20.2, 55.1)		12	38.4	(24.2, 54.9)		1	3.1	(0.4, 20.7)	
Fourth	9	24.1	(13.6, 39.0)		14	38.0	(23.1, 55.7)		1	2.7	(0.3, 18.9)	
Highest	8	29.6	(16.6, 47.1)		11	40.4	(25.0, 58.1)		0	--	--	
ALL PREGNANT WOMEN	49	28.2	(22.5, 34.6)	--	69	39.6	(32.8, 46.7)	--	4	2.3	(0.8, 6.1)	--

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. Total sample size: anemia=871, ID=774, IDA=827

[b] Mild, moderate, and severe anemia defined as hemoglobin 100-109 g/L, 70-99 g/L, and <70 g/L, respectively; after adjusting hemoglobin for altitude and smoking.

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

[d] 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

Table A9-5. Proportion of iodine deficiency in pregnant women by WHO categories, Sierra Leone 2013.

	Insufficient [a]		Adequate [a]		Above requirement [a]		Excess [a]	
Characteristic	n	%	n	%	n	%	n	%
Age (in years)								
15-24	37	40.1	29	31.4	22	24.1	4	4.3
25-34	29	57.6	13	26.7	8	15.7	0	--
35-49	3	36.7	4	50.5	1	12.9	0	--
Residence								
Urban	21	36.8	22	38.6	13	22.8	1	1.8
Rural	50	52.1	24	25.0	18	18.8	4	4.2
Region								
East	11	34.1	11	34.6	9	28.3	1	3.0
North	30	57.5	15	29.1	5	9.6	2	3.8
South	18	47.2	12	31.9	7	18.3	1	2.6
West	12	38.7	8	26.1	10	31.9	1	3.3
Women's education								
Never attended school	44	53.4	20	24.7	15	18.3	3	3.6
Completed primary school or less	14	46.5	9	29.9	7	23.6	0	--
Some or completed secondary+	13	31.7	17	41.5	9	21.9	2	4.9
Wealth quintile								
Lowest	15	53.6	6	21.4	5	17.9	2	7.1
Second	18	47.1	14	37.2	5	13.1	1	2.6
Middle	11	38.5	7	25.4	10	36.1	0	--
Fourth	10	32.3	13	41.9	7	22.5	1	3.3
Highest	15	67.9	4	18.5	3	13.6	0	--
Adequately iodized salt in household [b]								
Yes	45	41.6	36	33.3	24	22.3	3	2.7
No	16	75.9	3	14.8	2	9.3	0	--
ALL PREGNANT WOMEN	71	46.1	46	30.3	31	20.3	5	3.2

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data. Total sample size=153

[a] Iodine deficiency classified by urinary iodine concentration: Insufficient, <150µg/L; Adequate, 150-249 µg/L; Above requirements, 249-499 µg/L; Excess, ≥500 µg/L.

[b] Adequately iodized salt ≥ 15 ppm.

APPENDIX 10: SURVEY QUESTIONNAIRES (ENGLISH)

Affix HOUSEHOLD label here (starts with "H")	**SIERRA LEONE NATIONAL MICRONUTRIENT SURVEY 2013** **HOUSEHOLD QUESTIONNAIRE**
1. Region East .....1 North .....2 South.....3 West.....4	2. Village/Place: _____ 3. Location of this cluster Urban ..... 1 Rural 2
4. Cluster number ..... ☐☐	5. Cluster control form HH number ..... ☐☐
6. Name of head of household _____	7. Team number..... ☐
8. GPS Coordinates: North ___ • ___ ___ ___ ___ ___	West ___ ___ • ___ ___ ___ ___ ___

	Visit 1	Visit 2	Visit 3	9. Final visit
Date	__ __ / __ __	__ __ / __ __	__ __ / __ __	☐☐/☐☐/☐☐ Day Month Year
Interviewer no.	_____	_____	_____	10. Interviewer no. ..... ☐
Next visit: Date Time	__ __ / __ __ __ __ : __ __	__ __ / __ __ __ __ : __ __	__ __ / __ __ __ __ : __ __	11. Number of visits ..... ☐
Result	___	___	___	12. Final result code ..... ☐

FINAL RESULT CODES:

Completed	1	Refused	4
No household member or no competent respondent at home at time of visit	2	Dwelling vacant / Address not a dwelling	5
		Dwelling destroyed	6
		Dwelling not found	7
Entire household absent for long period or moved away	3	Other (specify) _____	8

Note: Questions 13 and 15 should be filled in following the completion of the household roster. Questions 14 and 16 to be filled in after the completion of the individual questionnaires.

13. Number of children 0-59 months ..... ☐☐	14. Number of children with data .....0 1 (circle #)
15. Number of NPW ..... ☐☐	16. Number of NPW with data .....0 1 2 (circle #)

Hello. We are working with the Ministry of Health and Sanitation in Sierra Leone. We are conducting a national nutrition survey to better understand various types of nutritional problems such as anemia, and vitamin and mineral deficiencies in women and children. This information will help the government to plan for better health in the future. We would very much appreciate your household's participation in this survey. The survey usually takes about 45 minutes to 1 hour to complete, and includes answering questions and a visit to another place to take a small blood sample from the women and children in the household. Whatever information you provide will be kept strictly confidential and will not be shown to other persons.

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. However, we hope that you will participate in this survey since your views are important. After these questions to you, I will speak with some of the women in your household and the women who take care of the children 0-59 months.

17. May I start now?

☐ YES, PERMISSION IS GIVEN -> BEGIN THE INTERVIEW.

☐ NO, PERMISSION IS NOT GIVEN -> COMPLETE THIS COVER PAGE. DISCUSS RESULT WITH TEAM LEADER.

First, I would like to ask you some general questions about the people who live in this household. Please tell me the name of each person who usually lives here, starting with the head of the household. *List the head of the household in line 01. List all household members and their sex. Then ask:* **Are there any others who live here, even if they are not at home now?** *If yes, complete listing for questions 16-19. Then, ask questions starting with 18 for each person at a time. Use an additional questionnaire if all rows in the household listing form have been used.*

