Nutrition Causal Analysis in Niger

Report of Key Findings

March 2017

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Acronyms

ACF	Action Contre la Faim
DHS	Demographic and Health Survey
FEWS NET	Famine Early Warning Systems Network
FCS	Food Consumption Score
GAM	Global Acute Malnutrition
HFIAS	Household Food Insecurity Access Scale
HAZ	Height-for-Age Z Score
IYCF	Infant and Young Child Feeding
LHZ	Livelihood Zone
NCA	Nutrition Causal Analysis
WHZ	Weight-for-Height Z Score
U5DR	Under Five Death Rate
USAID	United States Agency for International Development
WASH	Water, Sanitation and Hygiene

1. Executive Summary

Background and rationale

Levels of acute malnutrition remain persistently high throughout Niger. The 2012 DHS revealed that the national prevalence of wasting among children under 5 was 18.0%; the more recent 2014 National Nutrition Survey reported a slightly lower level of 14.8%. Despite the fact that parts of Maradi and Zinder are often referred to as the "bread basket" of the country, both regions exhibit levels of child wasting above the national average. Given the large burden of acute malnutrition and the severity of its consequences, a strong understanding of the causes of undernutrition in Niger is critical. Although the UNICEF conceptual framework serves as a useful paradigm for conceptualizing the main categories and levels of causes, there is a clear need to identify specific risk factors and understand their relative importance in order to design and target the most effective interventions to combat acute malnutrition in this particular setting.

Scope and methodology

In collaboration with local partners in Niger, FEWS NET conducted a Nutrition Causal Analysis (NCA) study to better understand the key factors that are driving the perpetually high burden of acute malnutrition in the agropastoral and agricultural livelihood zones of Maradi and Zinder. The specific objectives were to:

1. Identify characteristics which were independently associated with acute malnutrition during each round of data collection and rank their relative importance according to the strength of their association;

2. Identify characteristics which were associated with a change in WHZ from round 1 to round 2 of data collection among children who had anthropometric measurements taken during both rounds;

3. Identify the characteristics that were significantly associated with becoming wasted from round 1 to round 2 vs. remaining non-wasted during both rounds of data collection.

Data were collected in the same communities at two points in time: 1) between December 25, 2014 and January 17, 2015, a period which is considered the post-harvest season; and 2) between August 26, 2015 and September 22, 2015, a period which is considered the pre-harvest or lean season. Anthropometric measurements were performed on a total of 1702 children at both time points.

The quantitative component of the study was based on the SMART methodology; however, a detailed questionnaire was developed to collect information on household demographics and socioeconomic status; household food security; water, sanitation and hygiene; maternal nutrition and health; infant and young child feeding practices; child morbidity and utilization of health services.

Descriptive statistics were used to summarize all variables. Multivariate logistic analysis was employed to identify the correlates of wasting during each round of data collection. Multivariate linear regression analysis, using data from children who were included in both rounds of data collection, was employed for objective 2. To identify risk factors for "becoming wasted", multivariate logistic regression models were run using a restricted dataset that included only those children who remained non-wasted in both rounds of data collection or who were non-wasted in round 1, but became wasted in round 2.

Key results

The prevalence of wasting and mean WHZ among children included in both rounds of data collection is summarized in **Table 1** below according to round, region, and livelihood zone.

During round 1 of data collection (i.e. the post-harvest season), four factors were independently associated with an increased risk of child wasting in the multivariate analysis: occurrence of diarrhea in the two weeks preceding the survey, having a caregiver who did not wash her hands before eating, being 6-23 months of age (vs. 24-59 months of age), and having a mother without any formal education. The multivariate analysis of data from round 2 (i.e. pre-harvest season) revealed that occurrence of diarrhea in the previous two weeks, residence in an agropastoral livelihood zone, being 6-23 months of age, and having a fever in the previous two weeks were factors significantly associated with an increased risk of child wasting.

Table ES1. Prevalence of wasting and mean WHZ among children 6-59 months of age included in both rounds of data collection according to round, region, and livelihood zone

		Round 1		Round 2	
		% Wasting (95% CI)	Mean WHZ ± SE	% Wasting (95% CI)	Mean WHZ ± SE
Maradi	Agricultural LHZ	8.1 (5.6-10.4)	-0.53 ± 0.05	10.0 (7.4-12.5)	-0.86 ± 0.04
	Agropastoral LHZ	11.9 (9.1-14.8)	-0.69 ± 0.05	18.6 (15.2-22.1)	-1.09 ± 0.04
Zinder	Agricultural LHZ	6.8 (4.3-9.4)	-0.44 ± 0.05	11.1 (7.9-14.2)	-0.80 ± 0.05
	Agropastoral LHZ	9.1 (5.8-12.4)	-0.58 ± 0.07	18.9 (14.4-23.4)	-1.06 ± 0.05
All 4 areas		9.1 (7.7-10.5)	-0.56 ± 0.03	14.3 (12.6-15.9)	-0.95 ± 0.02

In the analysis of change in WHZ, children who lived in an agricultural livelihood zone experienced an average increase of 0.25 WHZ scores between round 1 and round 2. For every 10,000 CFA increase in household income during round 1, there was a 0.05 increase in WHZ. Children who experienced a respiratory infection in the 2 weeks preceding round 1, experienced an average increase of WHZ scores. The variable most strongly associated with the change in WHZ was round 1 WHZ. Every one WHZ increment at baseline was associated with a subsequent decline of -0.41 WHZ scores from round 1 to round 2.

Only three variables were significantly associated with the odds of becoming wasted between round 1 and round 2. As in the analysis of change in WHZ, round 1 WHZ was the strongest correlate: children who had a weight-for-height Z score between -1 and -2 during round 1 were 3.94 times more likely to become wasted than children who had a WHZ greater than -1. Similarly, children who were 6-23 months old during round 1 were 1.84 times as likely to become wasted than older children. Finally, children living in agropastoral areas were 1.76 times more likely than children living in agricultural areas to become wasted.

Key Messages

- There is significant seasonal variation in the prevalence of child wasting in the agropastoral and agricultural livelihood zones of Maradi and Zinder, Niger. The average prevalence of wasting across all four study areas increased from 9.1% during the post-harvest season to 14.3% during the lean season. The variation was particularly pronounced in the agropastoral livelihood zone.

- Although there were no marked differences in the prevalence of child stunting by region, livelihood zone or season, the average prevalence at both time points exceeded 60%. Such levels are alarmingly high and call for intensified efforts to prevent chronic undernutrition.

- Household food insecurity, as defined by the Household Food Insecurity Access Scale or Food Consumption Score, was not independently associated with the odds of being wasted or becoming wasted. In a typical year, the prevalence of child wasting is a poor indicator of the household food security situation. High levels of wasting do not automatically imply a food security crisis.

- Child morbidity was a consistent risk factor for wasting, reiterating the importance of the infection-undernutrition cycle. Services to treat and prevent child morbidity and acute malnutrition are critical. It may be most effective to design and target strategies according to the child's age and livelihood zone.

2. Background

The global burden of child undernutrition

The global burden of child undernutrition remains unacceptable high. The *2013 Lancet Series on Maternal and Child Nutrition* reported that, globally, 25.7% of children under 5 years of age are stunted and 8.0% are wasted (1). Although these prevalences represent declines from 1990 levels, the rate and magnitude of progress have varied considerably by region.

Stunting, which is defined as a low height-for-age, is reflective of chronic undernutrition. At the national level, there are 21 countries with a stunting prevalence ≥40%, and 16 of these countries are in sub-Saharan Africa (2). Wasting, on the other hand, is defined as a low weight-for-height, and is indicative of acute malnutrition. Although the prevalence and burden of wasting are highest in south Asia, sub-Saharan Africa now has one-third more wasted children than it did in 1990, given its recent population growth (2). Of the 10 countries with the highest wasting prevalence, 7 also have levels of severe wasting above 5% (2). Within Africa, striking geographical disparities in both the prevalence and burden of different forms of undernutrition remain. For example, in the regions of East, West, and Southern Africa, the respective prevalences of stunting are 41.6%, 35.8%, and 23.9%, whereas the prevalences of wasting in the same regions are 6.6%, 10.0%, and 3.9% (2).

Consequences of child undernutrition

The consequences associated with chronic and acute undernutrition are serious. It is estimated that maternal and undernutrition is responsible for 45% (3.1 million) of all deaths among children under 5 (1). The risk of mortality is particularly elevated among children with acute malnutrition: severely wasted children are nearly 12 times more likely to die than children with a normal weight-for-height Z score (3). It is also important to note that a child can experience multiple anthropometric deficits simultaneously, and the risk of mortality is greatest when stunting, wasting, and underweight are all present (4).

In addition to experiencing an increased risk of mortality, undernourished children are more vulnerable to infections and impaired development. Several studies have shown that stunting within the first two years of life predicts poorer cognitive development and educational performance in later childhood and adolescence, which can lead to reduced productivity in adulthood.

Causes of child undernutrition

Given the global burden of child undernutrition and the severity of its consequences, a strong understanding of the causes of undernutrition is critical. Such an understanding is necessary for the design, targeting, and delivery of interventions to effectively address the problem. The UNICEF conceptual framework was developed more than 30 years ago to depict the multifactorial causes of undernutrition. It is important to underscore that child undernutrition is not simply a results of insufficient food. As shown in **Figure 1**, in order for optimal nutritional status to be achieved, children must not only have access to affordable, diverse, nutritionally adequate food, but also receive appropriate caring and feeding practices, have access to adequate health care, and live in a healthy environment which includes safe water, proper sanitation, and good hygiene practices (2). Several social, economic, and political factors underpin the extent to which "food, health and care" can be achieved. In turn, the underlying causes directly influence the immediate causes of undernutrition: inadequate dietary intake, and the presence of disease.

Figure 1. UNICEF Conceptual Framework of Undernutrition
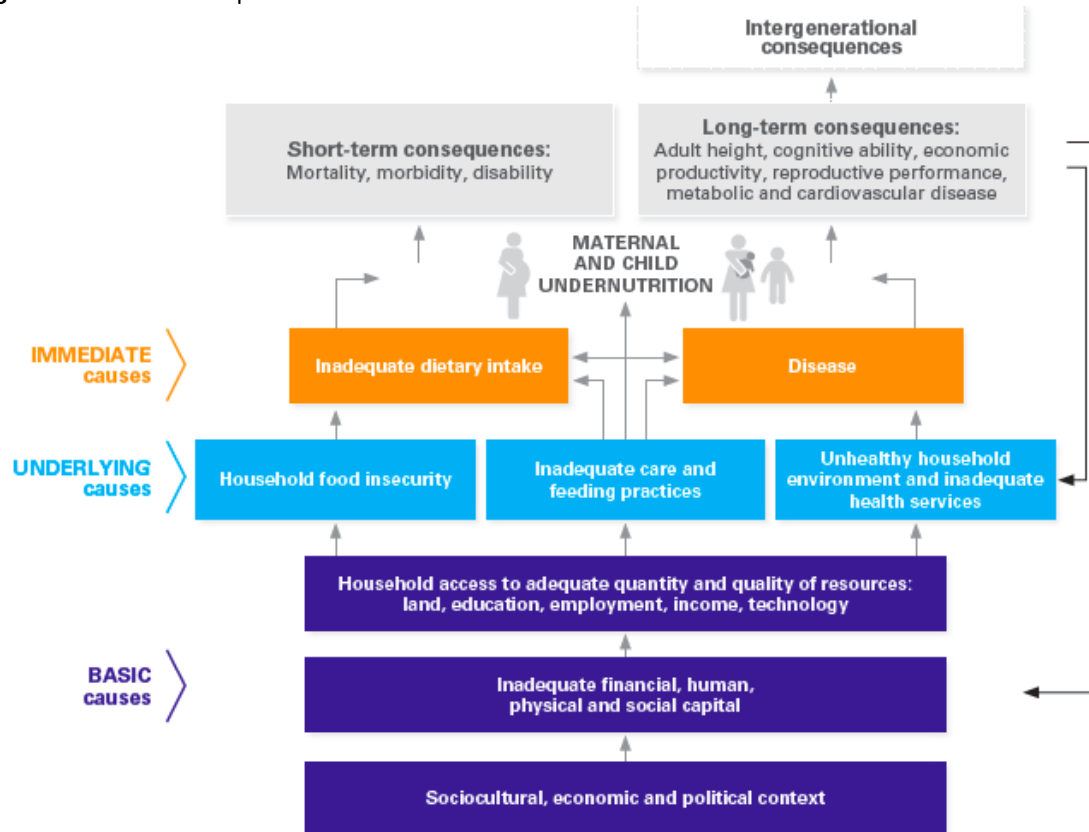
Source: UNICEF, 2013

3. Rationale for Nutrition Causal Analysis Research

Although the UNICEF framework serves as a useful paradigm for conceptualizing the causes of undernutrition, the magnitude and relative importance of various factors will differ from context to context. The pathways through which certain factors impact different forms of undernutrition will also vary. For example, specific morbidities are more common in certain settings and will likely amplify the risk of acute malnutrition accordingly. Similarly, the role of seasonality will likely have a greater effect on the risk of acute malnutrition in agriculturally based livelihoods in comparison to urban areas. Thus, there is a need to clearly understand the specific factors that are driving undernutrition in a specific context before an appropriate response can be designed and effectively delivered.

Nutrition causal analysis (NCA) is a general term used to describe research that aims to better understand the underlying causes of undernutrition in a particular context. Several methodologies have been used to carry out NCA research; however, the overarching goal of NCA is not only to identify variables that are associated with undernutrition in a particular context, but also to examine the factors collectively so that the magnitude of the associations can be assessed and the relative importance of each determinant can be assigned. Unfortunately, many NCA studies are limited by small sample sizes and limited geographical areas, which constrain the generalizability of results. Data collection is almost always cross-sectional in nature, which only enables the identification of correlates of acute malnutrition at one point in time. Furthermore, statistical analysis of the data is also often limited to univariate analyses, which don't account for the effects of confounding.

Data on the nutritional status of a population is one of many pieces of information FEWS NET uses in its food security analysis. Unfortunately, data on the underlying causes of undernutrition in the population under analysis is often lacking. For example, in certain regions of the Sahel, including Niger, the prevalence of global acute malnutrition among children under 5 is persistently above 10%. Without an analysis of causes, it is impossible to identify whether the primary factor

that is driving these perpetually high rates is constant food insecurity, a high burden of infectious disease, suboptimal feeding or caregiving practices, poor sanitation, or some other variable. As such, it is challenging to deliver an appropriate response that effectively addresses the root of the problem.

Clearly, there is a gap in the current knowledge base concerning the causes of different forms of undernutrition in different contexts. To help close this gap, FEWS NET pursued an NCA study involving primary data collection in the agricultural and agropastoral livelihood zones of Maradi and Zinder, Niger. To overcome the typical limitations, FEWS NET's approach, as described below, covered a large geographical area, had a large sample size, included longitudinal data collection, and involved multivariate statistical analysis of the data.

4. Scope and objectives of the NCA study in Maradi and Zinder, Niger

In collaboration with Convergence Consulting, a local consulting firm based in Niamey, FEWS NET conducted an NCA study to better understand the key factors that are driving the perpetually high burden of acute malnutrition in certain regions of Niger. Data collection involved a quantitative household survey based on the SMART methodology; focus group discussions (FGDs) with primary female caregivers and fathers; and key informant interviews (KIIs) with local health center staff. This report focuses on the quantitative component of the study.

Data were collected in the same communities in the agricultural and agropastoral livelihood zones of Niger's Maradi and Zinder regions at two points in time: 1) between December 25, 2014 and January 17, 2015, a period which is considered the post-harvest season; and 2) between August 26, 2015 and September 22, 2015, a period which is considered the pre-harvest or lean season.

The overarching goal of the study was to better understand the key factors that are driving the perpetually high burden of acute malnutrition in this area of Niger. In particular, we were interested in investigating whether food insecurity is the primary driving factor. A better understanding of the key correlates and risk factors will enable the design of more effective interventions and responses. It will also improve the way in which interventions can be targeted to the most vulnerable sub-groups.

The specific objectives were to:

1. Identify characteristics which were independently associated with acute malnutrition during each round of data collection and rank their relative importance according to the strength of their association;

2. Identify characteristics which were associated with a change in WHZ from round 1 to round 2 of data collection among children who had anthropometric measurements taken during both rounds;

3. Identify the characteristics that were significantly associated with becoming wasted from round 1 to round 2 vs. remaining non-wasted during both rounds of data collection.

5. Local collaboration

The NCA study was conducted with much interest and support from local partners in Niger, the greater West Africa region, and the larger nutrition community. When conceptualizing the study, FEWS NET consulted with ACF staff to learn about the methodology they were developing and their experiences piloting various NCA modalities. The concept note for the NCA study was also shared with the Division of Nutrition within Niger's Ministry of Health and was presented to the national nutrition cluster in November 2014. Representatives from the Division of Nutrition attended the training in Niamey and played a role in supervising data collection in the field. As soon as the anthropometric and mortality data were analyzed and validated, the results were shared with the Division of Nutrition and the nutrition cluster. The first round results were also used in the pilot of the IPC Classification for Acute Malnutrition, which was carried out in Niamey from May 4-8, 2015. Upon completion of the study and data analysis phase, results were shared with the Niger's Division of Nutrition, FEWS NET's home office staff, and USAID Washington (including Food for Peace's nutrition team).

