

**Determinants of Acute Malnutrition in children under five
years in Harare City**

Zimbabwe

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**Determinants of acute malnutrition in children under five years in
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ABSTRACT

Determinants of acute malnutrition in children under five years in Harare City, Zimbabwe 2011

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Background: Malnutrition is associated with 35% of the top five causes of childhood mortality in Zimbabwe. The aim of the study was to identify factors associated with acute malnutrition in Harare City.

Methods: A 1:1 age group matched case-control study using a structured interviewer administered questionnaire was done. A case was a child with low weight for height or a mid-upper arm circumference less than 125mm. A control was a child with no signs of malnutrition.

Results: We interviewed 116 cases and 115 controls in the six to 24 month age group and 57 cases and 60 controls in the 25 to 59 month age group. The median age was 18 months (Q1=11, Q3=27) for cases and (Q1=10, Q3=29) for controls. Significant determinants of malnutrition were: breastfeeding less than eight times a day [OR=1.83(1.05-3.20)]; eating less than three meals a day [OR=2.16 (1.22-3.81)]; drinking less during fever or cough [OR=2.12 (1.08-4.16)] and birth weight less than 2300g [OR=2.67 (1.01-7.06)]. Cases used more coping strategies, 110 (Q1=92, Q3=122) for finding food than controls, 91 (Q1=78, Q3=112), p-value 0.01. After further analysis, acute malnutrition remained independently associated with breastfeeding less than eight times the previous day [OR=1.86 (1.02-3.39)] and eating less than three meals a day [OR 2.16 (1.20-3.88)].

Conclusion: Determinants of acute malnutrition are breastfeeding less than eight times a day and children not feeding more than three times a day. To reduce childhood malnutrition, emphasis should be given to increasing the knowledge of caregivers on infant and young child feeding practices.

Key words:

Maternal nutrition, low birth weight, breastfeeding

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University of Zimbabwe (August 2011)

ABBREVIATIONS

AOR	Adjusted Odds Ratio
AIDS	Acquired Immuno Deficiency Syndrome
ART	Anti-Retroviral Therapy
CHAI	Clinton Health Access Initiative
CMAM	Community-based Management of Acute Malnutrition
CSI	Coping Strategy Index
FAO	Food and Agriculture Organisation
HIV	Human Immuno-deficiency Virus
IEC	Information, Education and Communication
IQR	Inter Quartile Range
IRB	Institutional Research Board
MDG	Millennium Development Goals
MIMS	Multiple Indicator Monitoring Survey
MUAC	Mid-Upper Arm Circumference
OR	Odds Ratio
OTP	Out- patient Therapeutic Programme
PLWHA	People Living With HIV and AIDS
RUTF	Ready-to-Use-Therapeutic-Food
SAM	Severe Acute Malnutrition
SC	Stabilization Centres
USD	United States Dollars
WHO	World Health Organisation

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1 CHAPTER 1

1.1 Introduction

1.1.1 Overview of Global Malnutrition

Worldwide nearly 55 Million children under five are estimated to be suffering from acute malnutrition at any given time¹. Acute malnutrition is defined by a low weight for height (<-2 z-scores of the median), using the new World Health Organisation (WHO) Growth Standards, or a mid-upper arm circumference (MUAC) of <125mm or by presence of nutritional oedema.¹ Among the most common causes of mortality in children, malnutrition has been associated with increased risk of mortality. The risk of mortality in acute malnutrition is directly related to severity and therefore these children have a higher risk of death. Furthermore, the recently published *Lancet Series* on Maternal and Child Undernutrition recognise Severe Acute Malnutrition (SAM) as one of the top three nutrition-related causes of death in children under-five.¹

1.1.2 Malnutrition in Sub Saharan Africa

In Sub Saharan Africa, more than one third of child deaths are attributable to maternal and child undernutrition. Achieving Millennium Development Goal (MDG) one, which aims to reduce poverty and hunger, would help avert child deaths from diarrhoea, pneumonia, malaria, Human Immuno-deficiency Virus (HIV) and measles and reduce neonatal mortality. Improving child nutrition is a prerequisite to achieving MDG four.²

Investing in prevention is critical. Preventive interventions can include: improving access to high-quality foods and to health care; improving nutrition and health knowledge and practices; effectively promoting exclusive breastfeeding for the first six months of a child's life where appropriate; promoting improved complementary feeding practices for all

children aged six to 24 months — with a focus on ensuring access to age-appropriate complementary foods (where possible using locally available foods); and improving water and sanitation systems and hygiene practices to protect children against communicable diseases.