Household Roster

18. Line No		19. **Is** (name) **male or female?**		20. **What is** (name)'s **date of birth?** 99 DK	9999 DK	21. **How old is** (name)? *Record in completed years. If age is 95 or above, record '95* 99 DK	Women age 15-49 *Circle line no. if woman is age 15-49 years*	Pregnant *Circle line no. if pregnant*	Children age < 5 years *Circle line no. if child is age 0-59 months*	Children < 5 years 25. **Who is the mother or primary caretaker of this child?** *Record line no. of mother or caregiver*
Line	Name	M	F	Month	Year	Age	15-49		0-59	caregiver
01	Household Head	1	2	__ __	__ __ __ __	__ __	01	01	01	__ __
02		1	2	__ __	__ __ __ __	__ __	02	02	02	__ __
03		1	2	__ __	__ __ __ __	__ __	03	03	03	__ __
04		1	2	__ __	__ __ __ __	__ __	04	04	04	__ __
05		1	2	__ __	__ __ __ __	__ __	05	05	05	__ __
06		1	2	__ __	__ __ __ __	__ __	06	06	06	__ __
07		1	2	__ __	__ __ __ __	__ __	07	07	07	__ __
08		1	2	__ __	__ __ __ __	__ __	08	08	08	__ __
09		1	2	__ __	__ __ __ __	__ __	09	09	09	__ __
10		1	2	__ __	__ __ __ __	__ __	10	10	10	__ __
11		1	2	__ __	__ __ __ __	__ __	11	11	11	__ __
12		1	2	__ __	__ __ __ __	__ __	12	12	12	__ __
13		1	2	__ __	__ __ __ __	__ __	13	13	13	__ __
14		1	2	__ __	__ __ __ __	__ __	14	14	14	__ __
15		1	2	__ __	__ __ __ __	__ __	15	15	15	__ __
16		1	2	__ __	__ __ __ __	__ __	16	16	16	__ __
17		1	2	__ __	__ __ __ __	__ __	17	17	17	__ __
18		1	2	__ __	__ __ __ __	__ __	18	18	18	__ __
19		1	2	__ __	__ __ __ __	__ __	19	19	19	__ __
20		1	2	__ __	__ __ __ __	__ __	20	20	20	__ __

Probe for additional household members. Probe especially for any infants or small children not listed, and others who may not be members of the family (such as servants, friends) but who usually live in the household. Insert names of additional members in the household list and complete form accordingly.

A household is defined a person or a group of persons, related or unrelated, who live together and share a common source of food and livelihood, and recognize one person as a head

To randomly select women and children from the household, use the information in this household roster to complete the following page. For each individual selected, prepare the first and last page of the questionnaire, including the labels. You should now have a separate questionnaire for each selected woman and child < 5 years in the household.

HOUSEHOLD FORM Cluster number ☐☐ Household number ☐☐ Page 3

To randomly select women and children from the households, all eligible women and children from the household roster must be listed according to the instructions below. Follow the four steps in order.

Pregnant women

- List all eligible pregnant women (Q23) below.

Age	Name	Line number on HH roster

1 → Prepare questionnaires for ALL pregnant women.

Non-pregnant women:

- List all eligible non-pregnant women (15-49 yrs) in order of increasing age.
- Record age in years (Q21), name, and line number (Q18) below.
- Consult Kish table and record line number of randomly selected women in Box A.

Age	Name	Line number on HH roster

2 → Box A

Children and mothers or caregivers:

- List all eligible children (< 5 years) in order of increasing age.
- Record age in years (Q21), name, line number (Q18), and mother's or caregiver's number.
- Consult Kish table and record randomly selected child in box B.
- Fill in the line number of the corresponding mother or caregiver in box C.

Age	Name	Child's line number on HH roster	Mother's or caregiver's line number on HH roster

3 → Box B | Box C

4 →

Prepare questionnaires for:

- ALL pregnant women (step 1).
- ALL non-pregnant women and children in boxes A, B, and C (steps 2 & 3).

If the line numbers in boxes A and C are the same, prepare only one questionnaire.

If the woman listed in box C is pregnant, only prepare one questionnaire for this woman.

Now I would like to ask you about some basic questions about the household head

26. **What is the religion of the head of this household?**	Christian ..... 1 Muslim ..... 2 Traditional ..... 3 No religion ..... 7 Other religion (specify) _____ 8 Don't know 9	
27. **What is the first language of the head of this household?**	Mende ..... 1 Temne ..... 2 Limba ..... 3 Creole ..... 4 Madingo ..... 5 Loko ..... 6 Sherbro ..... 7 Kono ..... 8 Other (specify) _____ 88 Don't know 99	
28. **Has the head of this household ever attended school or preschool?**	Yes ..... 1 No ..... 2 Don't know 9	-> Next Q -> Q30 -> Q30

29. **What is the highest level of school <u>attended</u> by the head of this household?**

How many years at this level did he/she <u>complete</u>?

	Circle code	Circle # years completed	DK
Kindergarten	0	0 1 2 3	9
Primary	1	0 1 2 3 4 5 6 7	9
JSS - Junior Secondary	2	0 1 2 3	9
SSS - Senior Secondary	3	0 1 2 3	9
Vocational/ commercial/ nursing/ technical/ teaching	4	0 1 2 3	9
Tertiary/college/univ	5	0 1 2 3 4 5 6	9
Don't know	9		

Now I would like to ask you about some basic questions about the household's characteristics

30. **How many rooms in this household are used for sleeping?**	Number of rooms ..... ☐☐	
31. Main material of dwelling floor *<u>Record only 1 observation</u>*	Natural floor Earth / Sand ..... 11 Dung ..... 12 Stone ..... 13 Rudimentary floor Wood planks ..... 21 Palm / Bamboo ..... 22 Finished floor Parquet or polished wood ..... 31 Vinyl or asphalt strips ..... 32 Ceramic tiles ..... 33 Cement ..... 34 Carpet ..... 35 Other (specify) _____ 88	

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32. Main material of the roof *Record only 1 observation*	Natural roofing No Roof ..... 11 Thatch / Palm leaf ..... 12 Sod ..... 13 Rudimentary Roofing Rustic mat ..... 21 Palm / Bamboo ..... 22 Wood planks ..... 23 Cardboard ..... 24 Finished roofing Metal / Zinc..... 31 Wood ..... 32 Calamine / Cement fibre ..... 33 Ceramic tiles ..... 34 Cement ..... 35 Roofing shingles ..... 36 Other (specify) _____ 88	
33. Main material of the exterior walls. *Record only 1 observation*	Natural walls No walls ..... 11 Cane / Palm / Trunks ..... 12 Dirt ..... 13 Rudimentary walls Bamboo with mud ..... 21 Stone with mud ..... 22 Uncovered mud brick ..... 23 Plywood ..... 24 Cardboard ..... 25 Reused wood ..... 26 Metal / Zinc ..... 27 Finished walls Cement ..... 31 Stone with lime / cement ..... 32 Bricks ..... 33 Cement blocks ..... 34 Covered mud brick ..... 35 Wood planks / shingles ..... 36 Other (specify) _____ .88	
34. **What type of fuel does your household mainly use for cooking?** *Record only 1 response*	Electricity ..... 1 Liquefied Petroleum Gas (LPG)..... 2 Natural gas ..... 3 Biogas ..... 4 Kerosene ..... 5 Coal / Lignite ..... 6 Charcoal..... 7 Wood..... 8 Straw / shrubs / grass ..... 9 Animal dung ..... 10 Agricultural crop residue ..... 11 No food cooked in household ..... 77 Other (specify: _____) .... 88 Don't know 99	

Now I would like to ask you some questions about things people in your household may own and things you may use at home.