6. Study setting

The study was carried out in the agricultural and agropastoral livelihood zones of Maradi and Zinder. As shown **in Figure 2**, both regions are located in south-central Niger.

Figure 2. Map of study areas
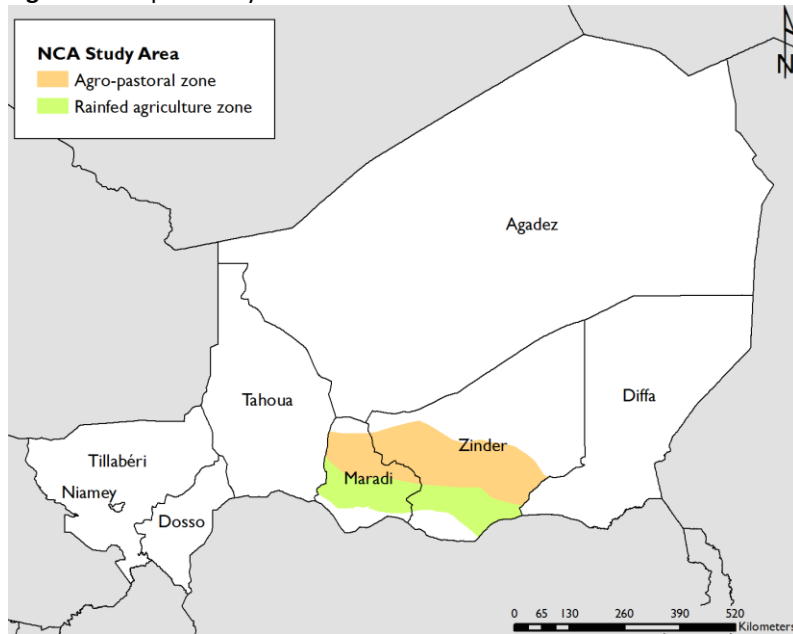
Source: FEWS NET

Despite the fact that Maradi is often referred to as the "bread basket" of the country, both regions persistently exhibit very high levels of acute malnutrition. The 2012 Demographic and Health Survey (DHS) reported that the prevalence of wasting in Maradi and Zinder was 19.0% and 18.8%, respectively (5). The more recent July-August 2014 National Nutrition found slightly lower levels of 15.7% and 14.8%, respectively (6).

Much of the agropastoral territory is at the limit where annual rainfall permits crop production (7). In recent generations what used to be pasturelands have been settled by pastoralists engaging in cultivation and by cultivators migrating from the south. Livestock ownership is highly skewed toward the wealthier half of households and poorer households are forced to rely more heavily on crop cultivation as well as small stock rearing and paid work (7).

In Maradi and Zinder, the agricultural livelihood zone consists primarily of the "rainfed millet and sorghum belt" (7). In this area millet predominates where rainfall is lower and soils are sandier, while sorghum is grown elsewhere. Cowpeas are also grown and are an important cash crop. In Maradi and Zinder, this livelihood zone is known for its production of surplus grain, although the actual amount of the surplus has declined recently due to population growth. Furthermore, the size of many household plots has been decreasing, making the poor more at risk of hunger in bad years. This risk is exacerbated by the fact that approximately 90% of cattle and 75% of small stock are owned by the wealthier half of the population (7). The lack of livestock among the poor contributes to the fact that their cash income in a good year is one-fifth to one-tenth that of the better-off. The poor are very dependent on employment and purchase much of their staple food at markets, which make them susceptible to price shocks.

The timing of data collection was selected with purpose. Although most nutrition surveys are carried out during the pre-harvest season (July-September), this is also the period during which levels of acute food insecurity are highest. We were specifically interested in understanding seasonal variation in acute malnutrition and examining the role of non-food factors as persistent causes of acute malnutrition; therefore, we chose to conduct the first round of data collection during the post-harvest season. The second round of data collection was carried out in the following lean season in order to examine the

change in the prevalence of acute malnutrition in relation to seasonal changes in potential underlying risk factors for acute malnutrition. Niger's seasonal calendar for a typical year is shown in **Figure 3** below.

Figure 3. Seasonal calendar for a typical year in Niger
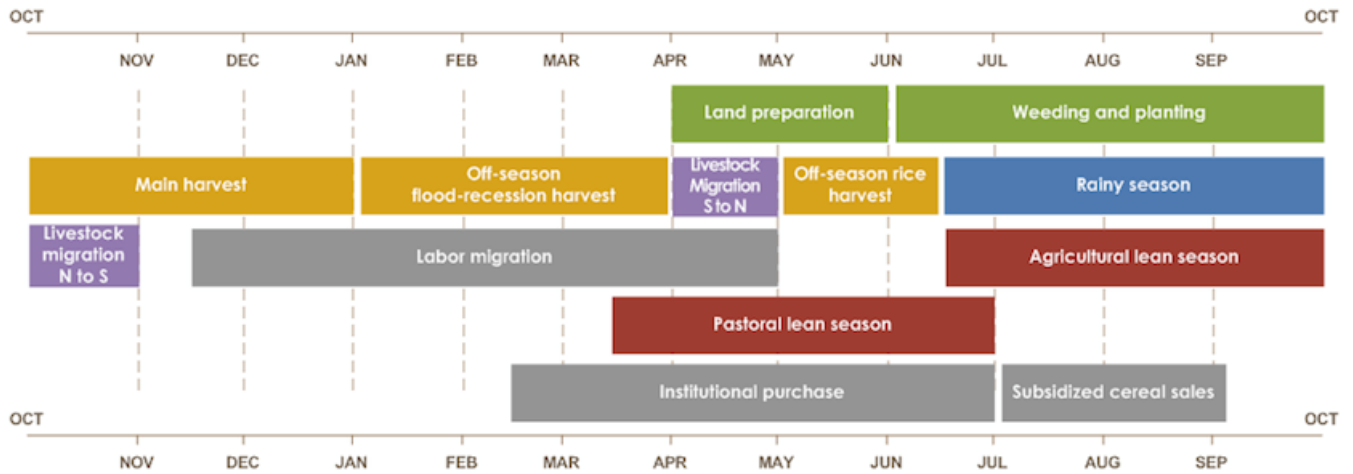
Source: FEWS NET

Figures 4 and 5 show precipitation between June 1 to September 30, 2014 and June 1 to September 30, 2015 as a percent of the historical average (8). These maps show that in both years, total rainfall in Maradi and Zinder was average or slightly better than average.

Figure 4. 2014 Rainfall as a Percent of the Historical Average
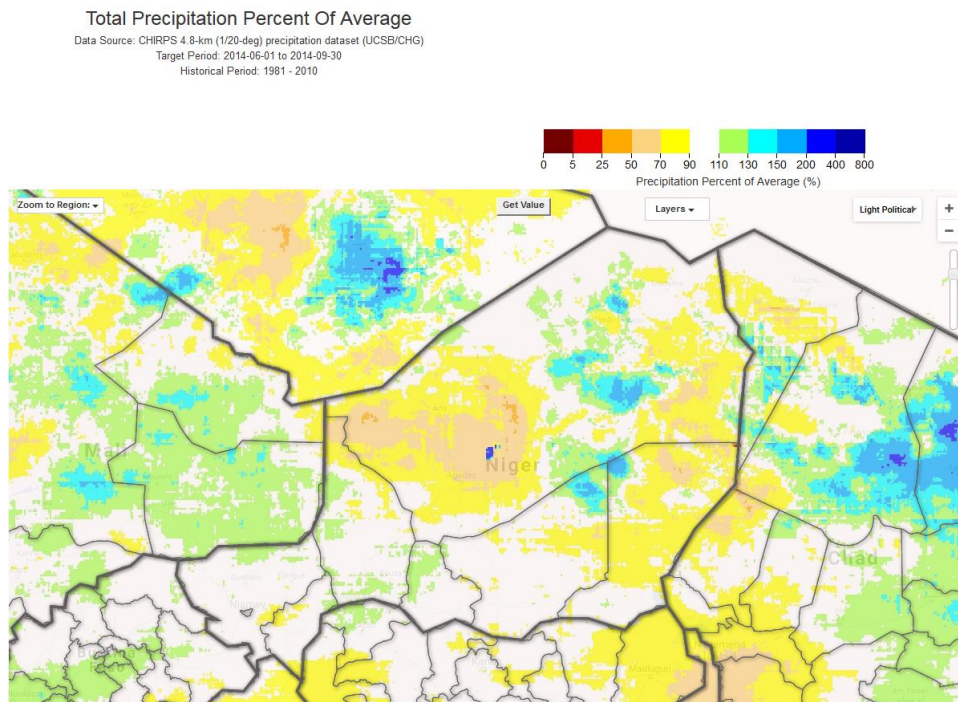
Source: FEWS NET/USGS

Figure 5. 2015 Rainfall as a Percent of the Historical Average
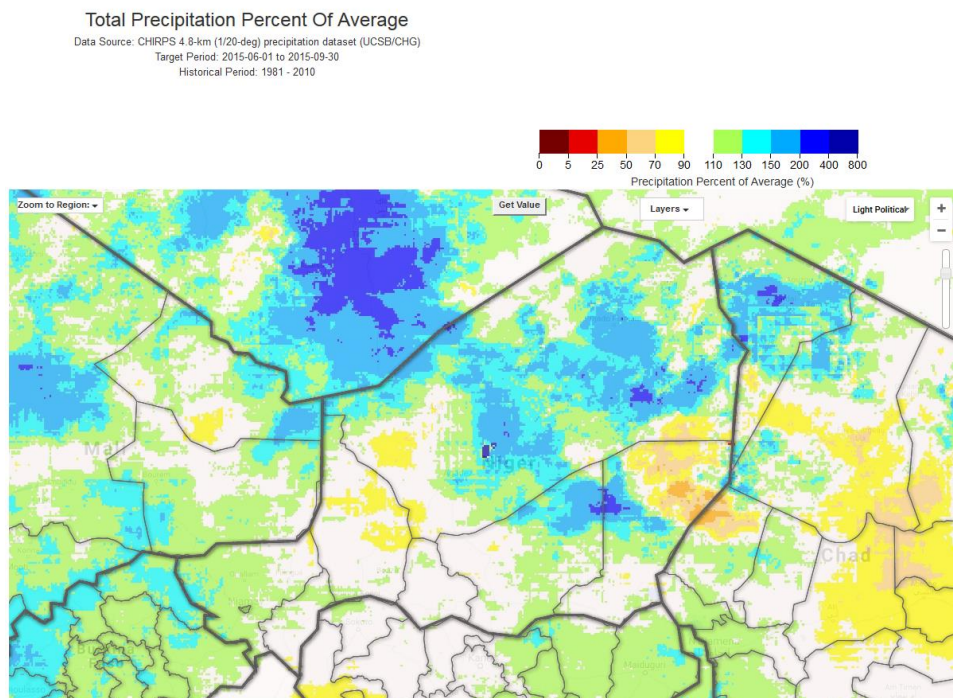
Source: *FEWS NET/USGS*

Similarly, the 2014 harvest of cereals and cash crops reflect very typical levels. In Maradi, cereal, cowpea, and groundnut production in 2014 were 112%, 99%, and 95% of the five-year (2009-2013) average, respectively. In Zinder, the corresponding values were 104%, 168% and 169%.

7. Methodology

7.1 Study design and sample size calculations

The study was a panel survey with data collection at two points in time in each of the four survey areas:
1.   Maradi agricultural livelihood zone;
2.   Maradi agropastoral livelihood zone;
3.   Zinder agricultural livelihood zone;
4.   Zinder agropastoral livelihood zone.

Each survey was a two-stage cluster survey that followed the SMART methodology (9). The sample size calculation for each survey was based on the following information:
1.   Estimated prevalence of GAM in each study location;
2.   Proportion of the population that is under 5 years of age;
3.   Desired level of precision;
4.   Design effect;
5.   Anticipated non-response rate;
6.   Average household size.

Table 1 summarizes the information that was inputted, the resulting number of required children and households, and the corresponding number of clusters that were calculated using ENA software.

Table 1. Sample size calculation for each of the four surveys

Study area	Estimated GAM %	% of population under 5	Design effect	Non-response rate	Average household size	Number of children	Number of households	Adjusted number of households	Number of clusters
Maradi agricultural	15.7	22.3	1.5	3	7.2	922	658	660	33
Maradi agropastoral	15.7	22.3	1.5	3	7.2	922	658	660	33
Zinder agricultural	14.8	23.4	1.5	3	7.1	879	606	610	31
Zinder agropastoral	14.8	23.4	1.5	3	7.1	879	606	610	31
Total						3,602	2,528	2,540	128

Results from the July-August 2014 National Nutrition Survey were used as a basis for the estimated prevalence of GAM in Maradi and Zinder (6). Data on the proportion of the population under 5 years of age were obtained from the 2013 survey results, as the 2014 data were not released at the time the sample size calculations were performed. The SMART survey methodology recommends using a design effect of 1.5 for standard multi-stage cluster surveys and it is standard practice to use a non-response rate of 3%.

As shown in **Table 1**, the desired sample size for each of the surveys was 922 in Maradi, and 879 in Zinder. This translated into approximately 33 clusters of 20 households in each survey in Maradi and 31 clusters of 20 households in each of the surveys in Zinder. Across the four surveys a total of 128 clusters of 20 households each (i.e. 2,540 households and approximately 3,602 children) were to be included in the study.

7.2 Sampling strategy

The sampling frame for each survey included all households in the agricultural and agropastoral livelihood zones of Maradi and Zinder. The specific boundaries of these areas were agreed upon in consultations between FEWS NET, Convergence Consulting, and government officials, and a list of all departments, municipalities, and villages along with the corresponding number of households in each village was prepared.

In the first stage of sampling, ENA was used to select the clusters (i.e. villages) that were to be visited during data collection using probability proportional to population size (PPS) sampling. Under this methodology, a cluster's chance of being selected is directly proportional to the size of its population. Three reserve clusters were also selected for use only in cases in which the selected cluster(s) were inaccessible on the scheduled day of data collection. A list of the selected villages in which data collection took place is provided in **Appendix A**.

The second stage of sampling involved the selection of households in each village on the day of data collection. After arriving at the village and consulting with local authorities, the survey team enumerated all households in the village/cluster. Then, systematic random sampling was carried out to select households, whereby:

1. The sampling interval was determined by dividing the total number of households in the village by the number of households to be visited (i.e. 20). In cases in which the sampling interval was not a whole number, the team rounded down to the nearest whole number.

2. The first household to be visited was selected by drawing a random number that was smaller than the sampling interval.

3. The next household to be visited was found by adding the sampling interval to the number of the first household that was selected. This process was continued until all 20 households were visited.

In cases where the respondent was unavailable or refused to participate in the interview, the survey team did not substitute this household with another household.

For the second round of data collection, household identifying information and GPS coordinates were used to identify and re-visit households that participated in the first round of data collection and had children who remained in the eligible age range (i.e. between 6-59 months of age) during both rounds of data collection. Households with children who were not eligible during the first round, but became eligible by the second round (i.e. households with children who aged into the eligibility criteria of 6-59 months) were also visited for data collection. Households with children who had become ineligible by the second round of data collection (i.e. children had aged out of the eligibility criteria of 6-59 months) were excluded from the second round of data collection. These practices were followed to ensure that the survey population at each time point conformed to the SMART guidelines.

7.3 Survey procedures

The quantitative household survey was carried out by six survey teams. Each team consisted of 1 supervisor and 2 pairs of enumerators/anthropometrists. These six teams were divided into two groups of 3 teams each, and each group collected data in one region. Each pair of enumerators/anthropometrists interviewed 10 households per day, so that each cluster could be completed in a day.

After arriving at the village, and selecting the households to be interviewed using the methodology described above, the head enumerator spoke with the male head of household and primary female caregiver. S/he explained the objective of the study, the type of information that would be sought, and the approximate duration of the interview. The head enumerator then gave the respondents an opportunity to ask any questions and obtained verbal consent from both respondents before starting the interview. Since the enumerator/anthropometrist pair usually consisted of one male and one female, the male enumerator/anthropometrist administered the household questionnaire to the household head (**Appendix B),** and the female enumerator/anthropometrist administered the maternal questionnaire (**Appendix C**) to the mother or primary female caregiver. The household questionnaire also included questions related to household demographics, socioeconomic status, and household food security. The maternal questionnaire included modules on water, sanitation and hygiene; maternal nutrition and health; infant and young child feeding practices; child morbidity; and anthropometry.

The age of all children under 5 in the household was determined in one of two ways. The primary and preferred approach was to record each child's exact date of birth from an official document (e.g. birth certificate, health card). If such a

document was unavailable, the enumerator estimated the child's current age in months using a local events calendar (**Appendix D**).

After both questionnaires were completed the enumerator/anthropometrist pair checked for bilateral edema and measured the weight, length/height, and mid-upper arm circumference (MUAC) of all children 6-59 months of age in the household. Children with a length < 87 cm were measured lying down and those with a height ≥ 87 cm were measured standing up. All length/height measurements were made to the nearest 0.1 cm using locally made stadiometers, weight measurements were made to the nearest 0.01 kg using SECA digital balances, and MUAC measurements were made to the nearest 1 mm using standard MUAC tapes procured from UNICEF. After all anthropometrics were completed, the pair thanked the respondents and children for their time and proceeded to the next selected household.