Severe acute malnutrition occurs often in families that have limited access to nutritious food and are living in unhygienic conditions, which increase the risk of repeated infections. Thus, preventive programmes have an immense job to do in the context of poverty, and in the meantime children who already are suffering from severe acute malnutrition need treatment.³

The Community-based Management of Acute Malnutrition (CMAM) utilizes a ready-to-use-therapeutic-food (RUTF) for treatment of malnutrition. In some countries, RUTF has been specifically designed to help improve the status of People Living With HIV and AIDS (PLWHA). Many of the cases of children with severe malnutrition have also been found to be HIV positive and research has shown that these children after treatment with RUTF in an Out-patient Therapeutic Programme (OTP) can recover to normal nutritional status. Children on Anti-Retroviral Therapy (ART) are often malnourished and benefit from CMAM and at the same time, children in the CMAM programme, can be routinely offered counseling and testing and if found positive, can be entered into the ART programme. (The emphasis of the CMAM programme to date is on the curative aspect of severe acute malnutrition and has made very little progress with effective sustainable interventions to prevent it.)

In May 2002, the Fifty-Fifth World Health Assembly endorsed the Global Strategy for Infant and Young Child Feeding, which recommends actively searching for malnourished infants and young children so they can be identified and treated. This approach, along with preventive action, can be added to the list of cost-effective interventions to reduce child mortality.

Following this convention in 2002, countries were urged to save children's lives by:

1. Adopting and promoting national policies and programmes that:
 - a) Ensure that national protocols for the management of severe acute malnutrition (based, if necessary, on the provision of RUTF) have a strong community-based component that complements facility-based activities.
 - b) Achieve high coverage of interventions aimed at identifying and treating children in all parts of the country and at all times of the year through effective community mobilization and active case finding.
 - c) Provide training and support for community health workers to identify children with severe acute malnutrition who need urgent treatment and to recognize those children with associated complications who need urgent referral.
 - d) Establish adequate referral arrangements for children suffering from complicated forms of severe acute malnutrition so they can receive adequate inpatient treatment.
 - e) Provide training for improved management of severe acute malnutrition at all levels, involving an integrated approach that includes community- and facility-based components.
2. Providing the resources needed for management of severe acute malnutrition, including:
 - a) Making RUTF available to families of children with severe acute malnutrition through a network of community health workers or community-level health

- facilities, preferably by encouraging the local food industry to produce RUTF in settings where families do not have access to appropriate local foods.
- b) Ensuring funding to provide free treatment of severe acute malnutrition because affected families are often among the poorest.
3. Integrating the management of severe acute malnutrition with other health activities, such as:
- a) Preventive nutrition initiatives, including promotion of breastfeeding and appropriate complementary feeding, and provision of relevant information, education and communication (IEC) materials.
 - b) Activities related to the Integrated Management of Childhood Illness at first level health facilities and at the referral level, and initiating such activities where they do not exist.⁴

1.1.3 Malnutrition in Zimbabwe

In Zimbabwe the above strategies have been adopted through The Community-based Management of Acute Malnutrition (CMAM). Since 2005 the Ministry of Health and Child Welfare (MOHCW) has been rolling out integrated facility based and Community-based Management of Acute Malnutrition (CMAM) with support from United Nations Children's Fund (UNICEF). The program is now spread across all districts in Zimbabwe with commodity support to the national pipeline coming from UNICEF and Clinton Health Access Initiative (CHAI). This support includes commodity support such as F-75 Therapeutic Milk, F-100 Therapeutic milk and Ready-to-Use Therapeutic Food to implementing sites in all 60 districts in Zimbabwe. To date over 451 health facilities are implementing CMAM. CMAM enables children with severe acute malnutrition to be treated at home if they have no medical complications. This enables families, and especially mothers, to continue with their normal routine responsibilities, without the fear and

stigmatization of hospitalization. Likewise, having the mother in the household ensures that the other children do not become neglected and face possible food insecurity with resulting malnutrition as the result of the mother being away for weeks at a time. Only children with acute malnutrition and complications need to be admitted to stabilization centres (SC) for initial treatment to stabilize the child before continuing therapeutic feeding in the home environment through Outpatient Therapeutic Programme sites (OTP).