35. **Does your household have _____?** *Ask about each item separately.*		Yes / No A. **Electricity?** ..... 1 2 B. **A television?** ..... 1 2 C. **A refrigerator?** ..... 1 2 D. **Non-mobile telephone?** ..... 1 2 E. **A radio?** 1 2	
36. **Does anyone in your household own a _____?** *Ask about each item separately.*		Yes / No A. **Watch?** ..... 1 2 B. **Mobile phone?** ..... 1 2 C. **Bicycle?** ..... 1 2 D. **Motorcycle?** ..... 1 2 E. **Car / Truck?** ..... 1 2 F. **Canoe?** ..... 1 2 G. **Boat with motor?** ..... 1 2 H. **Wheel barrow?** ..... 1 2 I. **Sprayer?** ..... 1 2 J. **Electric rice cutter?** ..... 1 2 K. **Sickle / Knife?** ..... 1 2 L. **Shovel / Hoe?** 1 2	
37. **Do you or someone living in this household own this dwelling?**		Yes ..... 1 No ..... 2 Don't know 9	
38. **Does any member of this household own any land that can be used for agriculture?**		Yes ..... 1 No ..... 2 Don't know 9	-> Next Q -> Q40 -> Q40
39. **If yes, how much agricultural land do members of this household own?** *Fill in agricultural land size for 1 category only.*		A. Plot ..... ☐☐☐ B. Town lot ..... ☐☐☐ C. Acres ..... ☐☐☐ Don't know 999	
40. **Does this household own any livestock, herds, other farm animals, or poultry?**		Yes ..... 1 No ..... 2 Don't know 9	-> Next Q -> Q42 -> Q42
41. **How many of the following animals does this household own?** *Ask about each item separately.* *If none, enter '00'* *If more than 95, enter '95'* *If unknown, enter '99'*		A. **Cattle, cows, bulls** ..... ☐☐ B. **Horses, donkeys, mules** ..... ☐☐ C. **Goats** ..... ☐☐ D. **Sheep** ..... ☐☐ E. **Rabbits** ..... ☐☐ F. **Pigs** ..... ☐☐ G. **Fowl** (Chickens, geese, ducks, turkeys) ☐☐ H. **Rodents to breed** ..... ☐☐ I. **Birds to sell** ..... ☐☐ J. **Bees** (Number of Hives) ..... ☐☐ K. Other (_____) ..... ☐☐	

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Now I would like to ask you about drinking water and sanitation in your household.

42. **What is the main source of drinking water for members of your household?** *Record only 1 response.*	Piped water Piped into dwelling ..... 11 Piped into compound, yard or plot ..... 12 Piped to neighbour ..... 13 Public tap / standpipe ..... 14 Tube well or borehole or handpump ..... 21 Dug well Protected well ..... 31 Unprotected well ..... 32 Water from spring Protected spring ..... 41 Unprotected spring ..... 42 Rainwater collection ..... 51 Tanker-truck ..... 61 Cart with small tank or drum ..... 71 Surface water (river, stream, dam, lake, pond, canal, irrigation channel) ..... 81 Bottled water ..... 91 Other (specify) _____ 88 Don't know 99	
43. **Do you do anything at home to the water to make it safer to drink?**	Yes ..... 1 No ..... 2 Don't know 9	-> Next Q -> Q45 -> Q45
44. **What do you usually do to make the water safer to drink?** *Probe*: **Anything else?** *Record all responses mentioned.*	Boil ..... A Add bleach or chlorine ..... B Strain it through a cloth ..... C Use water filter (ceramic, sand, composite, etc.) ..... D Solar disinfection ..... E Let it stand and settle ..... F Other (specify) _____ Y Don't know ..... Z	
45. **What is the main source of water used for washing utensils?** *Record only 1 response.*	Piped water Piped into dwelling ..... 11 Piped into compound, yard or plot ..... 12 Piped to neighbour ..... 13 Public tap / standpipe ..... 14 Tube well or borehole ..... 21 Dug well Protected well ..... 31 Unprotected well ..... 32 Water from spring Protected spring ..... 41 Unprotected spring ..... 42 Rainwater collection ..... 51 Tanker-truck ..... 61 Cart with small tank or drum ..... 71 Surface water (river, stream, dam, lake, pond, canal, irrigation channel) ..... 81 Bottled water ..... 91 Other (specify) _____ 88 Don't know 99	

46. **What kind of toilet facility do members of your household usually use?** *If "flush" or "pour flush", probe:* **Where does it flush to?** *If necessary, ask permission to observe the facility.* *Record only 1 response.*	Flush / Pour flush Flush to piped sewer system ..... 11 Flush to septic tank ..... 12 Flush to pit (latrine) ..... 13 Flush to somewhere else ..... 14 Flush to unknown place/ not sure / don't know where ..... 15 Pit latrine Ventilated Improved Pit latrine (VIP) ..... 21 Pit latrine with slab ..... 22 Pit latrine without slab / Open pit ..... 23 Composting toilet ..... 31 Bucket ..... 41 Hanging toilet, Hanging latrine ..... 51 No facility, Bush, Field ..... 61 Other (*specify*) _____ 88 Don't know 99	 -> Q48 -> Q48 -> Q48
47. **Do you share this facility with others who are not members of your household?**	Yes ..... 1 No ..... 2 Don't know 9	
48. **Please show me where members of your household most often wash their hands.**	Observed (Sink or fixed basin) ..... 1 Observed (Anywhere around dwelling) ..... 2 Not observed Not in dwelling / plot / yard ..... 3 No permission to see ..... 4 Other reason (*specify*) _____ 8	 -> Q51 -> Q51 -> Q51
49. *Observe presence of water at the specific place for handwashing.* *Verify by checking the tap/pump, or basin, bucket, water container or similar objects for presence of water.*	Water is available ..... 1 Water is not available 2	
50. *Record if soap or detergent is present at the specific place for handwashing.* *Circle 1 for Yes for each type of soap seen.* *Skip to Q52 if any soap or detergent code (A, B, or C) is YES. If D and E is circled YES, continue with next question.*	Yes No A. Bar soap ..... 1 2 B. Detergent (Powder / Liquid / Paste) ..... 1 2 C. Liquid soap ..... 1 2 D. Ash / Mud / Sand ..... 1 2 E. None 1	 -> Q52 -> Q52 -> Q52 -> Next Q -> Next Q
51. **Do you have any soap or detergent in your household for washing hands?** If Yes: **Can you please show it to me?** *Circle Yes for each type of soap seen.* If No, circle Yes for E.	Yes No A. Bar soap ..... 1 2 B. Detergent (Powder / Liquid / Paste) ..... 1 2 C. Liquid soap ..... 1 2 D. Ash / Mud / Sand ..... 1 2 E. None 1	

Now I would like to ask you some questions about the salt most commonly used in this household.