After all households had been visited in a cluster, both enumerator/anthropometrist pairs met with the supervisor at a central point in the village to debrief, discuss any problems, and review questionnaires for completeness. The supervisor entered the age and anthropometric measurements of all children into ENA and identified children with "flagged" or aberrant Z scores. These children were re-measured to resolve inconsistencies before leaving the village. Upon returning to the survey team's headquarters, the supervisors further reviewed all questionnaires and submitted them to the data entry team.

7.4 Data entry and analysis

All data from the quantitative household survey was entered by the study's four data entry clerks. ENA was used to enter all anthropometric and mortality data, calculate Z scores using the 2006 WHO Growth Standards, run the plausibility checks, and calculate the crude and under-five death rates. All remaining data was entered using CS PRO III. SAS version 9.4 was used to perform all statistical analysis. SAS' "SURVEY" procedures (i.e. PROC SURVEYMEANS, PROC SURVEYFREQ, PROC SURVEYREG, PROC SURVEYLOGISTIC) were used for the methods described below to account for the multi-level nature of the survey.

Basic descriptive statistics were used to summarize all "time-fixed" variables at baseline and "time-varying" variables at each time point. The mean, standard deviation, median, and range were calculated for continuous variables, and frequencies were calculated for categorical variables. These statistics are reported only for the children that were included in both rounds of data collection, since this sub-group constitutes the population under analysis for the analysis of change in anthropometric status over time.

As described in the objectives, the primary endpoints of interest were:
1.   Wasting (WHZ <-2) at each time point;
2.   Change in WHZ from round 1 to round 2;
3.   Non-wasted in round 1, became wasted in round 2

UNICEF's conceptual framework (**Figure 1**) was used as a guide to select "candidate" variables from the survey modules that represented potential underlying risk factors for undernutrition to pursue in the analysis. Data from all four survey areas were pooled at each time point, but dummy variables were created to indicate the livelihood zone and region.

For the first objective, data from each round were treated as distinctive datasets and were used in separate regression analyses. Univariate logistic regression models were run with the selected "candidate" characteristics as separate independent categorical variable, and wasting as the dependent variable. Odds ratios were estimated for each level of the categorical variable and a test for trend was employed to estimate a p value for the overall significance of the variable. Dummy variables were created for variables with missing data in order to maintain the largest dataset possible in the multivariate models. A multivariate logistic regression model was then constructed that included all variables that were significant in the univariate analysis with a p value <0.10 (MV model 1). We decided, a priori, to include the following variables in MV model 1, regardless of their significance: child sex, region, livelihood zone. Then, a final multivariate model (MV model 2) was constructed, which removed all variables that were not significant at a p value <0.05 in MV model 1, but maintained the mandatory variables (i.e. child sex, region, livelihood zone). Finally, the final set of independent variables

that remained significant in MV model 2 were ranked according to the strength of their association with the outcome (i.e. wasting).

Linear regression analysis, using data from children who were included in both rounds of data collection, was employed for objective 2. In these models the change in WHZ from round 1 to round 2 was modeled as the dependent variable and beta coefficients and standard errors were estimated for each of the independent variables. A similar model-building approach was pursued; however, WHZ in round 1 was added to the set of mandatory covariates to include in both MV model 1 and MV model 2.

For objective 3, a separate dataset was created that included children with anthropometric measurements from both rounds of data collection and either remained non-wasted in both rounds or were non-wasted in round 1 but wasted in round 2. Logistic regression analysis was employed to identify variables that were significantly associated with "becoming wasted". The same method was used to build the two multivariate models as described above. As with objective 3, WHZ in round 1 was included in the set of mandatory covariates.

The method used to build the multivariate regression models is commonly used in epidemiology to identify multiple correlates of an outcome (10). Since there is no single "exposure of interest" all variables that are significantly associated with the outcome are entered into the first multivariate model to capture most confounders, reduce the residual error, and fully account for the variation in the outcome. Later excluding variables that lose their significance helps limit potential collinearity.

8. Results

8.1 Subject participation

Table 2 summarizes the number of children 6-59 months of age with plausible anthropometric measurements that were included in rounds 1 and 2 of data collection in each survey area. This table also shows the number of children that were included in both rounds of data collection that were included in the analyses of change in anthropometric status over time. For the reasons described in section 7.1.2, the population of children included in both rounds of data collection was approximately 40% smaller than the size of the sample at either time point.

Table 2. Children with plausible anthropometric measurements that were included in each round of data collection

Region	Livelihood zone	Round 1	Round 2	Both rounds
Maradi	Agricultural	822	851	532
	Agropastoral	706	767	494
Zinder	Agricultural	659	686	380
	Agropastoral	596	613	296
All 4 areas		2783	2917	1702

8.2 Characteristics of the study population

Key background characteristics (i.e. sociodemographics, food security status; and water, sanitation and hygiene conditions) of the households with children that were included in both rounds of data collection are summarized in **Table 3**. For time-varying variables, results are presented separately for round 1 and round 2. The average age of the household head was approximately 40 years, and more than 40% of household heads had no formal education. Average household size was about seven people, and only one-fifth of households had 3 or more common household possessions. Nearly half of all households drank water from an improved source; however, nearly 70% of households spent more than 10 minutes collecting drinking water. Only 5% of households used improved sanitation facilities, and soap was shown to the enumerator in just more than one-third of households. Although median income in the month preceding the survey increased from 20,000 in round 1 to 24,000 CFA in round 2, the proportion of households that were in debt increased from 57.1% to 67.9%. Notably, there was a drastic increase in the proportion of moderate or severely food insecure households as defined by the Household Food Insecurity Access Scale (HFIAS) from 18.5% in round 1 to 50.5% in round 2.   However, this increase was not captured by the Food Consumption Score. According to the traditional FCS cut-offs, the proportion of households with "poor" food consumption remained stable at approximately 11%.

Table 3. Background characteristics of households with children 6-59 months of age included in both rounds of data collection

Indicator	Mean ± SD, Median (Q1; Q3) or N (%)
Age of household head, years	39.9 ± 11.8
Highest level of education attained by household head	
None	394 (40.7)
Adult literacy school	29 (3.0)
Islamic school	393 (40.6)
Primary school partially/fully completed	111 (11.5)
Secondary school partially/fully completed	40 (4.1)
Number of household possessions owned[1]	
0	261 (21.6)
1	322 (26.7)
2	352 (29.1)
≥ 3	273 (22.6)
Household size	6.9 ± 3.2
Source of drinking water	
Unimproved[2]	721 (54.7)
Improved[3]	597 (45.3)
Time to collect water, minutes	

0-10	393 (30.7)	
11-20	474 (37.0)	
21-40	221 (17.2)	
>40	194 (15.1)	
Type of sanitation facilities used by adults		
Unimproved[4]	1241 (94.6)	
Improved[5]	71 (5.4)	
Soap is present in household for hand-washing		
No	580 (44.3)	
Yes, was shown to interviewer	485 (37.0)	
Yes, but was not shown to interviewer	245 (18.7)	
Amount of agricultural land owned, hectares		
0	136 (11.3)	
0.1-1.0	143 (11.9)	
1.1-2.0	263 (21.8)	
2.1-4.0	405 (33.6)	
>4.0	259 (21.5)	
Household owns a home garden	120 (11.0)	
	Round 1	**Round 2**
Household income in the previous month, CFA	20,000 (15,000; 40,000)	24,000 (15,000; 40,000)
Household is in debt	684 (57.1)	811 (67.9)
Household Food Insecurity Access Scale Classification		
Food secure	822 (73.3)	490 (41.8)
Mildly food insecure	91 (8.1)	91 (7.8)
Moderately food insecure	142 (12.7)	486 (41.5)
Severely food insecure	65 (5.8)	105 (9.0)
Food Consumption Score Classification		
Poor	118 (10.5)	128 (10.9)
Borderline	322 (28.6)	330 (28.0)
Acceptable	687 (61.0)	722 (61.1)

[1]Household possessions are from the following list: functioning radio, functioning TV, mobile phone, generator, bicycle, motorcycle, car/truck, wagon, tractor, water pump

[2]Unimproved sources of drinking water include: surface water, unprotected tube well, truck, bottled water;

[3]Improved sources of drinking water include: rain water collection, tube well or borehole, public tap/standpipe, piped water into dwelling, protected dug well

[4]Unimproved sanitation facilities include: pour flush to elsewhere, pit latrine without slab, bucket, hanging toilet/latrine, no facilities (bush/field)

[5]Flush toilet, piped sewer system, septic tank, flush/pour flush to pit latrine, ventilated improved pit latrine, pit latrine with slab, compositing toilet

Key, time-fixed characteristics of mothers with children that were included in both rounds of data collection are summarized in **Table 4**. Since more than one mother was living in some households, the size of this population is larger than the number of households. Average maternal age was approximately 29 years at the time of round 1, about two-thirds of mothers had received no formal education, nearly 70% of mothers delivered their last child at home, and about four out of every five mothers consumed iron supplements during their last pregnancy.

Table 4. Characteristics of mothers with children 6-59 months of age included in both rounds of data collection

Indicator	Mean ± SD or N (%)
Age of mother (round 1), years	28.9 ± 7.5
Highest level of education attained by mother	
None	801 (67.8)
Adult literacy school	24 (2.0)
Islamic school	235 (19.9)
Primary school partially/fully completed	96 (8.1)
Secondary school partially/fully completed	26 (2.2)
Parity	4.8 ± 2.6
Place of delivery of last child	
Home	819 (69.8)

Hospital	87 (7.4)
Community health center	257 (21.9)
Other	10 (0.9)
Consumed iron supplements during last pregnancy	923 (79.4)

As shown in **Table 5**, just more than half of the children included in both rounds of data collection were male, and nearly two-thirds of children were between 24-59 months of age during round 1 of data collection. Somewhat surprisingly, the occurrence of all morbidities was higher during round 1 of data collection (i.e. the post-harvest season) vs. round 2 (i.e. the lean season). The most common morbidities were diarrhea, fever, and respiratory infection. During round 1, 22.6%, 24.3%, and 21.2% of children had experienced these illnesses in the two weeks preceding the survey. During round 2, the respective prevalences for these 3 illnesses dropped to 12.5%, 20.8%, and 5.1%. Among the children who were ill in the two weeks preceding the survey, more caregivers sought treatment during round 1 vs. round 2 (72.0% vs. 54%). Although most respondents reported that their child had a health/vaccination card, just more than one-fifth was actually able to show the card to the interviewer. There was a decline in receipt of vitamin A supplementation in the 6 months preceding the survey from 77.3% during round 1 to 60.2% during round 2. Coverage of deworming was just over 70% at both time points. During round 1, 14.5% of children had received treatment for acute malnutrition in the previous six months. During round 2, this proportion fell to 7.4%.

Table 5. Characteristics of children 6-59 months of age included in both rounds of data collection

Indicator	Mean ± SD or N (%)	
Male	885 (52.1)	
	Round 1	**Round 2**
Age, months		
6-23 months	626 (36.8)	
24-59 months	1074 (63.2)	
Morbidity in the 2 weeks preceding the survey		
Diarrhea	362 (22.6)	194 (12.5)
Fever	389 (24.3)	323 (20.8)
Respiratory infection	338 (21.2)	80 (5.1)
Vomiting	107 (6.7)	80 (5.1)
Loss of appetite	122 (7.7)	101 (6.5)
Treatment was sought when child was sick	473 (72.0)	148 (54.0)
Child has health/vaccination card		
No	294 (23.4)	193 (15.9)
Yes, card was shown	701 (55.8)	660 (54.4)
Yes, but card was not shown	261 (20.8)	360 (30.0)
Child received vitamin A supplementation in past 6 months	1187 (77.3)	917 (60.2)
Child received deworming in past 6 months	1095 (71.1)	1076 (70.6)
Child received treatment for malnutrition in past 6 months	229 (14.5)	114 (7.4)

8.3 Child anthropometric status at each time point

Table 6 summarizes the prevalence of wasting and the mean WHZ during round 1 and round 2 among children who were included in both rounds of data collection, according to each of the four study areas. Two important observations can be made. First, there is marked seasonal variation in both the prevalence of wasting and the mean WHZ in all four study areas. The overall prevalence of wasting increased from 9.1% during the post-harvest season to 14.3% in the following pre-harvest/lean season. Similarly, the overall mean WHZ declined from -0.56 to -0.95. Second, although the prevalence of wasting did not differ drastically by region, the prevalence of wasting was considerably higher in the agropastoral LHZ vs. the agricultural LHZ. This difference was particularly pronounced during round 2. In round 2, the prevalences of wasting in the agropastoral LHZ and agricultural LHZ of Maradi were 18.6% and 10.0%, respectively. In Zinder, the respective prevalences were 18.9% and 11.1% during round 2.

Table 6. Prevalence of wasting and mean WHZ among children included in both rounds, by round, region and livelihood zone

		Round 1		Round 2	
		% Wasting (95% CI)	Mean WHZ ± SE	% Wasting (95% CI)	Mean WHZ ± SE
Maradi	Agricultural LHZ	8.1 (5.6-10.4)	-0.53 ± 0.05	10.0 (7.4-12.5)	-0.86 ± 0.04
	Agropastoral LHZ	11.9 (9.1-14.8)	-0.69 ± 0.05	18.6 (15.2-22.1)	-1.09 ± 0.04
Zinder	Agricultural LHZ	6.8 (4.3-9.4)	-0.44 ± 0.05	11.1 (7.9-14.2)	-0.80 ± 0.05
	Agropastoral LHZ	9.1 (5.8-12.4)	-0.58 ± 0.07	18.9 (14.4-23.4)	-1.06 ± 0.05
All 4 areas		9.1 (7.7-10.5)	-0.56 ± 0.03	14.3 (12.6-15.9)	-0.95 ± 0.02

As shown in **Table 7**, the prevalence of child stunting in all four regions was exceptionally high during both rounds. The average prevalence across all four areas was 62.7% during round 1 and 65.7% during round 2. These levels are considerably higher than estimates from the 2012 DHS and the 2014 National Nutrition Survey. Unlike wasting, there was little variation by livelihood zone or by season. The lack of seasonal variation is not surprising, given the fact that child stunting is reflective of chronic undernutrition and more time is needed to see changes in a child's length/height in comparison to his or her weight.

Table 7. Prevalence of stunting among children included in both rounds, by round, region, and livelihood zone

		% Stunting (95% CI) during round 1	% Stunting (95% CI) during round 2
Maradi	Agricultural LHZ	64.9 (60.8, 68.9)	66.7 (72.7, 70.7)
	Agropastoral LHZ	58.9 (54.6, 63.3)	62.3 (58.1, 66.6)
Zinder	Agricultural LHZ	64.7 (59.8, 69.5)	69.9 (65.3, 74.5)
	Agropastoral LHZ	62.5 (57.0, 68.0)	64.2 (58.7, 69.7)
All 4 areas		62.7 (60.4, 65.0)	65.7 (63.5, 68.0)

8.4 Correlates of wasting at each time point

Table 8 summarizes the results of the logistic regression analysis of correlates of wasting during round 1 of data collection (i.e. the post-harvest season). The table only includes variables that were significant at a p value <0.10 in the univariate analysis.

In the univariate analysis, living in an agropastoral livelihood zone, having a mother with no formal education, living in a food insecure household (defined according to the HFIAS), not having soap for handwashing in the household, and having a caregiver that didn't wash her hands before eating were each associated with a increased odds of child wasting. Wasting was more common in children 6-23 months of age (vs. 24-59 months of age), and those who had diarrhea, fever, a respiratory infection, vomiting or loss of appetite in the previous two weeks. In multivariate model 1, maternal education, handwashing before eating, child age, and occurrence of diarrhea in the previous two weeks retained their significance. In the final multivariate model (MV model 2) these same four variables retained their significance. Occurrence of diarrhea was most strongly associated with the odds of wasting: children who had experienced diarrhea in the previous two weeks were 2.56 times more likely to be wasted than children who had not experienced diarrhea (95% CI: 1.76, 3.74; p<0.001). The second strongest correlate was hand-washing before eating. Children whose caregiver did not wash her hands before eating were 76% more likely to be wasted than children whose caregiver did wash her hands before eating (95% CI: 1.18, 2.63; p=0.006). Children who were 6-23 months of age were 1.62 times more likely to be wasted than children who were 24-59 months of age (95% CI: 1.10, 2.38; p=0.01). Finally, children whose mothers had no formal education were also 1.62 times more likely to be wasted than children whose mothers had some formal education (95%: 1.06, 2.50; p=0.03).