1.1.4 Management of acute malnutrition in Zimbabwe

CMAM programme started in Harare City in 2007 with implementation in the following five sites:

Mbare Poly clinic, Hopley clinic, Hatcliffe Poly clinic, Dzivarasekwa Poly clinic, Mabvuku Satellite Clinic. To date, the programme has since expanded to the nine clinics in Harare, resulting in each of the eight functional districts having at least one site that is implementing CMAM. The sites are:

- Mabvuku Satellite clinic
- Hatcliffe Poly Clinic
- Dzivaresekwa Clinic
- Mufakose Clinic (FHS)
- Rutsanana Poly Clinic
- Kambuzuma Poly Clinic
- Mbare Poly Clinic
- Hatfield Clinic
- Hopley Clinic

1.2 Statement of the problem

According to the latest National Nutrition Survey of January 2010, the prevalence of acute malnutrition remains relatively low across the country for children under five years at 2.1 per cent, the rate doubles among babies between six and 18 months of age. This suggests inherent problems in infant feeding practices, including a lack of access to the right foods. The rates of acute malnutrition found in the National Nutrition Survey of 2010 translate to thousands of acutely malnourished children at high risk of death in Zimbabwe.⁴ In Harare, 2.0% were found to be suffering from acute malnutrition with 0.5% using WHO growth standards suffering from severe acute malnutrition, a condition requiring specialized medical attention.⁵ This translates to a point prevalence of approximately 1,250 children, which usually translates to about double the amount 2,500 children expected to suffer from severe acute malnutrition (a life threatening condition) throughout 2010 in Harare City.

In addition, the survey showed that only about eight per cent of children below the age of two receive the minimum acceptable complementary foods in terms of quality and diversity.

2 CHAPTER 2

2.1 Literature review

According to the United Nations World Food Programme, over one billion people in the world do not have enough to eat. Every six seconds a child dies from malnutrition. That is more than the entire population of the United States, Canada, and the European Union. Chronic hunger and malnutrition can cause significant health problems. People who go hungry all the time are likely to be underweight, weighing significantly less than an average person of their size. Their growth may also be stunted, making them much shorter than average. Worldwide, as many as 27% of children younger than age five, are underweight.⁶ The main underlying preconditions that determine adequate nutrition are food, health and care: the degree of an individual's or a household's access to these preconditions affect how well they are nourished.⁷

Recent studies released on October 14, 2009 by Food and Agriculture Organisation (FAO), revealed that 1.02 billion people are undernourished, a sizable increase from its 2006 estimate of 854 million people. The increase has been due to three factors: 1) neglect of agriculture relevant to very poor people by governments and international agencies; 2) the current worldwide economic crisis, and 3) the significant increase of food prices in the last several years which have been devastating to those with only a few dollars a day to spend. 1.02 billion people is 15 percent of the estimated world population of 6.8 billion. Nearly all of the undernourished are in developing countries.⁸

Figure 1 below illustrates that worldwide, malnutrition is implicated in >50% of deaths of children under five years of age⁹

The major contributing factors are:

- Diarrhea 19%
- Acute Respiratory Infections (ARI) 19%
- Perinatal causes 18%
- Measles 7%
- Malaria 5%