52. **Do you have salt in your house now?**	Yes ..... 1 No ..... 2 Don't know 9	-> Next Q -> Q56 -> Q56
53. **May I have a small sample of the salt that you use for cooking?** Collect approximately 20-30 grams of salt to be used for quantitative testing at central laboratory.	Yes ..... 1 No 2	-> Collect Salt -> Q56

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54. SALT SPECIMEN COLLECTED?	Yes ..... 1 No 2	
55. Does salt container show that it is iodized? *Observe the package that salt is in*	Yes, original package says iodized ..... 1 Original package not mention iodization ... 2 Undetermined, not in original package ..... 3 Undetermined for other reason 8	
56. **How many times per day, week, or month do you usually purchase vegetable oil?** *Fill in number of times for 1 time period only.*	Number of times a: A. ☐ times per Day B. ☐☐ times per Week C. ☐☐ times per Month I don't use it ..... 00 Don't know / not sure 99	 ->Q58 ->Q58
57. **What quantity is usually obtained whenever vegetable oil is bought?** *Fill in quantity for 1 unit of measure only*	A. Pint(s) ..... ☐☐ B. Rubber(s) ..... ☐☐ C. Gallon(s) ..... ☐☐ D. Don't know / not sure 99	
58. **What type of food products made with wheat flour do you eat <u>most often</u> in this household?**	Bread ..... 1 Pan cakes ..... 2 Doughnuts ..... 3 Other (specify _____) . 8 Unknown 9	-> Next Q -> END -> END -> END -> END
59. **What type of bread do you eat most often in this household?**	Factory white bread ..... 1 Factory brown bread ..... 2 Other bread from bakery or factory..... 3 Home-made ..... 4 Other (specify _____) . 8 Unknown 9	
60. **How many times per day, week, or month do you usually purchase bread?** *Fill in number of times for only 1 time period.*	Number of times a: A. ☐ times per Day B. ☐☐ times per Week C. ☐☐ times per Month D. Don't know / not sure 99	
61. **What quantity is usually obtained whenever bread is bought?** *Fill in number of loaves for either full-size loaves, medium loaves, or small loaves, if BOTH is bought then fill BOTH*	A. Number of full-size loaves ..... ☐☐ B. Number of medium loaves ..... ☐☐ C. Number of small loaves (baguettes) . ☐☐ D. Don't know / not sure 99	

Comments about data collection at this household:

The form was reviewed by: _____ Date: _____
Team leader's signature

Data entry clerk name: _____ Data entry clerk code number: ☐

Affix HOUSEHOLD label here (starts with "H")	**WOMAN QUESTIONNAIRE** **SIERRA LEONE NATIONAL MICRONTURIENT SURVEY 2013**	Affix WOMAN label here (starts with "W")

1. Cluster number ..... ☐☐	2. HH number (in cluster control form) ..... ☐☐
3. Name of this woman:_____	4. Woman's line number..... ☐☐
5. Was this woman randomly selected? Yes..... 1 No..... 2 *Check Box A or C on page 3 of household questionnaire*	6. Interviewer number..... ☐☐
7. Date of data collection ..... ☐☐/☐☐/☐☐ Day Month Year	
8. Final result of woman data collection ..... (enter code from below) ☐	
FINAL RESULT CODES: Completed interview and accepted participation in either urine and/or blood collection ..... 1 Completed interview and refused participation in both urine/blood collection 2	Refused interview and all data collection ..... 3 Woman not home or not available..... 4 Other (specify) _____ 8
9. Number of urine specimens requested from woman? *At end of the interview, provide two urine beakers to the first four women in each cluster to complete a woman's questionnaire. The first beaker (with yellow label) should be filled immediately, and the second beaker (with red label) approximately 24 hours later.* *All other women in the cluster should receive only one urine beaker.*	Number of specimens requested..... 1 Number of specimens requested..... 2

Repeat greeting if not already read to this respondent: **We are working with the Ministry of Health and Sanitation in Sierra Leone. We are conducting a national nutrition survey to better understand various types of nutritional problems such as anemia, vitamins and minerals in women and children. This information will help the government to plan for better health in the future.**	*If greeting at the beginning of the household questionnaire has already been read to this woman, then read the following:* **Now I would like to talk to you more about YOUR health and other topics. All the information we obtain will remain strictly confidential and your answers will never be shared with anyone other than our project team.** **The survey usually takes about 20 minutes to complete, and includes answering questions and a visit to (location of lab/measuring site) to to take a small blood sample.**

10. May I start now?

☐ YES, PERMISSION IS GIVEN -> BEGIN THE INTERVIEW.

☐ NO, PERMISSION IS NOT GIVEN -> COMPLETE THIS COVER PAGE. DISCUSS THIS RESULT WITH YOUR TEAM LEADER.

I would first like to ask you some questions about yourself.

11. **In what month and year were you born?**	Month ..... ☐☐ Year ..... ☐☐☐☐	Don't know, enter '99' or '9999'
12. **How old are you?** *Probe:* **How old were you at your last birthday?** *Compare month and year of birth and stated age; correct one if necessary*	Age ..... ☐☐ (in completed years) (enter '99' if unknown)	
13. **Have you ever attended school?**	Yes ..... 1 No ..... 2 Don't know 9	->NEXT Q -> Q15 -> Q15
14. **What is the highest level of school you attended?** **How many years at this level did you complete?**	Kindergarten ..... 0 — # years completed: 0 1 2 3 9 Primary ..... 1 — 0 1 2 3 4 5 6 7 9 JSS-Junior Secondary ... 2 — 0 1 2 3 9 SSS-Senior Secondary... 3 — 0 1 2 3 9 Vocational/ commercial/ nursing/ technical/ teaching ..... 4 — 0 1 2 3 9 Tertiary/college/univ..... 5 — 0 1 2 3 4 5 6 9 Don't know 9	
15. **What does this say?** *Show sentence on the card to the respondent. If respondent cannot read whole sentence, probe:* **Can you read part of the sentence to me?**	Cannot read at all ..... 1 Able only to read only parts of sentence ..... 2 Able to read whole sentence ..... 3 No sentence in required language (specify)_____ ..... 4 Blind, mute, visually/speech impaired 5	
16. **What is your marital status now?**	Never married, never lived with a man ..... 1 Currently married ..... 2 Living with a man, but not married ..... 3 Divorced ..... 4 Separated ..... 5 Widowed 6	
17. **What is your job outside the home?**	No job ..... 0 Unskilled labor ..... 1 Skilled labor ..... 2 Agriculture ..... 3 Shop or office ..... 4 Own business ..... 5 Professional ..... 6 Other (specify: _____) ..... 8 Don't know 9	
18. **Do you smoke cigarettes?**	Yes ..... 1 No 2	-> Next Q -> Q20
19. **On average, how many cigarettes do you smoke per day?**	Number ..... ☐☐	

WOMAN FORM	Cluster number ☐☐	Household number ☐☐	Woman number ☐☐	Page 3
20. **Are you pregnant now?**		Yes .....1 No ..... 2 Unsure/ don't know 9		-> Next Q -> Q22 -> Q22
21. **How many months pregnant are you?**		Number of months ..... ☐		
22. **How many times, in total, have you been pregnant?** *If pregnant now, include this pregnancy.* *If never pregnant, enter "00".*		Number of times ..... ☐☐ Don't know 99		00->Q26
23. **During your last pregnancy, did you take iron or folic acid supplements for 90 days or more?**		Yes .....1 No ..... 2 Unsure/ don't know 9		
24. **How many times, in total, have you given birth to a baby?** *Include still births and live births*		Number of times ..... ☐☐		00->Q26
25. **Are you currently breastfeeding a child?**		Yes .....1 No.....2		