Table 9 shows the correlates of wasting during round 2 of data collection (i.e. the pre-harvest season). There were some similarities between the results of the univariate analysis during round 1 and those of round 2. As in round 1, residence in an agropastoral livelihood zone, younger child age, and recent morbidity were all associated with an increased risk of wasting in the univariate analysis. However paternal education, the material of the household's roof, source of drinking water, place of delivery, and distance to the nearest health center were also associated with wasting. In multivariate model 1 four variables retained significant at a p value <0.05: livelihood zone, child age, occurrence of diarrhea, and occurrence of fever. In the final multivariate model (MV model 2), these same four variables retained their significance. As in round 1,

recent occurrence of diarrhea was the strongest correlate of wasting: children who experienced diarrhea in the previous two weeks were 2.24 times more likely to be wasted than those who hadn't experienced diarrhea (95% CI: 1.46, 3.44; p=0.0003). Livelihood zone was the next strongest correlate: children living in an agropastoral livelihood zone were 2.06 times more likely to be wasted than those living in agricultural area (95% CI: 1.52, 2.79; p<0.0001). As in round 1, children 6-23 months of age were more likely to be wasted than children 24-59 months of age (AOR: 1.82; 95% CI=1.37, 2.42; p<0.0001). Finally, children who had suffered from a fever in the two weeks preceding the survey were 1.63 times more likely to be wasted than children who had not (95% CI: 1.15, 2.31; p=0.007).

Table 8. Correlates of wasting during round 1

	Univariate		Multivariate Model 1*		Multivariate Model 2**	
	OR (95% CI)	p	Adjusted OR (95% CI)	p	Adjusted OR (95% CI)	p
Livelihood zone						
Agricultural	1.00	0.03	1.00	0.16		
Agropastoral	1.49 (1.03, 2.16)		1.31 (0.90, 1.93)			
Maternal education						
Some formal education	1.00	<0.001	1.00	0.03	1.00	0.03
No formal education	1.70 (1.10, 2.62)		1.58 (1.04, 2.41)		1.62 (1.06, 2.50)	
HFIAS Classification						
Food Secure	1.00	0.01	1.00	0.12		
Mildly Food Insecure	1.96 (1.08, 3.57)		1.81 (0.98, 3.33)			
Moderately Food Insecure	1.80 (1.12, 2.87)		1.65 (0.99, 2.77)			
Severely Food Insecure	1.42 (0.71, 2.86)		1.20 (0.54, 2.66)			
Soap used for hand washing was shown to interviewer						
Yes	1.00	0.01	1.00	0.18		
No	1.57 (1.10, 2.23)		1.29 (0.89, 1.89)			
Respondent washes hands before eating						
Yes	1.00	0.01	1.00	0.03	1.00	0.006
No	1.65 (1.12, 2.41)		1.63 (1.06, 2.49)		1.76 (1.18, 2.63)	
Child's age						
24-59 months	1.00	0.0003	1.00	0.009	1.00	0.01
6-23 months	1.90 (1.35, 2.67)		1.69 (1.15, 2.50)		1.62 (1.10, 2.38)	
Diarrhea in the past 2 weeks						
No	1.00	<0.0001	1.00	0.0008	1.00	<0.001
Yes	2.76 (1.92, 3.94)		2.28 (1.42, 3.66)		2.56 (1.76, 3.74)	
Fever in the past 2 weeks						
No	1.00	0.03	1.00	0.82		
Yes	1.51 (1.04, 2.21)		1.06 (0.64, 1.75)			
Respiratory infection in the past 2 weeks						
No	1.00	0.03	1.00	0.54		
Yes	1.56 (1.06, 2.29)		1.17 (0.70, 1.96)			
Vomiting in the past 2 weeks						
No	1.00	0.05	1.00	0.38		
Yes	1.77 (0.99, 3.15)		0.74 (0.37, 1.46)			
No appetite in the past 2 weeks						
No	1.00	0.003	1.00	0.23		
Yes	2.31 (1.34, 3.99)		1.55 (0.75, 3.21)			

Multivariate model 1 also adjusted for child sex and region

** Multivariate model 2 also adjusted for child sex, region, and livelihood zone

Table 9. Correlates of wasting during round 2

	Univariate		Multivariate Model 1		Multivariate Model 2	
	OR (95% CI)	p	Adjusted OR (95% CI)	p	Adjusted OR (95% CI)	p
Livelihood zone						
Agricultural	1.00	<0.0001	1.00	<0.0001	1.00	<0.0001
Agropastoral	1.98 (1.47, 2.67)		1.90 (1.39, 2.59)		2.06 (1.52, 2.79)	
Highest education level of household head						
None	1.00	0.02	1.00	0.05		
Adult literacy school	0.89 (0.44, 1.81)		1.10 (0.53, 2.27)			
Islamic school	0.72 (0.51, 1.02)		0.76 (0.53, 1.10)			
Primary school partially/fully completed	0.86 (0.54, 1.38)		0.89 (0.54, 1.47)			
Secondary school partially/fully completed	0.29 (0.09, 0.96)		0.33 (0.10, 1.12)			
Material of household's roof						
Permanent materials	1.00	0.03	1.00	0.29		
Temporary materials	0.72 (0.54, 0.98)		0.83 (0.58, 1.18)			
Source of drinking water						
Unimproved	1.00	0.08	1.00	0.35		
Improved	0.77 (0.57, 1.03)		1.17 (0.84, 1.62)			
Place of delivery of youngest child						
Home, elsewhere	1.00	0.02	1.00	0.21		
Hospital or health center	0.66 (0.46, 0.94)		0.77 (0.51, 1.16)			
Distance to nearest health center or hospital, mins						
0-20	1.00	0.04	1.00	0.28		
21-40	1.23 (0.77, 1.95)		1.18 (0.75, 1.84)			
41-60	1.16 (0.75, 1.79)		1.06 (0.67, 1.68)			
> 60	1.55 (1.07, 2.26)		1.31 (0.86, 1.99)			
Child's age						
24-59 months	1.00	<0.0001	1.00	<0.0001	1.00	<0.0001
6-23 months	2.14 (1.64, 2.80)		1.82 (1.37, 2.43)		1.82 (1.37, 2.42)	
Diarrhea in the past 2 weeks						
No	1.00	<0.0001	1.00	0.0006	1.00	0.0003
Yes	2.91 (1.98, 4.28)		2.37 (1.46, 3.85)		2.24 (1.46, 3.44)	
Fever in the past 2 weeks						
No	1.00	<0.0001	1.00	0.003	1.00	0.007
Yes	2.07 (1.53, 2.81)		1.83 (1.23, 2.72)		1.63 (1.15, 2.31)	
Respiratory infection in the past 2 weeks						
No	1.00	0.0003	1.00	0.09		
Yes	2.42 (1.51, 3.89)		1.67 (0.93, 3.02)			
Vomiting in the past 2 weeks						
No	1.00	0.01	1.00	0.71		

Yes	2.10 (1.19, 3.73)		0.86 (0.38, 1.93)			
No appetite in the past 2 weeks						
No	1.00	0.04	1.00	0.13		
Yes	1.64 (1.02, 2.62)		0.60 (0.31, 1.16)			

Multivariate models 1 and 2 additionally controlled for child sex and region

8.5 Correlates of the change in WHZ between round 1 and round 2

The mean change in WHZ from round 1 to round 2 among children who had anthropometric measurements performed at both time points was -0.31 (95% CI: -0.37, -0.25). The first column of **Table 10** summarizes the variables that were significantly associated with the change in WHZ in univariate regression models. These univariate models indicate that living in an agricultural livelihood zone, living in the region of Maradi, having a home garden, and having a higher household income were each associated with an increase in WHZ from round 1 to round 2. Children who had higher WHZ scores during round 1 were more likely to experience a decline in WHZ between round 1 to round 2. This is not surprising, since there is a biological limit to the extent to which children with very low WHZ scores can further decline. Surprisingly, in the univariate analyses children who had experienced diarrhea, fever, ARI or loss of appetite in the 2 weeks preceding the round 1 survey exhibited a positive change in WHZ from round 1 to round 2.

Several variables lost their significance in multivariate model 1; however, livelihood zone, household income, round 1 WHZ, and ARI remained significantly associated with the change in WHZ. When these four variables were entered into the final multivariate model (multivariate model 2), the effect size and degree of significance were maintained or amplified. Children who lived in an agricultural livelihood zone experienced an average increase of 0.25 WHZ scores between round 1 and round 2. For every 10,000 CFA increase in household income during round 1, there was a 0.05 increase in WHZ. Children who experienced a respiratory infection in the 2 weeks preceding round 1, experienced an average increase of WHZ scores. The variable most strongly associated with the change in WHZ was round 1 WHZ. Every one WHZ increment at baseline was associated with a subsequent decline of -0.41 WHZ scores from round 1 to round 2.

Table 10. Correlates of change in WHZ from round 1 to round 2

	Univariate		Multivariate Model 1*		Multivariate Model 2**	
	β (SE)	p	Adjusted β (SE)	p	Adjusted β (SE)	p
Intercept			-0.93 (0.06)	<0.0001	-0.91 (0.06)	<0.0001
Agricultural livelihood zone	0.18 (0.06)	0.001	0.24 (0.05)	<0.0001	0.25 (0.05)	<0.0001
Maradi region	0.14 (0.06)	0.02	0.06 (0.05)	0.23		
Household income in the previous month (in 10,000 CFA increments)	0.05 (0.02)	0.02	0.05 (0.02)	0.03	0.05 (0.02)	0.02
Household has a home garden	0.13 (0.07)	0.05	0.07 (0.05)	0.13		
WHZ during round 1	-0.41 (0.03)	<0.0001	-0.41 (0.03)	<0.0001	-0.41 (0.03)	<0.0001
Child had diarrhea in the 2 weeks preceding round 1	0.22 (0.06)	0.0003	0.01 (0.06)	0.83		
Child had a fever in the 2 weeks preceding round 1	0.23 (0.07)	0.001	0.05 (0.06)	0.43		
Child had an ARI in the 2 weeks preceding round 1	0.23 (0.07)	0.0005	0.12 (0.06)	0.05	0.15 (0.06)	0.008
Child had no appetite in the 2 weeks preceding round 1	0.31 (0.12)	0.01	0.05 (0.09)	0.58		

Multivariate model 1 additionally controlled for child sex
Multivariate model 2 additionally controlled for child sex and region

8.6 Correlates of becoming wasted between rounds 1 and 2

Table 11 shows there were 161 children who were not wasted in round 1, but became wasted by round 2, and 1386 children who remained unwasted throughout both rounds. The subsequent analysis of correlates of "becoming wasted" was performed on these 1547 children.

As shown in **Table 12**, in the univariate analyses, livelihood zone, education level of the household head, household income, number of household assets owned, existence of a home garden, source of drinking water, time required to collect water, and place of delivery of the youngest child were all associated with the odds of becoming wasted. At the child-level, age, receipt of deworming in the 6 months preceding round 1, occurrence of fever in the 2 weeks preceding round 1, and WHZ

during round 1 were all associated with the odds of becoming wasted in the univariate analyses. However, most of these variables lost their significance when entered into multivariate model 1.

Table 11. Wasting status of children 6-59 months of age included in both rounds of data collection, in round 1 and round 2

		Wasted in Round 2		
		No	Yes	Total
Wasted in Round 1	No	1386	161	1547
	Yes	73	82	155
	Total	1459	243	1702

Only three variables remained significantly associated with the odds of wasting in multivariate model 1 and the final multivariate model 2: livelihood zone, child age, and WHZ during round 1. As in the previous models, round 1 WHZ was the strongest correlate: children who had a weight-for-height Z score between -1 and -2 during round 1 were 3.94 times more likely to become wasted than children who had a WHZ greater than -1 (95% CI: 2.70, 5.75; p<0.0001). Similarly, children who were 6-23 months old during round 1 were 1.84 times as likely to become wasted than older children (95% CI: 1.27, 2.67; p=0.001). Finally, children living in agropastoral areas were 1.76 times more likely than children living in agricultural areas to become wasted (95% CI: 1.24, 2.49; p=0.02).

Table 12. Correlates of becoming wasted from round 1 to round 2

	Univariate		Multivariate Model 1		Multivariate Model 2	
	OR (95% CI)	p	Adjusted OR (95% CI)	p	Adjusted OR (95% CI)	p
Livelihood zone						
Agricultural	1.00	0.0003	1.00	0.02	1.00	0.002
Agropastoral	1.57 (1.10, 2.65)		1.53 (1.06, 2.22)		1.76 (1.24, 2.49)	
Highest education level of household head						
None	1.00	0.07	1.00	0.70		
Adult literacy school	1.08 (0.60, 1.94)		1.32 (0.63, 2.74)			
Islamic school	0.81 (0.54, 1.23)		1.07 (0.68, 1.67)			
Primary school partially/fully completed	0.82 (0.48, 1.38)		1.01 (0.57, 1.79)			
Secondary school partially/fully completed	0.34 (0.08, 1.47)		0.47 (0.11, 2.09)			
Household income in the previous month, CFA						
≤ 10,000	1.00	0.02	1.00	0.13		
10,001-20,000	0.61 (0.37, 1.01)		0.63 (0.35, 1.15)			
20,001-30,000	0.61 (0.35, 1.05)		0.75 (0.39, 1.47)			
>30,000	0.51 (0.32, 0.82)		0.58 (0.32, 1.03)			
Number of assets owned by the household						
≥3	1.00	0.004	1.00	0.11		
2	1.72 (1.04, 2.85)		1.57 (0.93, 2.65)			
1	1.84 (1.07, 3.18)		1.54 (0.83, 2.87)			
0	2.30 (1.36, 3.90)		1.84 (0.97, 3.47)			
Household owns a home garden						
No	1.00	0.07	1.00	0.30		
Yes	0.52 (0.26, 1.06)		0.71 (0.36, 1.38)			
Source of drinking water						
Unimproved	1.00	0.07	1.00	0.92		
Improved	0.71 (0.50, 1.03)		0.98 (0.68, 1.41)			
Time to collect water, minutes						
0-10	1.00	0.004	1.00	0.07		
11-20	1.17 (0.78, 2.75)		1.12 (0.73, 1.72)			
21-40	1.82 (1.15, 2.87)		1.56 (0.91, 2.69)			
>40	1.76 (1.09, 2.84)		1.40 (0.82, 2.39)			
Place of delivery of youngest child						
Home, elsewhere	1.00	0.02	1.00	0.48		
Hospital or health center	0.63 (0.42, 0.93)		0.85 (0.53, 1.35)			
Child's age at round 1						
24-59 months	1.00	<0.0001	1.00	0.002	1.00	0.001
6-23 months	2.23 (1.58, 3.16)		1.64 (1.09, 2.48)		1.84 (1.27, 2.67)	
Received deworming in the 2 months preceding round 1						

No	1.00	0.07	1.00	0.50		
Yes	0.72 (0.51, 1.03)		0.87 (0.57, 1.31)			
Child had a fever in the 2 weeks preceding round 1						
No	1.00	0.09	1.00	0.43		
Yes	1.44 (0.95, 2.18)		1.20 (0.76, 1.91)			
WHZ during round 1						
> -1	1.00	<0.0001	1.00	<0.0001	1.00	<0.0001
≥ -2 and <-1	4.41 (3.08, 6.30)		3.69 (2.53, 5.40)		3.94 (2.70, 5.75)	

*MV models 1 and 2 additionally controlled for child sex and region

9. Discussion of key findings

The goals of this study were to identify correlates of acute malnutrition among children 6-59 months of age living in the agropastoral and agricultural livelihood zones of Maradi and Zinder, Niger during the post-harvest and pre-harvest/lean season of a typical year. The study also aimed to investigate factors that were associated with a change in WHZ and/or wasting status between these two time points.

By visiting the same children and households during these two seasons, we were able to reveal marked seasonal variation in the prevalence of wasting. During round 1 (i.e. the post-harvest season) the prevalence of wasting ranged from 6.8-11.9% in the four study areas and averaged 9.1% overall. In round 2 (i.e. the pre-harvest/lean season), the overall prevalence had increased by over 50% to 14.3%. This seasonal variation was particularly pronounced in agropastoral livelihood zones. In Maradi's agropastoral livelihood zone, the prevalence increased from 11.9% in round 1 to 18.6% in round 2. In Zinder's agropastoral livelihood zone, it more than doubled from 9.1% in round 1 to 18.9% in round 2.

In contrast, the prevalence of child stunting varied little by region or livelihood zone. As expected, there was also little seasonal variation in stunting prevalence. This is not surprising given the fact that changes in length occur more slowly than changes in weight. However, the fact that the overall stunting prevalence was over 60% at both time points was alarming, and underscores the critical need for efforts to prevent both acute and chronic malnutrition.

Our multivariate analysis of correlates of wasting revealed that recent occurrence of diarrhea, lack of handwashing by caregivers prior to eating, lack of maternal education, and younger child age were factors independently associated with an increased likelihood of child wasting during the post-harvest season. During the lean season, recent occurrence of diarrhea, residence in an agropastoral livelihood zone, younger child age, and recent fever were independent correlates of wasting. In our analysis of the change in WHZ, residence in an agropastoral livelihood zone, lower household income, occurrence of respiratory infection in round 1, and higher WHZ in round 1 were more likely to demonstrate a decline in WHZ between the post-harvest and the pre-harvest/lean season. Finally, in the last series of models, having a WHZ between -1 and -2 (in comparison to >-1), living in an agropastoral livelihood zone, and being 6-23 months old were all factors that were independently associated with an increased odds of becoming wasted between round 1 and round 2.