Fifty-five percent of the total has malnutrition

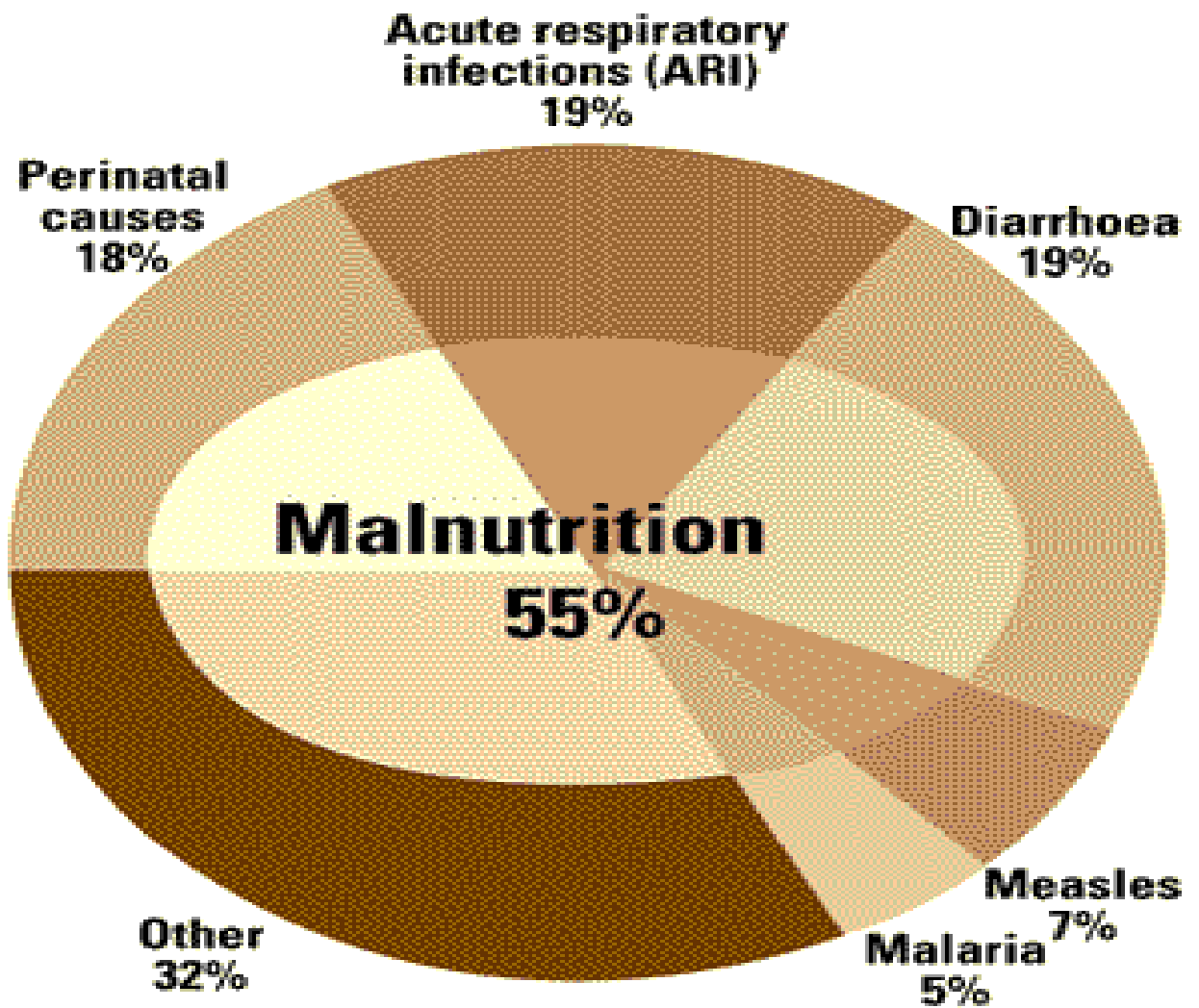


Fig 1: Illustration of how malnutrition contributes to 55% of deaths in children under five years of age

2.1.1 Malnutrition conceptual framework

The conceptual framework in Figure 2 enables the analysis of the causes of malnutrition in any community as it indicates the interrelationship between the various contributory factors. To alleviate malnutrition, the causal factors at the different levels of analysis need to be addressed. The immediate causes of malnutrition are associated with dietary intake, stress, trauma and disease. The immediate causes are influenced by the underlying causes of malnutrition which are linked to the levels of household food security, maternal and child care, education and information, as well as health services and the environment. In turn, the underlying causes are influenced by the basic causes of malnutrition like the availability and control of resources, as well as the political, social, ideological, economic and cultural factors that affect the availability and control of resources.