26. **Please describe everything that you ate yesterday during the day or night, whether at home or outside the home.**

a) **Think about when you first woke up yesterday. Did you eat anything at that time? if yes: Please tell me everything that you ate at that time.**
Probe: **"Anything else?"** *until respondent says nothing else. If no, continue to question b).*

b) **What did you do after that? Did you eat anything at that time? If yes: Please tell me everything you ate at that time.**
Probe: **"Anything else?"** *until respondent says nothing else.*
Repeat question b) above until respondent says she went to sleep until the next day.
If respondent mentions mixed dishes like a porridge, sauce or stew, probe:

c) **What ingredients were in that (mixed dish)?**
Probe: **"Anything else?"** *until respondent says nothing else.*

As the respondent recalls foods, underline the corresponding food and circle '1' in the column next to the food group. If the food is not listed in any of the food groups below, write the food in the box labelled 'other foods'. If foods are used in small amounts for seasoning or as a condiment, include them under the condiments food group. Once the respondent finishes recalling foods eaten, read each food group where '1' was not circled, ask the following question and circle '1' if respondent says yes, '2' if no and '9' if don't know:

Yesterday during the day or night, did you drink/eat any (food group items not already marked 1)?			
Other foods:			
	Yes	No	DK
A. Corn/maize, rice, sorghum, millet, or other foods made from these grains or any other grains (e.g. bread, noodles, porridge or other grain products, other local grains)	1	2	9
B. Pumpkin, carrots, squash, or orange peteteh?	1	2	9
C. Irish potatoes, white sweet potatoes, cassava, yam, garri, or any other foods made from roots?	1	2	9
D. Any dark green leafy vegetables (e.g. potato leaves, cassava leaves, krian-krain, green, or moringa)?	1	2	9
E. Ripe mango, ripe pawpaw, guava, or water melon?	1	2	9
F. Lemon, lime, grapefruit, orange, pineapple, banana, or plantain?	1	2	9
G. Any other fruits or vegetables (e.g. Pear, okroh, giblox, jakato, ball tamatis, or seed tamatis)?	1	2	9
H. Liver, kidney, heart, or other organ meats? If "Yes", confirm that respondent actually consumed meats and not just sauce cooked with meat. If only sauce consumed, mark "No".	1	2	9
I. Any meat, such as beef, pork, lamb, goat, chicken, cat, dog, monkey or duck? If "Yes", confirm that respondent actually consumed meats and not just sauce cooked with meat. If only sauce consumed, mark "No".	1	2	9
J. Eggs	1	2	9
K. Fresh or dried fish, oysters, crabs, shrimp, or cray fish or other seafood? If "Yes", confirm that respondent actually consumed fish etc, and not just sauce cooked with fish etc. If only sauce consumed, mark "No".	1	2	9
L. Any foods made from black eye binch, konsho binch, broad binch beans, grandnat, kushu, cowpea, benni, egusi, soya bean, lentils or any other seeds?	1	2	9
M. Cheese, yogurt, or other milk products?	1	2	9
N. Any oil, fats, or butter, or foods made with any of these?	1	2	9
O. Any sugary foods such as chocolates, sweets, candies, pastries, cakes, or biscuits?	1	2	9
P. Condiments for flavor, such as pepper, hot pepper, onions, spices, herbs, or fish powder	1	2	9
Q. Snails or insects, snakes	1	2	9
R. Foods made with red palm oil, red palm nut, or red palm nut pulp sauce	1	2	9

WOMAN FORM	Cluster number ☐☐	Household number ☐☐	Woman number ☐☐	Page 5

Now I would like to ask you about some foods which may contain extra nutrients.

27. **Have you heard about iodized salt (i.e. salt with added iodine)?**	Yes ..... 1 No ..... 2 Don't know 9	-> Next Q -> Q29 -> Q29
28. **Why do you think <u>iodized</u> salt is important?** *Do not prompt. <u>Mark all responses mentioned</u>*	Prevents goitre/Gehgeh ..... A Improves intelligence ..... B Prevents iodine deficiency .. C Improve health status ..... D Other ..... Y (specify: _____) Don't know ..... Z	
29. **Have you heard about <u>fortified</u> vegetable oil (i.e. oil with nutrients added)?**	Yes ..... 1 No ..... 2 Don't know 9	-> NEXT Q -> Q31 -> Q31
30. **Why do you think fortified oil (i.e. with added nutrients) is important?** *Do not prompt. <u>Mark all responses mentioned</u>*	Prevents blindness ..... A Reduces mortality ..... B Prevents vitamin deficiency C Improve health status ..... D Other ..... Y (specify: _____) Don't know ..... Z	

Now I would like to ask you some questions about vitamins or minerals you may be taking or have recently taken.

31. **During the last six months did you take any iron tablets or syrup, such as Dexorange, Dawn of Life, Pinoplex, Haemoforte, Rescofer Blood Tonic, HB 12?** *Show iron tablets and syrup.*	Yes ..... 1 No ..... 2 Not sure if it was iron 9	-> Next Q -> Q35 -> Q35
32. **For how long did you take iron tablets or syrup?**	One week or less ..... 1 More than 1 week, less than 1 month ..... 2 One month or more 3	
33. **Are you still taking iron tablets or syrup?**	Yes ..... 1 No 2	-> Q35 -> Next Q
34. **When did you stop taking iron tablets or syrup?**	Less than 3 months ago ..... 1 3 months ago or more ..... 2 Don't know 9	
35. **During the last six months did you take any folic acid tablets?** *Show folic acid tablets.*	Yes ..... 1 No ..... 2 Not sure if it was folic acid 9	-> Next Q -> Q39 -> Q39
36. **For how long did you take folic acid tablets?**	One week or less ..... 1 More than 1 week, less than 1 month ..... 2 One month or more 3	
37. **Are you still taking folic acid tablets?**	Yes ..... 1 No 2	-> Q39 -> Next Q
38. **When did you stop taking folic acid tablets?**	Less than 3 months ago ..... 1 3 months ago or more ..... 2 Don't know 9	
39. **Following your last pregnancy (i.e. after delivery), did you take any vitamin A capsules?** *Show vitamin A capsule.*	Yes ..... 1 No ..... 2 This woman has never been pregnant ..... 3 Not sure if it was vitamin A 9	
40. **During the last six months did you take any multi-vitamin supplements, such as Fefol, Vitamin B complex, Omega H3?**	Yes ..... 1 No ..... 2 Not sure if it was a multi-vitamin 9	->CONSENT -> Consent -> Consent

Comments about data collection with this woman:

The form was reviewed by: _____ Date: _____
Team leader's signature

Data entry clerk name: _____ Data entry clerk code number: ☐

WOMAN FORM	Cluster number ☐☐	Household number ☐☐	Woman number ☐☐	Page 7

41. Written Consent for urine and/or blood collection:

Now that we've finished the questions, we would like to draw a small amount of blood. This small blood sample will be used to test for anemia and malaria. In addition, a small portion of blood will be collected to test for other vitamin problems, such as iron, vitamin A, folate, vitamin B12 and iodine. Also, we would like to ask you to provide a small amount of urine, which will also be used for iodine testing.