When comparing and contrasting the results of these various analyses, a few clear and consistent conclusions can be drawn. First, it is worth highlighting that household food insecurity, defined according to the HFIAS or FCS, was not independently associated with child wasting in either season. It was also not independently associated with a decline in WHZ or an increased likelihood of becoming wasted between rounds 1 and round 2. This underscores the important point that high levels of child wasting do not automatically imply a food security crisis. Furthermore, it highlights that at the household- and child-level, factors other than food insecurity are more closely linked to the likelihood of being wasted or becoming wasted in the future.

Second, although region was not independently associated with wasting, livelihood zone was. Children living in the agropastoral livelihood zone were more likely to be wasted than children living in agricultural livelihood zone during the lean season. They were also more likely to experience a decline in WHZ and/or become wasted between rounds. This finding has particular relevance in the context of intervention targeting and suggests that it may be more appropriate to focus the delivery of interventions by livelihood zone instead of administrative area.

Third, common childhood illnesses such as diarrhea and fever were consistently identified as independent correlates of wasting. This finding reinforces the vicious cycle of undernutrition and infection and calls for an intensification of efforts to prevent and treat these illnesses throughout the year. Caregivers must learn how to identify morbidity symptoms in their children, and know when and where to seek appropriate medical treatment. High-quality, widely accessible health services are also crucial.

Fourth, the fact that children 6-23 months of age were consistently more likely to be wasted or become wasted reiterates the demand for interventions that focus specifically on this age group, as well as the wider 1,000 day period between conception and two years of age. Such interventions are likely to be more effective than more generic approaches which treat all children 6-59 months of age the same way. Children between 6-23 months of age are no longer exclusively breastfed, are often receiving nutrient-poor complementary foods with limited diversity, and are exposed to more environmental pathogens as they become more mobile.

Finally, when evaluating predictors of change in WHZ or wasting status, our results show the importance of considering the child's current nutritional status. Since there is a biological limit to the extent to which a child with a very low WHZ can further decline before dying, it is more likely for a child with higher WHZ scores to decline. This emphasizes the need for interventions that not only treat acute malnutrition, but also prevent acute malnutrition. This is particularly important for children with mild wasting, as they were nearly 4 times more likely to become wasted than children with a WHZ >-1 during round 1.

A number of strengths and limitations of our analysis also deserve mention. Our study covers a large geographical area, including two important livelihood zones in two regions of Niger, which enhances the generalizability of our findings. We also obtained data from a large number of children at two distinct time points, and collected a comprehensive set of variables. The study team completed rigorous training according to the SMART methodology, and the overall quality of the anthropometric measurements was good. Our study also employed rigorous multivariate modeling, a technique that is seldom conducted in other NCA studies. This allowed us to control for the effects of confounding. Our models of change in WHZ/wasting status also adjusted for baseline WHZ, a variable that is extremely important from a biological perspective, but often overlooked.

Unfortunately, the sample size of our analysis of the change in WHZ and wasting status was reduced owing to the fact that some children "aged in" or "aged out" of the cohort between rounds. Some households/children were not present during round 2 and there were some challenges in identifying the same households, which resulted in missing data. These factors lowered the statistical power of our models and may have limited our ability to detect associations. Although we collected extensive data at two time points, we were unable to capture changes in either the exposures or outcome that may have occurred in the intervening period. This limitation is particularly relevant for child morbidity, and our inability to depict the child's total morbidity burden between seasons.

To conclude, this NCA study provides strong evidence that in a typical year, the prevalence of child wasting is a poor indicator of the household food security situation. High levels of wasting do not automatically imply a food security crisis, but rather call for further investigation into other underlying causes of undernutrition. A more nuanced understanding of the correlates of wasting enables analysts to build better projections of acute malnutrition. These findings also highlight the effect of season on wasting levels and the critical need for season to be considered when interpolating or extrapolating results from other nutrition surveys. Finally, a better understanding of the key correlates of wasting allow improvements to be made in the design, targeting, and delivery of interventions and programs.

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11. List of Appendices

Appendix A. Selected villages in which data collection took place

Appendix B. Household questionnaire

Appendix C. Maternal questionnaire

Appendix D. Local calendar of events

Appendix A. Selected villages in which data collection took place

Maradi Agricultural

Nom des localités	Département	Commune	Nombre de ménage en 2012	Numéro de grappe
KASSARAOUA HASSANE	Madarounfa	Dan Issa	53	1
KOBOBI	Madarounfa	Dan Issa	125	2
MARAKA I	Madarounfa	Gabi	142	3
BABBAN RAFI	Madarounfa	Safo	225	4
TCHILADJI	Madarounfa	Safo	281	5
GOUALAM	Gazaoua	Gazaoua	79	6
DARTO	Gazaoua	Gazaoua	62	7
DOUNDAY	Gazaoua	Gazaoua	100	8
DAN BOUZOU	Aguié	Tchadoua	111	9
MARAKE	Aguié	Tchadoua	84	10
DO RAMAOUA	Aguié	Tchadoua	167	11
ABDOU ALOURA (CPT)	Aguié	Tchadoua	33	12
DAN BARDE	Dakoro	Adjiekoria	75	13
KATAGUIRI	Dakoro	Kornaka	116	14
EL TSAYA	Dakoro	Kornaka	288	15
ILLIAS SABOUA	Dakoro	Kornaka	47	16
SABON MACHI	Dakoro	Sabonmachi	214	17
SABON MACHI	Guidan roumji	Chadakori	85	18
DOUMANA SARKI FAWA	Guidan roumji	Guidan roumji	95	19
ROUNFAL KOURMA (GUEBE)	Guidan roumji	Guidan roumji	134	20
SARKIN DIYA TSONOUA	Guidan roumji	Sae Saboua	120	21
MAGADI	Guidan roumji	Guidan Sori	97	22
ZONGON KINITAN	Guidan roumji	Guidan Sori	21	23
SOURA ABOUBACAR	Guidan roumji	Tibiri (Maradi)	209	24
DANTOUDOU	Mayahi	Issawane	74	25
DAKORA HAROUNA	Mayahi	Kanambakache	130	26
SERKIN HACHI (H)	Mayahi	Mayahi	47	27
DAN SARA	Mayahi	Sarki Haoussa	153	28
TOKI	Tessaoua	Korgom	121	29
TOTSA	Tessaoua	Tessaoua	92	30
GUIDAN ZOUGAOU	Tessaoua	Tessaoua	93	31
TOUBOURTOU	Tessaoua	Hawandawaki	54	32
GUIDAN BASSANE	Tessaoua	Djirataoua	98	33

Maradi Agropastoral

Nom des localités	Département	Commune	Nombre de ménage en 2012	Numéro de grappe
DAN AMARIA	Dakoro	BIRNI LALLE	52	34
MAIGOCHI DJAKOU	Dakoro	BIRNI LALLE	76	35
ZONGON MOULOUK	Dakoro	DAKORO	28	36
ADALAK KODA DAOUA	Dakoro	DAKORO	54	37
KORAHANE I ET II	Dakoro	KORAHANE	126	38
IBBO (VA)	Dakoro	BADER GOULA	95	39
DAN MAZA IDI	Dakoro	BADER GOULA	25	40
NAHANTCHAWA (VA)	Dakoro	BADER GOULA	58	41
HADIN BADI	Dakoro	BADER GOULA	32	42
MAIGOCHI SABOUA	Dakoro	BADER GOULA	169	43
ROUGAGUE TAGRISS	Dakoro	TAGRISS	46	44
GUIDAN KAOURA RABO	Dakoro	TAGRISS	24	45
HAMADA	Dakoro	TAGRISS	43	46

DAN DAGOUMA	Mayahi	ALHASSANE MAIREYREY	51	47
MAY SANSAME	Mayahi	ALHASSANE MAIREYREY	131	48
KOREN SABRE	Mayahi	ATTANTANE	124	49
TOSSA	Mayahi	ATTANTANE	108	50
AMANI GOUSSOUM (VA)	Mayahi	ATTANTANE	129	51
ALFORMA GUIDAN BOUNOU	Mayahi	ATTANTANE	22	52
MAGOUZOU	Mayahi	ATTANTANE	93	53
GUIDAN BAGOUARI	Mayahi	ATTANTANE	73	54
DAN FAROU (H)	Mayahi	GUIDAN AMOUMOUNE	84	55
GUIDAN ANGO	Mayahi	GUIDAN AMOUMOUNE	32	56
IN'KOUSSA BARE BARI	Mayahi	GUIDAN AMOUMOUNE	32	57
GUIDAN BAKOYE MAIKASSOUA	Mayahi	GUIDAN AMOUMOUNE	16	58
GUIDAN YARIMA SAMIA	Mayahi	TCHAKE	92	59
DAN TOUDOU	Mayahi	TCHAKE	86	60
DANAI	Tessaoua	OURAFANE	104	61
GUIDAN MAYAKI	Tessaoua	OURAFANE	79	62
GARARE	Tessaoua	OURAFANE	152	63
TOUDOUN KIRIA	Tessaoua	OURAFANE	94	64
MAI HAMADA	Tessaoua	OURAFANE	30	65
GUIDAN SARKIN MAKERA	Tessaoua	OURAFANE	94	66

Zinder Agricultural

Nom des localités	Département	Commune	Nombre de ménage en 2012	Numéro de grappe
BARGOUMA (VA)	Takeita	DAKOUSSA	102	67
MADA (VA)	DAMAGARAM TAKAYA	DAMAGARAM TAKAYA	99	68
INCHAROUA	Mirriah	DROUM	292	69
ROUAN GIGAWA ZEIKARE	Takeita	GARAGOUMSA	47	70
TAKIETA	Takeita	Takeita	305	71
FOUROUMI	Mirriah	GOUNA	256	72
BAOUCHERI	Mirriah	KOLERAM	225	73
GANGARA BOULAMA	Mirriah	MIRRIAH	263	74
KALGO GUIDAN LAMY	Takeita	TIRMINI	37	75
ZARIYA (H)	Mirriah	ZERMOU	15	76
KOULOUWA	Gouré	BOUNE	13	77
KANGARAOUA	Gouré	GOURE	75	78
KOMKOM (VA)	Gouré	GUIDIGUIR	56	79
BOUZARI	Magaria	BANDE	74	80
HAWAN DAWAKI BABBA (VA)	Magaria	DANTCHIO	58	81
ZANGON BACHAR	Magaria	DANTCHIO	138	82
ANGOAL MASSAKI	DUNGASS	DUNGASS	54	83
ANGOAL KORROU	DUNGASS	DUNGASS	54	84
GARIN RIMI MAJEMA (VT)	DUNGASS	GOUCHI	145	85
GARIN GALADIMA (VA)	Mirriah	HAMDARA	29	86
ANGOUAL GAMJI II	MAGARIA	MAGARIA	55	87
DASKORI KARAMA	Dungass	MALLAOUA	89	88
DAWAN BEYE	MAGARIA	SASSOUMBROUM	156	89
YEKOUA YARORO	MAGARIA	YEKOUA	114	90
SOLA (KATCHERO)	Kantché	DAOUCHE	25	91

GUIDAN ELH OUSMANE	Kantché	KOURNI	11	92
DOUNGOURAWA	Kantché	TSAOUNI	109	93
GUIDAN BIZO	Dungass	DOGO DOGO	74	94
GOURGOUZAWA (VA)	Mirriah	DOGO	113	95
CHAFAWA	Mirriah	DOGO	183	96
DAN RAKOUMI	Kantché	DAN BARTO	65	97

Zinder Agropastoral

Nom des localités	Département	Commune	Nombre de ménage en 2012	Numéro de grappe
GUIDAN MAKADA	Tanout	GANGARA	26	98
KOUROU BAYE	Tanout	GANGARA	25	99
FALENKO	Tanout	GANGARA	357	100
GANGARA	GANGARA	GANGARA	261	101
WOUNTCHILA II	Tanout	GANGARA	38	102
GUIDAN DAN GANA et GUIDAN ABDOU	Tanout	GANGARA	25	103
TAGOUYE	Tanout	GANGARA	34	104
KOITA	Tanout	GANGARA	55	105
GOBOURAWA ET KONDIGAL	Tanout	OLLELEWA	23	106
ZERMOU II	Tanout	OLLELEWA	261	107
BAKIN BIRGI	Tanout	OLLELEWA	338	108
DAKOIRA II	Tanout	OLLELEWA	119	109
BIRGI TOUGA	Tanout	OLLELEWA	108	110
KAKIFADA	Tanout	OLLELEWA	126	111
DANIA TIGA	Tanout	OLLELEWA	35	112
DJAJI DOUNAKANTA	Tanout	TANOUT	106	113
FARIN TOUDOU	Tanout	TANOUT	57	114
KADERI BABOULWA	Tanout	TANOUT	54	115
MADITCHLANDI	Tanout	TANOUT	48	116
TCHIM BORAGANE	Tanout	TANOUT	91	117
DAN GOUM	Tanout	TANOUT	36	118
ACHANGO II	Tanout	TANOUT	25	119
GATKOUM (KADILWA)	Tanout	TANOUT	40	120
GARIN EL MAMAN	Tanout	TANOUT	22	121
AHOUNERI (nomade)	Tanout	TANOUT	25	122
TADEINI	Tarka	TARKA	80	123
MAHAMANE JIKA	Tarka	TARKA	21	124
YAN BAKAOU	Tarka	TARKA	65	125
KATCHINAWA TEMBEYE ET SALE II DANGO	Tarka	TARKA	34	126
GANDOUN GOROUBA	Tarka	TARKA	80	127
GHAI	Tarka	TARKA	63	128

Appendix B. Household questionnaire

Questionnaire ménage

ANALYSE DES CAUSES DE LA MALNUTRITION A MARADI ET ZINDER

CONFIDENTIEL
Toutes les informations recueillies dans cette enquête seront strictement confidentielles et ne seront utilisées que pour des fins de recherche uniquement.

I. INFORMATIONS D'IDENTIFICATION

IDENTIFICATION GEOGRAPHIQUE	ENREGISTREMENT

IDENTIFICATION GEOGRAPHIQUE

REGION: ☐
(*Code: 4=Maradi; 7=Zinder*)

ZME ☐
(*Code: 1=Agricole; 2=Agropastorale*)

DEPARTEMENT: _____ ☐☐

COMMUNE: _____ ☐☐☐☐

VILLAGE: _____ ☐☐

MENAGE: ☐☐

COORDONNÉES GPS

   LATTITUDE: ☐☐.☐☐☐☐

   LONGITUDE: ☐☐.☐☐☐☐

ENREGISTREMENT

DATE DE INTERVIEW: 20 |__|__| / |__|__| / |__|__|
                          A A   M M   J J

Nom de l'enquêteur : _____

Date de vérification : 20 |__|__| / |__|__| / |__|__|
                          A A   M M   J J

Nom du Superviseur:_____

SAISIE DE DONNÉES: 20 |__|__| / |__|__| / |__|__|
                           A A   M M   J J

Nom Agent de saisie:_____

Commentaires: _____

_____

_____

_____

No.	COL 1	COL 2	COL 3	COL 4	COL 5	COL 6
	NOM	SEXE M/F	AGE (ANNÉES)	AGE (MOIS) POUR < 5ANS	NE DEPUIS LA FETE DE TABASKI (5 OCTOBRE 2014)	ARRIVE DEPUIS LA FETE DE TABASKI (5 OCTOBRE 2014)
A.	**LISTER TOUTES LES PERSONNES ACTUELLEMENT PRESENTES DANS LE MENAGE**					
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
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12						
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15						
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17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
B.	**LISTER TOUS LES MEMBRES DU MENAGE QUI ONT QUITTE LE MENAGE DEPUIS LA FETE DE TABASKI (5 OCTOBRE 2014).**					
1						
2						
3						
4						
5						
6						
C.	**LISTER TOUS LES MEMBRES DU MENAGE QUI SONT DECEDES DEPUIS LA FETE DE TABASKI (5 OCTOBRE 2014).**					
1						
2						
3						
4						
5						
6						

II.   COMPOSITION MENAGE

RÉCAPITULATIF MENAGE			
		TOTAL	**MOINS DE 5 ANS**
1. Personnes actuellement présents	**A. COL. 1**		
2. Arrivés dans le ménage depuis la FÊTE TABASKI	**A. COL. 6**		
3. Membres partis du ménage depuis la FÊTE TABASKI	**B. COL. 1**		
4. Naissances intervenues depuis la FÊTE TABASKI	**A, B. COL. 5**		
5. Décès depuis la FÊTE de TABASKI	**C. COL. 1**		
6. Combien de femmes (épouses de chef de ménage) y a-t-il dans le ménage?			
7. Combien de personnes (âgés de moins de 18 ans) vivent au total dans votre ménage?			

III.	INFORMATIONS MENAGE DESTINE AU CM/Représentant	
1. Nom du répondant	1. Chef de menage 2. Femme du chef du ménage 3. Grand-parent 4. Autres	☐
2. Quel est votre statut matrimonial?	1. Marié 2. Célibataire 3. Divorcé 4. Veuf/veuve	☐
3. Quel âge avez-vous?		☐☐ ans
4. Quel est votre plus haut niveau de scolarité ?	1. Aucun 2. École primaire partiellement achevé 3. École primaire completement achevé 4. Études secondaires partielles 5. Études superieures entièrement terminée 6. Alphabetiser (cours d'adulte) 7. Coranique 8. Université / école technique	☐
5. Quelle est votre principale occupation	1. Sans emploi 2. Agriculteur / éleveur avec du grand bétail 3. Agriculteur / éleveur avec du petit bétail 4. Agriculture seulement 5. Transporteur (e.g. taxi, moto) 6. Travailleur occasionnel / travail journalier 7. Petites entreprises / boutique / étalage marché 8. Garde d'animaux 9. Cuisinier 10. Technicien / ouvrier qualifié 11. Fonctionnaire/contractuel 12. Autres a preciser: _____	☐☐
6. Quelle est la personne qui détient la principale source de revenu monétaire du ménage?	1. Chef de ménage 2. Femme de chef de ménage 3. Grand parents 4. Enfants plus de 15 ans 5. Autres: _____	☐
7. Veuillez classer les 5 principales sources de revenu de votre ménage au cours de la dernière année par ordre d'importance. *1= Plus grande / la plus importante source de revenu* *5= Plus petite / la moins importante source de revenu*	a. Main d'œuvre agricole	☐
	b. Vente bétail/ Embouche/ vente produits d'élevage (e.g. œuf, lait, poulet…)	☐
	c. Vente de produits agricoles (e.g. fruits, légumes)	☐
	d. Travail salarié / main-d'œuvre qualifiée	☐
	e. Salarié	☐
	f. Petite entreprise ou un magasin/petit commerce	☐
	g. Ramassage / chasse	☐
	h. Vente de Bois de chauffage / charbon /paille	☐
	i. Crédit/Emprunt	☐
	j. Transfert	☐
	k. Artisanat	☐
	l. Don/zakat/ Mendicité	☐
	m. Autres à préciser:_____	☐
8. Combien de personnes dans votre ménage ont eu un travail rémunéré au cour du mois passé ? (Si 0 Aller à Q 11)		☐☐ personnes

4

9. Combien de jours de travaille le salarié de votre ménage a effectué au cours du mois passé? *(calculer la moyenne si plus d'une (1) personne)*	☐☐
10. Quel est le salaire moyen journalier que gagne un travailleur salarié (ouvrier journalier) de votre ménage?	☐☐☐☐ CFA
11. Quel était le revenu de votre ménage le mois dernier?	☐☐☐☐☐☐ CFA
12. Quelle est votre appréciation du revenu du mois dernier comparés aux revenus habituels pour cette même période des années précédentes?	1. Beaucoup moins que d 'habitude 2. À peu près la même chose que d'habitude 3. Beaucoup plus que d'habitude ☐
13. Quelle est la nature du principal matériel de construction du toit du logement du ménage? (si possible observer et noter)	1. Paille / Bois / Peau / Nattes/ Autres matériaux temporaire 2. Terre/Argile/Banco 3. Tôle/métal/Ciment/béton/Tuiles/autres matériaux durables 4. Autres à préciser ☐
14. Quelle est la nature principale des murs du logement? (observer et noter)	1. Paille/ Bois/bambou/autres matériaux temporaires 2. Terre/Argile/Banco 3. Ciment, briques cuites, pièrres,tôles en métal, autres matériaux permanents, ☐
15. Est-ce que la maison a de l'électricité ?	0. Non 1. Oui ☐
16. Quel est le principal moyen de transport de ménage utilise pour aller au marché?	1. A pied 2. Âne / charrette 3. Velo 4. Propre moto du ménage 5. Moto taxi/location 6. Propre voiture/camion du ménage 7. Voiture/caminon de marché 8. Autre, specifier : _____ ☐
17. Est-ce que votre ménage possède : *Code: 0=Non 1=Oui*	a. Un poste radio fonctionnel ☐
	b. Un poste téléviseur fonctionnel ☐
	c. Un téléphone mobile en marche ☐
	d. Un groupe electrogene ☐
	e. Un velo ☐
	f. Une moto ☐
	g. Une voiture/camion/fourgon ☐
	h. Un chariot ☐
	i. Une charrue / tracteur ☐
	j. Un forage/motopompe ☐
18. Combien de poulets / dindes / oies / canards/ pigeons possède votre ménage présentement ?	☐☐☐
19. Combien de chèvres / moutons possède votre ménage présentement ?	☐☐☐
20. Combien de chevaux / ânes / possède votre ménage présentement?	☐☐
21. Combien de bovins / bœufs/ chameaux possède votre ménage présentement?	☐☐

5

22. Avez-vous vendu des chèvres / moutons ou Bovins/bœufs/chameaux le mois passé?	0. Non → Aller à Q 27 1. Oui ☐
23. Combien de Bovins/bœufs/chameaux avez-vous vendu le mois passé ?	☐☐
24. Combien de francs avez-vous vendu chaque Bovins/bœufs/Chameaux ?	☐☐☐☐☐☐ CFA
25. Combien de chèvres / moutons avez-vous vendu le mois passé?	☐☐
26. Combien de francs avez-vous vendu chaque chèvre / moutons?	☐☐☐☐☐ CFA
27. Avez-vous vendu des poulets le mois passé?	0. Non → Aller à Q 29 1. Oui ☐
28. Combien de poulets avez-vous vendu le mois passé?	☐☐☐
29. Combien de francs avez-vous vendu chaque poulet?	☐☐☐☐☐ CFA
30. Est-ce que votre ménage est actuellement endetté?	0. Non 1. Oui ☐
31. Votre ménage s'était-il endetté au cours de la même période l'année dernière?	0. Non 1. Oui ☐

IV. SÉCURITÉ ALIMENTAIRE DU MÉNAGE	
32. Avez-vous un champ que vous exploitez?	0. Non → Aller à Q 39 1. Oui ☐
33. Ce champ vous appartient-il ?	0. Non 1. Oui ☐
34. Combien d'hectares de champs votre ménage possède-t-il?	☐☐,☐ (hectares)
35. Quelle est la superficie totale du/des champ qui a été exploitée par votre ménage durant la campagne agricole précédente?	☐☐,☐ (hectares)
36. Quelles sont les principaux types de cultures qui sont cultivés sur votre champ durant la campagne agricole précédente ? *Code: 0=Non* *1=Oui*	a. Mil ☐
	b. Maïs ☐
	c. Sorgho ☐
	d. Arachides / niébé / sesame / lentilles ☐
	f. Fruit, précisez:_____ ☐
	g. Légumes, précisez:_____ ☐
	h. Autres a préciser:_____ ☐

37. Veuillez classer les principales utilisations faites des types de cultures qui ont été cultivées sur votre terrain durant la saison précédente par ordre d'importance/utilisation ? (gestion de production)
 	
  1= Utilisation la plus importante
  5= Utilisation la moins importance
	a. Consommation par les membres du ménage ☐

	b. Consommation par le bétail ☐
	c. Vente / génération de revenus ☐
	d. Stockage/ magasin/grenier ☐

	e. Autre, précisez:	☐
38. Quelle est la durée moyenne du stock de votre ménage après la production de la campagne agricole précédente?		☐☐ mois
39. Votre ménage possède-t'il un jardin ?	0. Non → Aller à Q41 1. Oui	☐
40. Quelles types de cultures faites-vous pousser dans votre jardin de la maison? *Code: 0=Non* *1=Oui*	a. Céréales / graines: Mais, mille, sorgho	☐
	b. Légumineuses / noix: les haricots, le niébé, le sésame, les lentilles, le soja, les noix	☐
	c. Les racines et tubercules: pommes de terre, l'igname, le manioc	☐
	d. Les légumes orangés: carottes, poivron rouge/vert, courge, pommes de terre, patate douces a chair orange	☐
	e. Les légumes verts: moringa, le brocoli(fleurs vertes du chou), l'amarante	☐
	f. Fruits: Orange, mangue, papaye, abricot, la pêche	☐
	g. Autres fruits:_____	☐
	h. Autres, précisez:_____	☐
41. Veuillez classer par ordre d'importance les sources de nourriture de votre ménage de l'année passée ? *1= Plus grande source / la plus importante* *6= Plus petite source / la moins importante*	a. Achat sur le marché	☐
	b. Paiement en nature / troc	☐
	c. Emprunt en nature auprès de la famille / amis…	☐
	d. Propre production	☐
	e. Assistance alimentaire	☐
	f. Autres, précisez: _____	☐
42. Votre ménage a-t-il reçu une aide alimentaire au cours d'une distribution générale dans les 12 derniers mois?	0. Non → Aller à Q 44 1. Oui	☐
43. Quel type d'aide alimentaire votre ménage a-t-il reçu? *Code: 0=Non* *1=Oui*	a. Farine de blé	☐
	b. Mil	☐
	c. Blé	☐
	d. Mélange Maïs & soja	☐
	e. Sucre	☐
	f. Huile végétale	☐
	g. Farine misola	☐
	h. haricots	☐
	i. Autres a preciser : _____	
44. Combien de fois votre ménage a-t-il reçu une aide alimentaire pendant l'année précédente?	1. Plus d'une fois par mois 2. Une fois par mois (i.e. 12 fois dans l'année écoulée) 3. Tous les deux mois (i.e. 6 fois dans l'année écoulée) 4. 3-4 fois dans l'année écoulée 5. 1-2 fois dans l'année écoulée	☐

| 45. Votre ménage a-t-il reçu un assistance financier au cours de l'année écoulée? | 0.   Non
1.   Oui | ☐ |

Appendix C. Maternal questionnaire

<div align="center">

Questionnaire mères

ANALYSE DES CAUSES DE LA MALNUTRITION A MARADI ET ZINDER

</div>

CONFIDENTIEL Toutes les informations recueillies dans cette enquête seront strictement confidentielles et ne seront utilisées que pour des fins de recherche uniquement.	
SECTION I : INFORMATIONS D'IDENTIFICATION	

IDENTIFICATION GEOGRAPHIQUE	ENREGISTREMENT
REGION: ☐ (*Code: 1=Maradi; 2=Zinder*)	DATE DE INTERVIEW: 20 |__|__| / |__|__| / |__|__| A A M M J J
ZME ☐ (*Code: 1=Agricole; 2=Agropastorale*)	Nom de l'enquêteur : _____
DEPARTEMENT: _____ ☐☐	Date de vérification: 20 |__|__| / |__|__| / |__|__| A A M M J J
COMMUNE: _____ ☐☐	Nom du Superviseur:_____
VILLAGE: _____ ☐☐	SAISIE DE DONNÉES: 20 |__|__| / |__|__| / |__|__| A A M M J J
NUM MENAGE: ☐☐	Nom Agent de saisie:_____
NUM FEMME : ☐☐	
COORDONNÉES GPS	
LATTITUDE: ☐☐.☐☐☐☐	
LONGITUDE: ☐☐.☐☐☐☐	

SECTION II : CARACTERISTIQUES SOCIO-DEMOGRAPHIQUES DE LA MERE

1. Nom du répondant	1. Chef de menage 2. Mere 3. Grand-mere 4. Autres; precisér: _____ ☐
2. Quel est votre âge ?	☐☐ ans
3. Quel est votre statut matrimonial ?	1. Monogame 2. Polygame 3. Veuve 4. Divorcée 5. Celebitaire ☐
4. Quel est votre plus haut niveau de scolarité?	1. Aucun 2. École primaire partiellement achevé 3. École primaire completement achevé 4. Études secondaires partielles 5. Études superieures entièrement terminée 6. Alphabetiser (cours d'adulte) 7. Coranique 8. Université / école technique ☐
5. Quelle est votre principale occupation ?	1. Sans emploi 2. Agriculture / élevage avec du grand bétail 3. Agriculture / élevage avec du petit bétail 4. Agriculture seulement 5. Transport (e.g. taxi, moto) 6. Travail occasionnel / travail journalier 7. Petites entreprises / boutique / étalage marché 8. Garde d'animaux 9. Cuisinière 10. Technicienne / ouvrière qualifiée 11. Employée du gouvernement / enseignantes 12. Autres a preciser: _____ ☐☐
6. Combien d'enfants vivants avez-vous donné naissance ?	☐☐

SECTION III : SÉCURITÉ ALIMENTAIRE DU MÉNAGE

Échelle de l'insécurité alimentaire des ménages

Pour chacune des questions suivantes, veuillez à ce que vos réponses cadrent avec la période de rappel a savoir les 4 dernières semaines (30 jours). Veuillez respecter les échelles d'appréciation : jamais (pas même une seule fois), rarement (une ou deux fois), parfois (3-10 fois) ou souvent (plus de 10 fois)?

7a. Au cours des 4 dernières semaines, avez-vous eu peur que votre ménage n'ait pas assez de nourriture?	0. Non → Aller à Q 8a 1. Oui ☐
7b. Combien de fois cette situation est-elle arrivée?	1. Rarement (1-2 fois dans les 30 derniers jours) 2. Parfois (3-10 fois dans les 30 derniers jours) 3. Souvent (plus de 10 fois dans les 30 derniers jours) ☐
8a. Au cours des 4 dernières semaines, vous ou tout autres membres de votre ménage était confronté à une situation où il n'avait pas pu manger les types d'aliments que vous préférez à cause d'un manque de ressources ?	0. Non → Aller à Q 9a 1. Oui ☐
8b. Combien de fois cette situation s'est-elle présentée ?	1. Rarement (1-2 fois dans les 30 derniers jours) 2. Parfois (3-10 fois dans les 30 derniers jours) 3. Souvent (plus de 10 fois dans les 30 derniers jours) ☐
9a. Au cours des 4 dernières semaines, avez-vous ou un membre de votre ménage était contraint de mangé une variété limitée d'aliments en raison d'un manque de ressources?	0. Non → Aller à Q 10a 1. Oui ☐
9b. Combien de fois cette situation s'est-elle présentée ?	1. Rarement (1-2 fois dans les 30 derniers jours) 2. Parfois (3-10 fois dans les 30 derniers jours) 3. Souvent (plus de 10 fois dans les 30 derniers jours) ☐
10a. Au cours des 4 dernières semaines, avez-vous ou un membre de votre	0. Non → Aller à Q 11a 1. Oui

ménage été contraint de manger certains aliments dont vous n'avait vraiment pas envie de manger à cause d'un manque de ressources pour obtenir d'autres types d'aliments ?	☐
10b. Combien de fois cette situation s'est-elle présentée ?	1. Rarement (1-2 fois dans les 30 derniers jours) 2. Parfois (3-10 fois dans les 30 derniers jours) 3. Souvent (plus de 10 fois dans les 30 derniers jours) ☐
11a. Au cours des 4 dernières semaines, avez-vous ou un membre de votre ménage été contraint de manger un repas de petite quantité par rapport à ceux que vous avez l'habitude de consommer parce qu'il n'y avait pas assez de nourriture ?	0. Non → Aller à Q 12a 1. Oui ☐
11b. Combien de fois cette situation s'est-elle présentée ?	1. Rarement (1-2 fois dans les 30 derniers jours) 2. Parfois (3-10 fois dans les 30 derniers jours) 3. Souvent (plus de 10 fois dans les 30 derniers jours) ☐
12a. Au cours des 4 dernières semaines, avez-vous ou un membre de votre ménage été contraint de manger moins de repas par jour parce qu'il n'y avait pas assez de nourriture ?	0. Non → Aller à Q 13a 1. Oui ☐
12b. Combien de fois cette situation s'est-elle présentée ?	1. Rarement (1-2 fois dans les 30 derniers jours) 2. Parfois (3-10 fois dans les 30 derniers jours) 3. Souvent (plus de 10 fois dans les 30 derniers jours) ☐
13a. Au cours des 4 dernières semaines, est-il arrivé à votre menage de rester sans rien à manger de toute nature en raison du manque de ressources pour acquérir de la nourriture ?	0. Non → Aller à Q 14a 1. Oui ☐
13b. Combien de fois cette situation s'est-elle présentée ?	1. Rarement (1-2 fois dans les 30 derniers jours) 2. Parfois (3-10 fois dans les 30 derniers jours) 3. Souvent (plus de 10 fois dans les 30 derniers jours) ☐
14a. Au cours des 4 dernières semaines, avez-vous ou un membre de votre ménage passé une nuit entière sans rien manger parce qu'il n'y avait pas assez de nourriture?	0. Non → Aller à Q 15a 1. Oui ☐
14b. Combien de fois cette situation s'est-elle présentée ?	1. Rarement (1-2 fois dans les 30 derniers jours) 2. Parfois (3-10 fois dans les 30 derniers jours) 3. Souvent (plus de 10 fois dans les 30 derniers jours) ☐
15a. Au cours des 4 dernières semaines, avez-vous ou tout membre de votre ménage passé un jour et une nuit entiers sans rien manger parce qu'il n'y avait pas assez de nourriture ?	0. Non → Aller à Q 16 1. Oui ☐
15b. Combien de fois cette situation s'est-elle présentée ?	1. Rarement (1-2 fois dans les 30 derniers jours 2. Parfois (3-10 fois dans les 30 derniers jours) 3. Souvent (plus de 10 fois dans les 30 derniers jours) ☐

Score de consommation alimentaire du menage

Au cours des 7 derniers jours, combien de jours, les membres de votre ménage avaient préparés et / ou consommés les aliments suivants à la maison, et quelle était la source?

Note: Utilisez les codes ci-dessous, écrire 0 si aliment n'a pas ete consommé dans les 7 derniers jours. Déterminer si la consommation de poisson, le lait était seulement en petites quantités.