The anemia and malaria results will be provided in less than 15 minutes following the taking of blood. Should you be diagnosed with severe anemia or malaria, we will provide you with a referral slip to get adequate treatment at the nearest health facility. Other results (e.g. iron, vitamin A, etc) will be used by national health officials to better understand the nutrition situation of women in Sierra Leone. All the information will be kept confidential and personal identities will not be revealed in any report.

Blood will be collected by trained technicians and they will use clean and sterile material. The risk for you is very minimal. At most there will be temporary discomfort where the blood will be taken. The blood draw will take less than 5 minutes.

Your participation is entirely voluntary. You may choose not to participate and you may withdraw your participation or that of any household member at any time. Refusal to participate will not involve a penalty or loss of benefits of any kind.

Contact information: If you have any questions or concerns about this study or if any problems arise, please contact the field workers. You may also wish to contact the MoHS Nutrition Programme Director, Aminata Shamit Koroma, directly at 033 705866.

Do you agree to participate in this part of the survey?**	Yes.....1	_____	_____
If "Yes", can you please sign this page?	No 2	Woman's name (print)	Woman's signature or fingerprint

****Note:** If respondent agrees to provide urine only, blood only, or both urine and blood, circle "Yes" for Q41 above and complete the heading of the following page. Then give the respondent the labelled urine beaker and write below the location of the laboratory site. If the respondent does not agree to participate, end the interview.

Please take this form and the filled urine beaker to laboratory site. This is located at:

Write location of site here

Affix HOUSEHOLD label here (starts with "H")	Cluster number	Household number	Woman number	Affix WOMAN label here (starts with "W")
	☐☐	☐☐	☐☐	

Address: _____ Family name: _____ Woman's name: _____

Is this woman pregnant?	Yes.....1	->Take blood from finger and mark 9.9 for Q45
	No 2	->Take blood from vein

Pregnant women: **Now we would like to do a fingerpick to measure anemia and malaria.**

Non-pregnant women: **Now we would like to take some blood from your vein for testing for vitamin levels.**

42. Urine beaker received?	Yes .....1 No 2	
43. Hemoglobin concentration	Hb (g/dL) ..... ☐☐.☐	
44. Malaria status from rapid test kit	Positive .....1 Negative 2	
45. Approximate volume of blood collected (ml)	ml ..... ☐.☐ No blood, unsuccessful blood draw ..... use 8.8 No blood, pregnant woman ..... use 9.9	
46. Phlebotomist's code number:	Code number ..... ☐☐	

Comments about data collection with this woman:

The form was reviewed by: _____ Date: _____
Team leader's signature

Data entry clerk name: _____ Data entry clerk code number: ☐

Affix HOUSEHOLD label here (starts with "H")	**CHILD QUESTIONNAIRE** **SIERRA LEONE NATIONAL MICRONUTRIENT SURVEY 2013**	Affix CHILD label here (starts with "C")

1. Cluster number ☐☐	2. Cluster control form HH number ☐☐
3. Name of this child: _____	4. Child number ☐☐
5. Interviewer number ☐☐	
6. Date of data collection ☐☐/☐☐/☐☐ (Day / Month / Year)	7. Child's mother's woman number: ☐☐
8. Final result of child data collection ☐	

FINAL RESULT CODES:

Completed interview and accepted participation in blood collection 1	Refused interview and all data collection 3
Completed interview and refused participation in blood collection 2	Child not at home at time of visit 4
	Other (specify_____) 8

Child questionnaire should be administered to the child's caregiver as identified by the household roster. Repeat greeting if not already read to this respondent. **We are working with the Ministry of Health and Sanitation in Sierra Leone. We are conducting a national nutrition survey to better understand the various nutritional deficiencies, such as such as anemia, vitamins and minerals in women and children. This information will help the government to plan for better health in the future.**	If greeting at the beginning of the household questionnaire has already been read to this woman, then read the following: **Now I would like to talk to you more about (*child's name*)'s health and other topics. When I ask about (*child's name*), please think only of this child and answer only about this child. Try not to mix up other children in the household. All the information we obtain will remain strictly confidential and your answers will never be shared with anyone other than our project team.** **The survey usually takes about 20 minutes to complete, and includes answering questions and a visit to** (location of laboratory site) **to take a small blood sample of (*child's name*).**

9. May I start now?

☐ YES, PERMISSION IS GIVEN ->BEGIN THE INTERVIEW.

☐ NO, PERMISSION IS NOT GIVEN ->COMPLETE THIS COVER PAGE. DISCUSS THIS RESULT WITH YOUR TEAM LEADER.

Now I would like to ask you some basic questions about (NAME).

10. **Is (NAME) a boy or girl?**	Male ..... 1 Female 2	
11. **What is (NAME)'s date of birth?** *Copy date of birth from document(or child health card) if available, or probe:* **What month and year was (NAME) born?**	D. Day ..... ☐☐ (enter '99' if unknown) M. Month ..... ☐☐ Y. Year ..... ☐☐	
12. **How old is (NAME) in completed months?** *If necessary, use local calendar to derive age.* *Record '99' if unknown.* *Compare date of birth above and stated age; correct one if necessary.*	Age (in months) ..... ☐☐ (in completed months) (enter '99' if unknown)	
13. **Was (NAME) weighed at birth?**	Yes ..... 1 No ..... 2 Don't know 9	-> Next Q ->Q15 ->Q15

14. **How much did (name) weigh?** *Record weight from health card, if available*	A. From card (kg) ..... ☐☐.☐☐ B. From recall (kg) ..... ☐☐.☐☐ Don't know ..... 9.999 in B	
15. **Did you give birth to this child?**	Yes ..... 1 if "Yes", please note her line number on the household roster (Q18; HH questionnaire) A. Mother number ..... ☐☐ No 2	-> Q18 -> Next Q
16. **Is the woman who gave birth to (NAME) alive?**	Yes ..... 1 No ..... 2 Don't know 9	-> Next Q -> Q18 -> Q18
17. **Does (NAME's) biological mother live in this household?**	Yes ..... 1 if "Yes", please note her line number on the household roster (Q18; HH questionnaire) A. Mother number ..... ☐☐ No 2	
18. **Is (NAME's) father alive?**	Yes ..... 1 No ..... 2 Don't know 9	

Now I would like to ask you about illnesses (NAME) may have had in the past 2 weeks. Please keep in mir only this time period; do not include any illnesses (NAME) had before 2 week ago.