Aliments	Nombre de jours de consommation durant les 7 derniers jours (Si 0 jours de consommation, ne pas préciser la source principale)	Comment la nourriture a été acquise? Ecrire la principale source de nourriture pour les 7 derniers jours. 1=Propre production (produits de cultures, animaux) 2= Pêche / chasse 3=Collecter 4= Prêt 5=Marché (achat avec de l'argent) 6=Marché (achat avec le credit) 7= Mendier pour avoir la nourriture 8= Travail d'échange ou les articles alimentaires 9= Cadeau (aliment) des parents de la famille ou des amis 10=L'aide alimentaire de la société civile, les

			ONG, le gouvernement, le PAM	
16. **Céréales et graines:** Riz, pâtes, pain / gâteau / beignets, sorgho, mil, maïs		☐	☐	☐
17. **Les racines et tubercules:** pomme de terre, igname, manioc, patates douces blanches , taro et / ou autres tubercules.		☐	☐	☐
18. **Légumineuses / noix:** haricots, niébé, arachide, lentilles, soja, noix, sésame		☐	☐	☐
19. **Les légumes orangés:** carotte, poivron rouge, potiron, patates douces a chair orangée		☐	☐	☐
20. **Légumes à feuilles vertes:** moringa, brocoli, amarante et / ou autres feuilles vert foncé, feuilles de manioc		☐	☐	☐
21. **Autres légumes:** Oignon, tomates, concombre, radis, haricots verts, petits pois, laitue, etc.		☐	☐	☐
22. **Fruits oranges:** mangue, papaye, abricot, pêche		☐	☐	☐
23. **Autres fruits:** banane, ananas, citron, mandarine		☐	☐	☐
24. **Viande:** chèvre, boeuf, volaille, mouton, (la viande en grande quantité et non pas comme un condiment)		☐	☐	☐
26. **Foie, reins, cœur et / ou d'autres abats**		☐	☐	☐
27. **Poisson / coquillages:** les poissons, comme le thon/sardine en conserve, escargot, et / ou autres produits aquatiques (poisson en grande quantité et non pas comme un condiment)		☐	☐	☐
28. **Oeuf**		☐	☐	☐
29. **Lait et autres produits laitiers:** lait, yogourt, fromage, autres produits laitiers *NB: sont exclut margarine / beurre ou de petites quantités de lait juste pour le thé / café*		☐	☐	☐
30. **Huile / graisse / beurre:** huile végétale, huile de palme, beurre, margarine, autres graisses / huile		☐	☐	☐
31. **Sucre ou des friandises/boissons:** Sucre, miel, confiture, gâteaux, bonbons, biscuits, pâtisseries, boissons sucrées		☐	☐	☐
32. **Condiments / épices:** thé, café / cacao, sel, ail, épices, levure / poudre à pâte, tomate / sauce, viande ou du poisson sechée comme condiment, condiments, y compris petite quantité de café lait / thé.		☐	☐	☐

SECTION IV : EAU, HYGIENE ET ASSAINISSEMENT

33. Quelle est la principale source d'eau de consommation pour les membres de votre ménage?	1. Eaux de surface (fleuve, rivière, marigot, ruisseau, etc.) 2. Puits creusé 3. Camion citerne ou panier avec petit réservoir ou tambour

	4. Eau en bouteille 5. Eaux de pluie collectée 6. Puits en tube ou forage 7. Robinet public ou borne-fontaine 8. Eau courante à domicile (robinet SEEN) 9. Puits creusé bien protégé 10. Autres, à préciser: _____ ☐
34. Quelle est la principale source d'eau utilisée par votre ménage pour d'autres fins telles que la cuisine et le lavage des mains ?	1. Eaux de surface (fleuve, rivière, marigot, ruisseau, etc.) 2. Puits creusé 3. Camion citerne ou panier avec petit réservoir ou tambour 4. Eau en bouteille 5. Eaux de pluie collectée 6. Puits en tube ou forage 7. Robinet public ou borne-fontaine 8. Eau courante à domicile (robinet SEEN) 9. Puits creusé bien protégé 10. Autres, à préciser:_____ ☐ ☐
35. Combien de temps faut-il pour marcher de votre maison à la source d'eau de consommation pour collecter de l'eau et puis revenir à votre domicile ?	☐☐☐ minutes
36. Quelle est la personne qui va habituellement à cette source pour chercher de l'eau de consommation pour votre famille ?	1. Chef de ménage 2. Epouse 3. Autres coepouses ou autres femmes adultes membre du ménage 4. Garçons (ages de moins de 15 ans) 5. Filles (agees de moins de 15 ans) 6. Autres, à préciser: _____
37. Avez-vous une méthode/technique pour améliorer la qualité de votre eau afin de la rendre plus sûre pour la consommation ? Si oui, qu'est-ce que vous faites ? (si Q33 différents de 7 ou 8)	1. Pas de methode/technique 2. Décantation (dépôt et séparation des particules insolubles) 3. Filtrer à travers un tissu 4. Utiliser un filtre à eau (céramique, et, composite, etc.) 5. Désinfection solaire 6. Faire bouillir l'eau 7. Ajouter de l'eau de javel / chlore / aquatabs 8. Autres, à préciser: _____ ☐
38. Comment vous stockez votre eau destinée à la consommation dans votre ménage ?	1. Récipient ouvert avec grande ouverture 2. Récipient ouvert avec une ouverture étroite 3. Récipient ferme avec une large ouverture 4. Récipient ferme avec une étroite ouverture 5. Bidon ☐
39. Combien de francs votre ménage dépense dans l'eau par semaine ?	☐☐☐☐☐ CFA
40. Où est ce que les adultes de votre ménage font leurs besoins généralement ?	1. Défécation en plein air (c.-à-brousse / champ / autour de la maison) 2. Recipient/ sceau 3. Tout type d'installation qui est partagé avec d'autres personnes qui ne font pas partis du ménage 4. Toilette suspendue ou latrine suspendu 5. Latrine à ciel ouvert / latrine à fosse sans dalle 6. Latrine avec chasse d'eau à réseau d'égouts, fosses septiques, latrines à fosse 7. Latrine avec chasse d'eau 8. Latrine améliorée aéré /ventilé 9. Latrine à fosse avec dalle 10. Toilette à compost 11. Autres, à préciser: _____ ☐
41. Où est ce que les jeunes enfants de votre ménage défèquent généralement?	1. brousse / champ / autour de la maison 2. Recipient/sceau 3. Tout type d'installation qui est partagé avec d'autres personnes qui ne font pas partis du ménage 4. Toilette suspendue ou latrine suspendu 5. Latrine à ciel ouvert / latrine à fosse sans dalle 6. Latrine avec chasse d'eau à réseau d'égouts, fosses septiques, latrines à fosse 7. Latrine avec chasse d'eau 8. Latrine améliorée aéré /ventilé 9. Latrine à fosse avec dalle ☐

	10. Toilette à compost 11. Autres; à preciser: _____	
42. La dernière fois que (nom du plus jeune enfant) a fait ces selles, comment avez-vous fais pour évacuer les selles?	1. Lesenfants utilisent les toilettes / latrines 2. Déverser/rincer dans les toilettes/latrines 3. Déverser/rincer dans le drainage ou la fosse 4. Jeter dans la poubelle 5. Enterrer 6. Jeter en plein air/dans la nature 7. Autres à preciser:_____ 8. Ne sait pas	☐
43. Avez-vous du savon dans votre ménage du savon pour vous laver les mains? Pouvez-vous me le montrer?	1. Non 2. Oui, le savon a été montré a l'enqueteur 3. Oui, mais le savon n'a pas été montré a l'enqueteur 4. Ne sait pas	☐
44. Utilisez-vous le savon pour laver vos mains?	0. Non 1. Oui	☐
45. Si oui, quand pensez-vous vous lavez les mains avec du savon? (Cochez toutes les cases) *Code: 0=Non* *1=Oui*	a. Avant de préparer / manipuler des aliments	☐
	b. Avant de donner a manger aux enfants	☐
	c. Avant de manger	☐
	d. Après la préparation des aliments	☐
	e. Après le travail de terrain / nettoyage	☐
	f. Après avoir changé le bébé / nettoyage de l'enfants	☐
	g. Après avoir finis de manger	☐
	h. Après avoir finis de déféquer / utiliser des toilettes	☐
	i. Autres à preciser:_____	☐
46. Lavez-vous régulièrement les mains de vos enfants avec du savon?	0. Non →Aller à Q 48 1. Oui	☐
47. Si oui, quand est-ce que vous avez lavé les mains de vos enfants? (Cochez toutes les cases) *Code: 0=Non* *1=Oui*	a. Avant qu'ils mangent	☐
	b. Après avoir défèqué / utiliser les toilettes	☐
	c. Autres à preciser :_____	☐
48. Lavez-vous régulièrement vos ustensiles de cuisine avec du savon? *Code: 0=Non* *1=Oui*		☐

SECTION V : NUTRITION ET SANTE DE LA MERE		
49. Êtes-vous présentement enceinte?	0. Non → Aller à Q 54 1. Oui 2. Incertaine →Aller à Q 54	☐
Si présentement enceinte veuillez poser les questions 50 à 53 :		
50. Combien de mois de grossesse avez-vous? *Mettre '88' si elle ne sait pas*		☐☐mois
51. Est-ce que vous prenez des comprimés de fer? (montrer un exemple)	0. Non → Aller à Q 53 1. Oui	☐
52. Combien de fois prenez-vous des comprimés de fer?	1. Tous les jours 2. 4-5 fois par semaine	

	3. 2-3 fois par semaine 4. Unefois par semaine 5. Moins d'une fois par semaine	☐
53. Avez-vous pris des comprimés de vermifuges pour le déparasitage (Mebendazole) depuis que vous êtes enceinte?(montrer un exemplaire du comprime)	0. Non 1. Oui 2. Ne sait pas	☐
Posez les questions 54-60 à toutes les mères: 54. Durant votre toute dernière grossesse avez-vous consommé des comprimés de fer? (montrer un exemplaire du comprime)	0. Non 1. Oui 2. Ne sait pas	☐
55. Durant votre toute dernière grossesse avez-vous pris des comprimés vermifuges pour le déparasitage?	0. Non 1. Oui 2. Ne sait pas	☐
56. Durant votre toute dernière grossesse, avez-vous eu des problèmes de vision pendant la journée?	0. Non 1. Oui	☐
57. Durant votre toute dernière grossesse, avez-vous souffert de cécité nocturne?	0. Non 1. Oui	☐
58. Durant votre toute dernière grossesse, combien de visites prénatales avez-vous effectue avant l'accouchement?		☐☐visites
59. Qui vous a fourni les soins lors des visites?	1. Agent de sante qualifie 2. Accoucheuse traditionnelle 3. Autres àpreciser:_____ / _____/_____	☐
60. Où avez-vous donné naissance/accouche votre dernier enfant ?	1. A la maison 2. hôpital public 3. hôpital prive 4. Centre de sante communautaire (Case de sante) 5. Autres àpreciser: _____	☐
61. Qui vous a assisté lors de l'accouchement de votre dernier ?	1. Agent de santé qualifie 2. Accoucheuse traditionnelle 3. Autres à preciser:_____	☐
62. Avez-vous allaité (Nom du dernier enfant) après l'accouchement ?	0. Non →Aller à Q 64 1. Oui	☐
63. Combien de temps après la naissance avez-vous mis (Nom du dernier enfant) au sein pour la première fois ?	1. Immédiatement après la naissance 2. Dans l'heure de naissance 3. Dans les 12 heures suivant la naissance 4. Dans les 24 heures suivant la naissance 5. Dans la première semaine de naissance 6. Après la première semaine suivant la naissance	☐
64. Combien de repas avez-vous mangé dans la journée d'hier?		☐repas
65. Combien de collations entre les repas avez-vous mangé dans la journée d'hier?		☐collation

SECTION VI: PRATIQUES D'ALIMENTATION DU NOURRISSON ET DU JEUNE ENFANT			
*NB: Les questions dans le section VI doivent être posées pour chaque enfant de **moins de 24 mois** dans le ménage*			
66. Identité de l'enfant	☐☐	☐☐	☐☐
67. Nom de l'enfant			
68. Quel est le mois et l'année de naissance de votre enfant? *NB: Veuillez-vous référer à l'acte de naissance/carnet de santé/carte de vaccination lorsque disponible*	Jour: ☐☐ Mois: ☐☐ Année: 20☐☐	Jour: ☐☐ Mois: ☐☐ Année: 20☐☐	Jour: ☐☐ Mois: ☐☐ Année: 20☐☐
69. Quel est l'âge de (Nom de l'enfant) en mois ? *NB: enregistrement de l'âge en mois révolus et vérifier avec la réponse précédente*	☐☐ mois	☐☐ mois	☐☐ mois
70. (Nom de l'enfant) n'avait-il jamais été allaités? *Code: 0=Non → Aller à Q 74* *1=Oui*	☐	☐	☐
71. Allaitez-vous encore (Nom de l'enfant)? *Code: 0=Non → Aller à Q 73* *1=Oui*	☐	☐	☐
72. Hier, durant le jour ou la nuit, (Nom de l'enfant) a-t-il/elle été allaité? *Code: 0=Non* *1=Oui → Aller à Q 74*	☐	☐	☐
73. À quel âge (nom de l'enfant) a arrêté l'allaitement ? *Mettre '88' si elle ne sait pas*	☐☐ mois	☐☐ mois	☐☐ mois
74. Savez-vous si (nom de l'enfant) a reçu des gouttes de vitamines ou autres médicaments hier dans la journée ou la nuit? *Code: 0=Non* *1=Oui*	☐	☐	☐
75. Savez-vous si hier pendant la journée ou la nuit du SRO a été donné à (nom de l'enfant)? *Code: 0=Non* *1=Oui*	☐	☐	☐
76. Est-ce que (nom de l'enfant) boit ou a consommé des liquides (eau, jus…) ou des aliments en plus du lait maternel? *Code: 0=Non → Aller à Q 78* *1=Oui*	☐	☐	☐
77. À quel âge (Nom de l'enfant) a commencé à recevoir d'autres liquides ou aliments en plus du lait maternel? *Mettre '88' si elle ne sait pas*	☐☐ mois	☐☐ mois	☐☐ mois
78. Maintenant, je voudrais vous demander quel liquide (NOM) a-t-il bu hier pendant le jour ou la nuit. (NOM) a-t-il/elle but : *NB: pour chaque case préciser le code, code: 0 = Non* *1 = Oui*			

a. Eau	☐	☐	☐
b.1. Aliment lacté pour nourrissons, comme : Cerelac… b.2. Combien de fois hier pendant la journée ou la nuit, a-t-il consommé cet aliment?	☐ ☐fréquence	☐ ☐fréquence	☐ ☐fréquence
c.1. Lait concentré en boite, en poudre ou le lait frais animal c.2. Combien de fois hier pendant la journée ou la nuit, a-t-il consommé cet aliment?	☐ ☐fréquence	☐ ☐fréquence	☐ ☐fréquence
d.1. Jus de fruit naturel, boisson, jus en conserve ? d.2. Combien de fois hier pendant la journée ou la nuit, a-t-il consommé cet aliment?	☐	☐	☐
e.1. Bouillie légère e.2. Combien de fois hier pendant la journée ou la nuit, a-t-il consommé cet aliment ?	☐ ☐ fréquence	☐ ☐ fréquence	☐ ☐fréquence
f.1. Yaourt f.2. Combien de fois hier pendant la journée ou la nuit, a-t-il consommé cet aliment ?	☐ ☐fréquence	☐ ☐fréquence	☐ ☐fréquence
g.1. Bouillie épaisse g.2. Combien de fois hier pendant la journée ou la nuit, a-t-il consommé cet aliment ?	☐ ☐fréquence	☐ ☐fréquence	☐ ☐fréquence
h. Tout autres liquides tels que [autres liquides à base d'eau disponibles dans le contexte local]	☐	☐	☐
i. Autres liquids; precise: _____	☐	☐	☐

79. S'il vous plaît, veuillez décrire tout ce que (NOM) a mangé hier au cours de la journée ou de la nuit, que ce soit à la maison ou à l'extérieur de la maison.

   a.   Pensez quand (NOM) premier réveillé hier. Est-ce que (NOM) a mangé quoi que ce soit en ce moment-là? Si OUI: S'il vous plaît me dire tout ce que (NOM) a mangé en ce moment-là? Bien vérifier: s'il n'y'a pas autre chose? JUSQU'A CE QUE LE RÉPONDANT DIT RIEN D'AUTRE. Si NON, passez à la question 79b).
   b.   Qu'est-ce que (NOM) a fait par la suite? Est-ce que (NOM) a mangé quoi que ce soit en ces moments-là? Si OUI: S' il vous plaît me dire tout ce que (NOM) a mangé dans la journée. Bien vérifier: s'il n'y'a pas autre chose? JUSQU'A CE QUE LE RÉPONDANT DIT RIEN D'AUTRE. REPETER LA QUESTION b) ci-dessus jusqu'à ce que le RÉPONDANT vous donne le dernier aliment consomme avant que l'enfant est allé dormir jusqu'au lendemain.
   c.   SI LA PERSONNE MENTIONNE UN PLATS mixte comme une bouillie, la sauce ou ragoût, Chercher plus de précision:Quels sont les ingrédients utilises (composition du plat)? Demander:s'il n'y'a pas autre chose? JUSQU'A CE QUE LE RÉPONDANT VOUS DIT QU'IL N'Y'A RIEN D'AUTRE.

Veuillez enregistrer correctement les codes dans les cases correspondantes pour les aliments correspondants : Si les aliments ne

figurent pas dans l'un des groupes de denrées alimentaires citées, Veuillez ÉCRIRE la nourriture dans la case «AUTRES ALIMENTS». Si les aliments sont utilisés en petites quantités pour l'assaisonnement comme condiment, de les intégrer dans le groupe CONDIMENTS ALIMENTAIRE.
Une Fois termine, l'enquêteur doit FAIRE un RAPPELE des aliments consommés, en LISANT même les groupes alimentaires qui n'a pas n'ont pas été codé avec un «1».

a.	Bouillie à base de graine de céréale, pain, riz, mille, mais, sorgho ou tous autres aliments à base de grains	☐	☐	☐
b.	Citron, carottes, courges, patates douces à chair jaunes ou oranges	☐	☐	☐
c.	Pommes de terre, igname, manioc blanc, manioc, ou autres aliments à base de racines	☐	☐	☐
d.	Les légumes vert foncé à feuilles	☐	☐	☐
e.	Mangues mûres, papayes mûres, abricots ou de pêches	☐	☐	☐
f.	Tous autres fruits ou légumes	☐	☐	☐
g.	Foie, reins, cœur, ou autres abats	☐	☐	☐
h.	Toutes autres viandes, comme le bœuf, mouton, agneau, chèvre, poulet, canard…	☐	☐	☐
i.	Oeuf	☐	☐	☐
j.	Poisson frais, congelés ou séché, fruits de mer, autres produits aquatiques	☐	☐	☐
k.	Les aliments à base de haricots, les pois, les lentilles, les noix ou de graines	☐	☐	☐
l.	Fromage, yaourt, ou autres produits laitiers	☐	☐	☐
m.	Huile, graisses, beurre, ou autres aliments fabriqués avec l'une de ces produits	☐	☐	☐
n.	Les aliments sucrés comme les chocolats, bonbons, pâtisseries, gâteaux ou biscuits	☐	☐	☐
o.	Condiments pour la saveur, comme les piments, épices, herbes, ou poudre de poisson…	☐	☐	☐
p.	Criquets, chenille, escargots, insectes…	☐	☐	☐

q. Les aliments à base d'huile de palme rouge, rouge écrou de palme, ou rouge sauce de pâte de noix de palme	☐	☐	☐
r. Autres aliments (A lister):			
80. Est-ce que hier pendant la journée ou la nuit (NOM) a mangé des aliments solides, semi-solides, ou mous? *Code: 0=Non →Aller à Q 82* *1=Oui* *9=Ne sait pas*	☐	☐	☐
81. Combien de fois (NOM) a-t-il mangé des aliments solides, semi-solides ou mous autres que les liquides qu'il a bu hier pendant la journée ou la nuit? *NB: enregistrer le nombre de fois, entré «99» si inconnu*	☐☐fois	☐☐fois	☐☐fois
82. Est-ce que hier pendant la journée où de la nuit (NOM) n'avait rien but dans une bouteille avec une tétine? *Code: 0=Non* *1=Oui* *9=Ne sait pas*	☐	☐	☐

SECTION VII: MORBIDITE INFANTILE					
*Note: Les questions dans le section VII doivent être posées pour chaque enfant de **moins de 5 ans** dans le ménage*					
83. ID de l'enfant	☐☐	☐☐	☐☐	☐☐	☐☐
84. Nom de l'enfant					
85. Maintenant, je voudrais vous poser des questions sur certaines maladies dont certains de vos enfants de moins de 5 ans ont souffert au cours des 2 dernières semaines ainsi que les traitements que vous avez administré lorsque votre enfant était malade. *Note: pour chaque case préciser le code, Code: 0 = Non* *1 = Oui* *9 = Ne sait pas*					
a. Diarrhée (définie comme 3 ou plus selles molles ou liquides dans un délai de 24 heures)	☐	☐	☐	☐	☐
b. Fièvre	☐	☐	☐	☐	☐
c. Toux ou difficultés respiratoire (IRA)	☐	☐	☐	☐	☐
d. Vomissement	☐	☐	☐	☐	☐
e. Perte d'appétit / refus de manger / boire / téter	☐	☐	☐	☐	☐
Note: Si l'enfant a souffert au moins d'une des maladies indiquées ci-dessus, veuillez poser les questions suivantes Q86 a Q90 autrement, aller à Q 91					
86. Avez-vous demandé un traitement lorsque (NOM) était malade? *Code: 0=Non →Aller à Q 88* *1=Oui*	☐	☐	☐	☐	☐
87. Où avez-vous recherché des conseils ou un traitement lorsque (NOM) était malade? *Code: 1. Centre de sante* *2. Hôpital/CSI* *3. Cabinet/Clinique privé* *4. Pharmacie* *5. Guérisseur traditionnel* *6. Membre de la famille / ami* *7. Marchand ambulant/boutique* *8. Autres à préciser:_____*	☐	☐	☐	☐	☐
Note: Si l'enfant a souffert de diarrhée, veuillez poser les questions Q 88 à Q89, autrement aller à Q93					

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88. Avez-vous fournis un traitement ou respecter les conseils qui vous avez été donné pour traiter la diarrhée de votre enfant? *Code: 0=Non →Aller à Q 91* *1=Oui*	☐	☐	☐	☐	☐
89. Quel type de traitement a été fourni pour corriger la diarrhée? *Remplir toutes les cases avec le code: 0=Non* *1=Oui*	☐	☐	☐	☐	☐
a. SRO	☐	☐	☐	☐	☐
b. Tablette de Zinc	☐	☐	☐	☐	☐
c. Antibiotique	☐	☐	☐	☐	☐
d. Respect de conseil pour fournir plus de liquides à votre enfant	☐	☐	☐	☐	☐
e. Respect des conseils pour offrir plus de nourriture à votre enfant	☐	☐	☐	☐	☐
f. Autre à préciser:_____	☐	☐	☐	☐	☐
90. Pourquoi n'avez-vous pas demandé un traitement lorsque (NOM) était malade? *Code: 1=Ne pas penser que la maladie est suffisamment grave* *2=Un ami ou un membre de la famille vous a déconseillé* *3=l'hôpital/centre de santé était trop loin / n'a pas pu obtenir de transport* *4=Pas assez d'argent* *5=Autres à préciser : _____*	☐	☐	☐	☐	☐
91. (NOM) a-t-il reçu des vaccinations? *Code: 0=Non →Aller à Q 94* *1=Oui* *9=Ne sait pas*	☐	☐	☐	☐	☐
92. Est-ce que (NOM) possède un carnet de santé / carte de vaccination? Pouvez-vous me le montrer? *Code: 0=Non, pas de carte →Aller à Q 94* *1=Oui, avec carte* *2=Oui, mais pas de carte→Aller à Q 94*	☐	☐	☐	☐	☐

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9=Ne sait pas →Aller à Q 94					
93. Referez-vous à la carte de vaccination/carnet de santé de l'enfant pour enregistrer les vaccinations que l'enfant a reçu *Remplir toutes les cases avec le code: 0=Non* *1=Oui*					
a. BCG	☐	☐	☐	☐	☐
b. Pentavalent1+Polio	☐	☐	☐	☐	☐
c. Pentavalent2+Polio	☐	☐	☐	☐	☐
d. Pentavalent3+Polio	☐	☐	☐	☐	☐
e. VPO0	☐	☐	☐	☐	☐
f. VPO1	☐	☐	☐	☐	☐
g. VPO2	☐	☐	☐	☐	☐
h. VPO3	☐	☐	☐	☐	☐
i. Rougeole	☐	☐	☐	☐	☐
94. Est-ce que (NOM) a reçu la supplémentation en vitamine A dans les 6 derniers mois? (montrer un exemple) *Code: 0=Non* *1=Oui* *9=Ne sait pas*	☐	☐	☐	☐	☐
95. Est-ce que (NOM) a reçu les médicaments de déparasitage dans les 6 derniers mois? (montrer un exemple) *Code: 0=Non* *1=Oui* *9=Ne sait pas*	☐	☐	☐	☐	☐
96. Est-ce que (NOM) a dormi sous une moustiquaire imprégnée la nuit dernière? *Code: 0=Non*	☐	☐	☐	☐	☐

1=Oui *9=Ne sait pas*					
97. (NOM) était-il admis dans une unité de récupération nutritionnelle ou centre de santé pour le traitement de la malnutrition dans les 6 derniers mois? *Code: 0=Non* *1=Oui* *9=Ne sait pas*	☐	☐	☐	☐	☐
98. Est-ce que (NOM) a reçu des rations alimentaires supplémentaires "à emporter" pour le traitement de la malnutrition dans les 6 derniers mois? *Code: 0=Non* *1=Oui* *9=Ne sait pas*	☐	☐	☐	☐	☐
99. Combien de temps vous faut-il pour aller au centre de santé le plus proche ou à l'hôpital (en minutes)? *Si elle ne sait pas mettre '999'*	☐☐☐ min	☐☐☐ min	☐☐☐ min	☐☐☐ min	☐☐☐ min

SECTION VIII : ANTHROPOMETRIE 6-59 MOIS				
100. Identité de l'enfant	☐☐	☐☐	☐☐	☐☐	☐☐
101. Nom de l'enfant					
102. Quel est le mois et l'année de naissance de votre enfant? *NB: Si l'enfant a un extrait de naissance/carnet de sante*	Jour: ☐☐ Mois: ☐☐ Année: 20 ☐☐	Jour: ☐☐ Mois: ☐☐ Année: 20 ☐☐	Jour: ☐☐ Mois: ☐☐ Année: 20 ☐☐	Jour: ☐☐ Mois: ☐☐ Année: 20 ☐☐	Jour: ☐☐ Mois: ☐☐ Année: 20 ☐☐
103. Age en mois *NB : Si l'enfant n'a pas un extrait de naissance/ carnet de sante*	☐☐ mois	☐☐ mois	☐☐ mois	☐☐ mois	☐☐ mois
104. Evaluer œdème 0. Absent 1. Présent	☐	☐	☐	☐	☐
105. PB (cm)	____ ____ , ____	____ ____ , ____	____ ____ , ____	____ ____ , ____	____ ____ , ____
106. Poids (kg)	____ ____ , ____	____ ____ , ____	____ ____ , ____	____ ____ , ____	____ ____ , ____
107. Taille (cm)	___ ___ ___ , ___	____ ____ , ____	____ ____ , ____	____ ____ , ____	____ ____ , ____

Commentaires:

_____

Appendix D. Local calendar of events

Calendrier des principaux événements (Janvier 2015)

Saisons	Fêtes religieuses	Autres évènements	Evénements locaux	Mois musulman	Mois / années	Age (mois)
Froid				Rabi al Awal	Jan-15	0
Froid		18 décembre à Dosso		Safar	déc-14	1
Début froid	Achoura	Attaque à Ouallam 30/10/14	Watan shara	Muharam/ Safar	nov-14	2
Fin récolte				Doual al hijja / Muharam	oct-14	3
Début récolte	Tabaski 25/09/2014			Thw al-Qi`dah/Foulamzam	sept-14	4
Période des grandes pluies				Chaawal/Méferi	août-14	5
Début de grandes pluies	Fin/Fête du Ramadan 28/07/14			Ramadan/Méhaou	juil-14	6
Période des pluies (semis)	Début Ramadan 29/06/14			Chabaan / Tchékorno	juin-14	7
Période première pluies			Azumi tshofi	Radjab/Wayzéno	mai-14	8
Chaleur (pluies de mangues)		Fête de la concorde 24 avril	Watan bakwai	Jumaada al-THaany /bambana	avr-14	9
Début chaleur				Jumaada al-awal/Binkouna	mars-14	10
Fin froid		Championnat de lutte à Diffa (Yacouba Adamou)		Rabit at Tani/ Gani banda	févr-14	11
Froid	Mouloud 13/01/2013			Rabi al Awal/ Gani	janv-14	12
Froid				Safar/Dadab kaïna	déc-13	13
Début froid	Achoura		Watan shara	Doual al hijja / Muharam	nov-13	14
Fin récolte	Tabaski 15/10/2013			Thw al-Qi`dah /Doual al hijja	oct-13	15
Début récolte				Chaawal/Méferi Dou al qada/Foulamzam	sept-13	16
Période des grandes pluies	Fin/Fête du Ramadan 07/08/13	Gouvernement de large ouverture 13/08/203		Ramadan/Méhaou Chaawal/Méferi	août-13	17
Début de grandes pluies	Début Ramadan 09/07/13	Election présidentielle au Mali 28/07/2013		Chabaan/ Ramadan/Méhaou	juil-13	18
Période des pluies (semis)			Azumi tshofi	Rajab / Chabaan / Tchékorno	juin-13	19
Période première pluies		Attaque à Agadez et Arlit 28/05/2013	Azumi tshofi	Radjab/Wayzéno	mai-13	20
Chaleur (pluies de mangues)		Fête de la concorde 24 avril	Watan bakwai	Djoumada al Sani /bambana	avr-13	21
Début chaleur				Djoumada at Oula/ Djoumada al Sani	mars-13	22
Fin froid		Championnat de lutte à Niamey (Alio Saloua)		Rabit at Tani/ Djoumada at Oula/ Binkouna	févr-13	23
Froid	Mouloud 25/01/2013	Intervention de la France dans le nord du Mali		Rabi al awal/ Rabit at Tani/ Gani banda	janv-13	24
Froid		Démission du PM cheick Modibo Diarra du Mali		Safar/ Rabi al Awal/ Gani	déc-12	25
Début froid	Achoura	Réélection Obama	Watan shara	Muharam/Safar	nov-12	26
Fin récolte	Tabaski 26/10/2012			Doual al hijja/Muharam	oct-12	27
Début récolte				Dou al qada / Foulamzam	sept-12	28
Période des grandes pluies	Fin/Fête du Ramadan18/08/12			Chaawal/Méferi	août-12	29
Début de grandes pluies	Début Ramadan 20/07/12			Ramadan/Méhaou	juil-12	30
Période des pluies (semis)		Groupes islamistes chassent le MNLA du nord	Azumi tshofi	Rajab/Chabaan	juin-12	31
Période première pluies			Azumi tshofi	Djoumada al Sani/RAjab	mai-12	32
Chaleur		Occupation du MNLA des villes du nord Mali	Watan bakwai	Djoumada at Oula/Djoumada al Sani	avr-12	33
Début chaleur		Lutt trad Maradi (Laminou Mai Daba)	Coup d'Etat au Mali	Rabi at Tani/Djoumada at Oula	mars-12	34

Fin froid	Mouloud 04/02/12	Arrivés des refugiés malien au Niger, lutt tradi à Maradi	Décès sultan d'Agadez21/02	Rabi al Awal/Rabi at Tani	févr-12	35
Froid				Safar/ Rabi al Awal	janv-12	36
Froid	Achoura		Watan shara	Muharam/Safar	déc-11	37
Début froid	Tabaski 06/11/2011	Décès Général Ali Chaibou 01/11/2011		Doual al hijja/Muharam	nov-11	38
Fin récolte		Décès kadafi 20/10/2011		Dou al qada / Foulamzam	oct-11	39
Début récolte				Chaawal/Méferi	sept-11	40
Période des grandes pluies	Début ramadan 01/08/2011	Fête du Ramadan 30/08/2011		Ramadan/Méhaou	août-11	41
Début de grandes pluies				Chabaan/Tchékorno	juil-11	42
Période des pluies (semis)			Azumi tshofi	Radjab/Wayzéno	juin-11	43
Période premières pluies				Djoumada al Sania/bambana	mai-11	44
Chaleur		Investiture du président de la république 07/04/2011	Watan bakwai	Djoumada at Oula/Binkouna	avr-11	45
Début chaleur		Election présidentiel 2ème tour		Rabi at Tani/Gani banda	mars-11	46
Fin froid	Fête de Mouloud 16/02/2011	Début crise libyenne		Rabi al Awal/Gani	févr-11	47
Froid		Election Législative et Présidentielle 31/01/11		safar/Rabi al Awal/Gani	janv-11	48
Froid		Election locale 11/12/2010	Watan shara	Muharam/Safar/Dadab kaïna	déc-10	49
Début du froid	Tabaski 17/11/2010			Dou al hijja/Dadab beri	nov-10	50
Fin récolte				Chaawal/Méféri / Dou al Qada/	oct-10	51
Début récolte	Fin ramadan 09/09/10			Ramadan/Méhaou / Chaawal/Méféri	sept-10	52
Période des grandes pluies	Début ramadan 11/08/2010			Ramadan/Méhaou	Aout 2010	53
Début de grandes pluies				Chaaban/Tchékorno	juil-10	54
Période des pluies (semis)			Azumi tshofi	Rajab/Wayzéno /Chaaban/Tchékorno	juin-10	55
Période premières pluies		Fête de travail	Azumi tshofi	Djoumada al Sania/Banbana / Rajab/Wayzéno	mai-10	56
Chaleur		Fête de la concorde	Watan bakwai	Djoumada at Oula/Djoumada al Sania	avr-10	57
Début chaleur		JNV Polio		Rabiul At Tani /Djoumada at Oula	mars-10	58
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