19. **At any time in the last 2 weeks, has (NAME) had diarrhoea?** *Diarrhoea = watery stool at least three times per day*	Yes ..... 1 No ..... 2 Don't know 9	-> Next Q -> Q21 -> Q21
20. **Was there any blood in the stools?**	Yes ..... 1 No ..... 2 Don't know 9	
21. **At any time in the last 2 weeks, has (NAME) been ill with a fever?**	Yes ..... 1 No ..... 2 Don't know 9	-> Next Q -> Q24
22. **At any time during this illness with fever, did (name) have blood taken from his/her finger or heel for malaria testing?**	Yes ..... 1 No ..... 2 Don't know 9	->Next Q -> Q24 -> Q24
23. **Did that test show that (name) had malaria?**	Yes ..... 1 No ..... 2 Don't know 9	
24. **At any time in the last 2 weeks, has (NAME) had an illness with a cough?**	Yes ..... 1 No ..... 2 Don't know 9	->Next Q -> Q27 ->Q27
25. **When (NAME) had an illness with a cough, did he/she breathe faster than usual with shallow, rapid breaths or have difficulty breathing?**	Yes ..... 1 No ..... 2 Don't know 9	-> Next Q -> Q27 -> Q27
26. **Was the fast or difficult breathing due to a problem in the chest or a blocked or runny nose?**	Problem in chest only ..... 1 Blocked or runny nose only ..... 2 Both ..... 3 Other (specify) _____ ..... 8 Don't know 9	

CHILD FORM Cluster number ☐☐ Household number ☐☐ Child number ☐☐ Page3

NOTE: Dietary questions (questions 27-37) are to be asked ONLY about children 0 – 23 months of age. Check the child's date of birth and age above. If the child is 24 months of age or older, skip to question 38.

Now I will ask you questions about (NAME)'s diet. Please answer only for (NAME). Do not confuse (NAME) with other young children in the household.

27. **Has (NAME) ever been breastfed?** *Include giving breastmilk by spoon or bottle or breastfeeding by other women.*	Yes ..... 1 No ..... 2 Don't know 9	-> Next Q -> Q32 -> Q32
28. **How long after birth was (NAME) first put to the breast?** *If respondent reports she put the infant to the breast immediately after birth, circle '00' for 'immediately'.* *If less than 1 hour, circle 'A' for hours and record '00' hours* *If less than 24 hours, circle 'A' and record number of completed hours, from 01 to 23.* *If 24 hours or longer, circle 'B' and record number of completed days* *If respondent does not know, circle "99".*	Immediately ..... 00 or A. Hours ..... ☐☐ or B. Days ..... ☐☐ Don't know 99	
29. **Is (NAME) still being breastfed?**	Yes ..... 1 No ..... 2 Don't know 9	-> NEXT Q -> Q32 -> Q32
30. **Was (NAME) breastfed yesterday during the day or at night?**	Yes ..... 1 No ..... 2 Don't know 9	
31. **Sometimes babies are fed breast milk in different ways, for example by spoon, cup or bottle. This can happen when the mother cannot always be with her baby. Sometimes babies are breastfed by another woman, or given breast milk from another woman by spoon, cup or bottle or some other way. This can happen if a mother cannot breastfeed her own baby.** **Did (NAME) consume breast milk in any of these ways yesterday during the day or at night?**	Yes ..... 1 No ..... 2 Don't know 9	

32. **Next I would like to ask you about some liquids that (NAME) may have had yesterday during the day or at night.** **Did (NAME) have any** (item from the list)**?:** *Read the list of liquids starting with 'Plain Water'* *Ask the mother to mention and tick from the list*	Yes	No	DK	33. **How many times yesterday during the day or at night did (NAME) eat or drink any** (item from list)**?** *Fill in B & C if "Yes" to Q32*
A. Plain water?	1	2	9	
B. Infant formula such as Lactogen, SMA gold/progressive/white, Guigoz 1 or 2, Nan, or Baby milk in tins or sachets?	1	2	9	B. ..... ☐☐
C. Milk (such as tinned, powdered, or fresh animal milk) or Yogurt?	1	2	9	C. ..... ☐☐
D. Juice or juice drinks?	1	2	9	
E. Clear broth (rice water, banana water)?	1	2	9	
F. Thin porridge (e.g. Light Pap)?	1	2	9	
G. Liquids such as sweet tea, herbal tea, or soda (e.g. coca cola, fanta), drinks, palm wine?	1	2	9	
H. Vitamin or mineral supplements or any medicines?	1	2	9	
I. ORS (oral rehydration solution)?	1	2	9	
J. Any other liquids?	1	2	9	

34. **Please describe everything that (NAME) ate yesterday during the day or night, whether at home or outside the home.**

a) Think about when (NAME) first woke up yesterday. Did (NAME) eat anything at that time? if yes: Please tell me everything (NAME) ate at that time.
*Probe:***"Anything else?"***until respondent says nothing else. If no, continue to question b).*

b) What did (NAME) do after that? Did (NAME) eat anything at that time? If yes: Please tell me everything (NAME) ate at that time.
*Probe:***"Anything else?"***until respondent says nothing else.*
Repeat question b) above until respondent says the child went to sleep until the next day.
If respondent mentions mixed dishes like a porridge, sauce or stew, probe:

c) What ingredients were in that (mixed dish)?
*Probe:***"Anything else?"***until respondent says nothing else.*

As the respondent recalls foods, underline the corresponding food on the next page and circle '1' in the column next to the food group. If the food is not listed in any of the food groups below, write the food in the box labeled 'other foods'. If foods are used in small amounts for seasoning or as a condiment, include them under the condiments food group. Once the respondent finishes recalling foods eaten, read each food group where '1' was not circled, ask the following question and circle '1' if respondent says yes, '2' if no and '9' if don't know:

Yesterday during the day or night, did (NAME) drink/eat any (food group items not already marked 1)?

Other foods:

CHILD FORM Cluster number ☐☐ Household number ☐☐ Child number ☐☐ Page5

	Yes	No	DK
A. Corn/maize, rice, sorghum, millet, or other foods made from these grains or any other grains (e.g. bread, noodles, porridge or other grain products, other local grains)	1	2	9
B. Pumpkin, carrots, squash, or orange peteteh?	1	2	9
C. Irish potatoes, white sweet potatoes, cassava, yam, garri, or any other foods made from roots?	1	2	9
D. Any dark green leafy vegetables (e.g. potato leaves, cassava leaves, krian-krain, green, or moringa)?	1	2	9
E. Ripe mango, ripe pawpaw, guava, or water melon?	1	2	9
F. Lemon, lime, grapefruit, orange, pineapple, banana, or plantain?	1	2	9
G. Any other fruits or vegetables (e.g. Pear, okroh, giblox, jakato, ball tamatis, or seed tamatis)?	1	2	9
H. Liver, kidney, heart, or other organ meats? *If "Yes", confirm with respondent that child actually consumed meats and not just sauce cooked with meat. If only sauce consumed, mark "No".*	1	2	9
I. Any meat, such as beef, pork, lamb, goat, chicken, or duck? *If "Yes", confirm with respondent that child actually consumed meats and not just sauce cooked with meat. If only sauce consumed, mark "No".*	1	2	9
J. Eggs	1	2	9
K. Fresh or dried fish, oysters, crabs, shrimp, cray fish or other seafood? *If "Yes", confirm with respondent that child actually consumed fish etc, and not just sauce cooked with fish etc. If only sauce consumed, mark "No".*	1	2	9
L. Any foods made from black eye binch, konsho binch, broad binch beans, grandnat, kushu, cowpea, benni, egusi, soya bean, lentils or any other seeds?	1	2	9
M. Cheese, yogurt, or other milk products?	1	2	9
N. Any oil, fats, or butter, or foods made with any of these?	1	2	9
O. Any sugary foods such as chocolates, sweets, candies, pastries, cakes, or biscuits?	1	2	9
P. Condiments for flavor, such as pepper, hot pepper, onions, spices, herbs, or fish powder	1	2	9
Q. Snails or insects	1	2	9
R. Foods made with red palm oil, red palm nut, or red palm nut pulp sauce	1	2	9
	If all 'NO', go to Q35 If at least 1 'YES' or all 'DK' go to Q36		

35. **Did (NAME) eat solid or semi-solid (soft, mushy) food yesterday (e.g. soft cooked rice, cooked potatoes, plasaspenmahun), during the day or night?** *If YES for this question and all foods in question 34 above = NO, go back to probe.*	Yes ..... 1 No ..... 2 Don't know 9	->See instructions under Q35 ->Q37 ->Q37
36. **How many times did (NAME) eat solid or semi-solid (soft, mushy) food yesterday (e.g. soft cooked rice, cooked potatoes, plasaspenmahun), during the day or night?**	Number of times ..... ☐☐	
37. **Yesterday, during the day or night, did (NAME) drink anything from a bottle with a nipple?**	Yes ..... 1 No ..... 2 Don't know 9	

NOTE: Include the following questions for ALL children 0 – 59 months of age:

Now I would like to ask you about some additional foods and medicines (NAME) may have recently received.

38. **Now I would like to ask you about some particular foods (NAME) may have eaten. I am interested in whether your child had the item even if it was combined with other foods.** **Yesterday, during the day or night, did (NAME) consume any iron-fortified cookies or other foods which have added iron (e.g. Bennimix, Cerelac, Golden country, Nutrilac, Frescocem?** *If "Yes", ask mother or care giver to show the package of the food for the interviewer to confirm*	Yes ..... 1 No ..... 2 Don't know 9	
39. **Yesterday, during the day or night, did (NAME) consume any Ready-to-use Therapeutic Food (RUTF) (e.g. Granat)?**	Yes ..... 1 No ..... 2 Don't know 9	
40. **Yesterday, during the day or night, did (NAME) consume any infant formula containing extra iron, such as Guigoz, Lactogen, SMA, Nan etc?**	Yes ..... 1 No ..... 2 Don't know 9	
41. **During the last six months was (NAME) given any iron tablets or syrup?** *Show iron tablets and syrup.*	Yes ..... 1 No ..... 2 Not sure if it was iron ..... 3 Don't know 9	-> Next Q ->Q45 ->Q45 ->Q45
42. **For how long did (NAME) take iron tablets or syrup?**	One week or less ..... 1 More than 1 week less than 1 month ..... 2 1 month or more ..... 3 Don't know 9	
43. **Is (NAME) still taking iron tablets or syrup?**	Yes ..... 1 No ..... 2 Don't know 9	-> Q45 -> Next Q ->Q45
44. **When did (NAME) stop taking iron tablets or syrup?**	Less than 3 months ago ..... 1 3 months ago or more ..... 2 Don't know 9	
45. **During the last six months was (NAME) given a vitamin A capsule?** *Show vitamin A capsule.*	Yes ..... 1 No ..... 2 Not sure if it was vitamin A ..... 3 Don't know 9	
46. **During the last six months was (NAME) given any multi-vitamins, such as Abedic or Alion?** *Show capsule or example packages.*	Yes ..... 1 No ..... 2 Not sure if it was multi-vitamin ..... 3 Don't know 9	
47. **During the last six month, was (NAME) given any drug for intestinal worms, such as vermox/Zentel/Albendazole/mebendazole during the last *mami n pekinwel-bodi* week?**	Yes ..... 1 No ..... 2 Don't know 9	

Comments about data collection with this child:

The form was reviewed by: _____ Date: _____
Team leader's signature

Data entry clerk name: _____ Data entry clerk code number: ☐

CHILD FORM Cluster number ☐☐ Household number ☐☐ Child number ☐☐ Page7

48. Written Consent for blood collection:

Now that we've finished the questions, we would like to draw a small amount of (child's name)'s blood. This small blood sample will be used to test for anemia and malaria. In addition, a small portion of blood will be collected to test for other vitamin problems, such as iron and vitamin A.

The anemia and malaria results will be provided in less than 15 minutes following the taking of blood. Should (child's name) be diagnosed with anemia or malaria, we will provide you with a referral slip to get adequate treatment at the nearest health facility. Other results (e.g. iron, vitamin A) will be used by national health officials to better understand the nutrition situation of children in Sierra Leone. All the information will be kept confidential and personal identities will not be revealed in any report.

Blood will be collected by trained technicians and they will use clean and sterile material. The risk for (child's name) is very minimal. At most there will be temporary discomfort where the blood will be taken. The blood draw will take less than 5 minutes.

The participation of (child's name) is entirely voluntary. You may choose not to participate and you may withdraw (child's name)'s participation or that of any household member at any time. Refusal to participate will not involve a penalty or loss of benefits of any kind.

Contact information: If you have any questions or concerns about this study or if any problems arise, please contact the field workers. You may also wish to contact the MoHS Nutrition Programme Director, Aminata Shamit Koroma, directly at 033 705866.

Do you agree to have *(child's name)* participate in this part of the survey?**	Yes.....1		
If "Yes", can you please sign this page?	No 2	..... Mother's or caretaker's name (print)	..... Mother's or caretaker's signature or fingerprint

****Note:** If respondent agrees to participate in the blood collection component of the survey, complete the heading of the following page and write below the location of the laboratory site. If the respondent does not agree to participate, end the interview.

Please take this form to the laboratory site.
This is located at:

Write location of site here

Affix HOUSEHOLD label here (starts with "H")	Cluster number	Household number	Child number	Affix CHILD label here (starts with "C")
	☐☐	☐☐	☐☐	

Address: _____ Family name: _____ Child's name: _____

What is the age of the child?		
	0 – 5 months 1	-> DO NOT collect blood
	6 - 12 months.....2	-> Collect blood from HEEL
	13 – 59 months 3	-> Collect blood from FINGER

Now we would like to take some blood from (NAME)'s heel (6-12 months) or finger (13-59 months)?

49. Hemoglobin concentration	Hb (g/dL)..... ☐☐.☐	
50. Approximate volume of blood collected (µL)	µL..... ☐☐.☐ No blood, unsuccessful blood draw . use 88.8	
51. Malaria status from rapid test kit	Positive..... 1 Negative 2	
52. Phlebotomist's code number:	Code number..... ☐☐	

Comments about blood collection of this child:

The form was reviewed by: _____ Date: _____
Team leader's signature

Data entry clerk name: _____ Data entry clerk code number: ☐