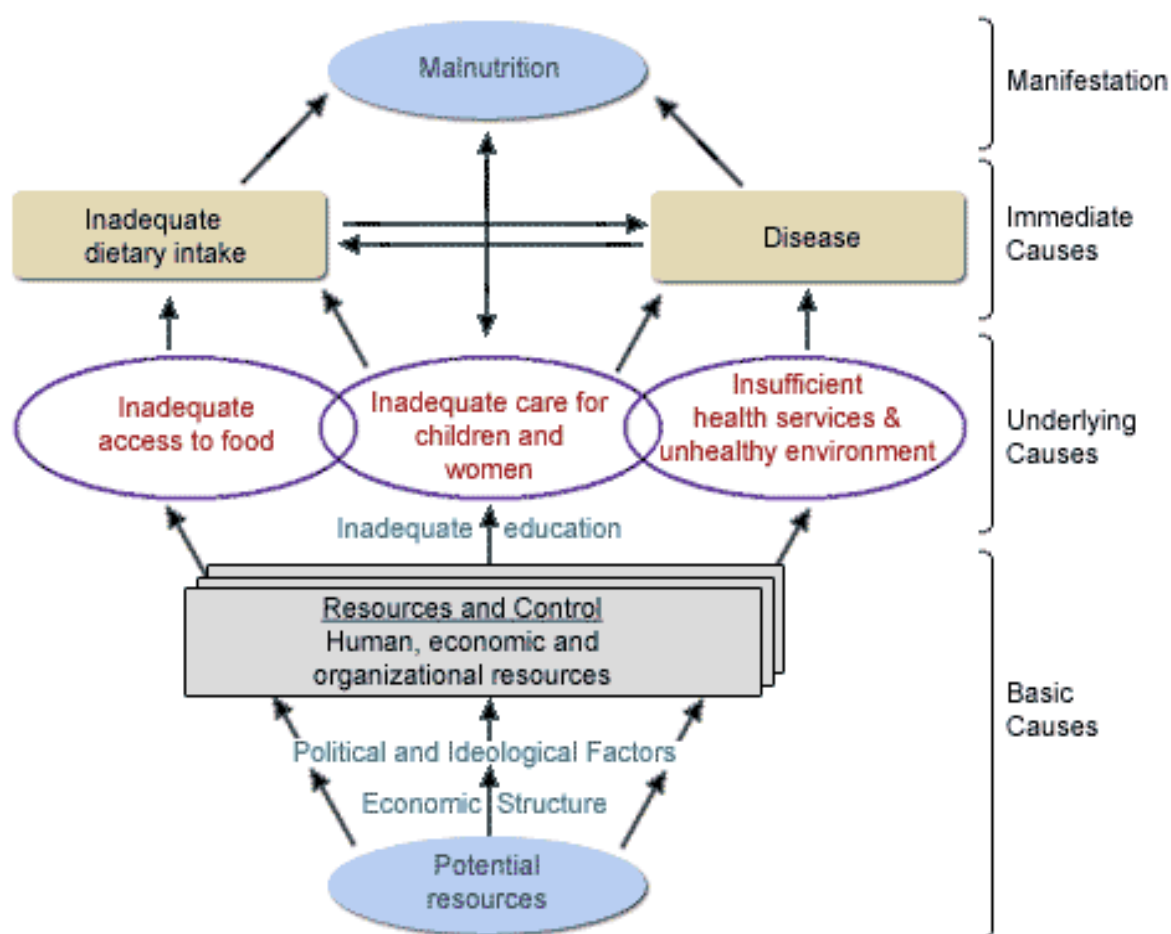


Figure 2: UNICEF Conceptual Framework of Malnutrition

2.2 Objectives

2.2.1 Broad objective

To assess determinants of acute malnutrition in children under the age of five in Harare City during the year 2011.

2.2.2 Specific Objectives

1. To assess the socio demographic characteristics of children with acute malnutrition and their caregivers.
2. To identify immediate determinants of acute malnutrition
3. To identify underlying determinants of malnutrition
4. To identify basic determinants of malnutrition

2.2.3 Immediate determinants of malnutrition

Immediate determinants of malnutrition are inadequate dietary intake and disease. The synergistic relation between malnutrition and infection is well known, and nutritional interventions have been recognised as an important approach for reducing mortality from acute respiratory illness and diarrhoea.¹⁰ The WHO Integrated Management of Childhood illness initiative is based on the premise that combining efforts to promote the appropriate case-management of serious infectious diseases with nutritional interventions, immunisation programmes, and other disease prevention and health promotion activities will be more effective in decreasing child mortality than implementing any one of the components alone.¹¹ This study focused on fever, cough, diarrhoea and HIV as immediate causes of malnutrition related to disease. Breast feeding, complementary feeding, dietary diversity and coping strategy index were the focus areas for immediate causes related to dietary intake.

2.2.4 Underlying determinants of malnutrition

Malnutrition is the result of a complex interaction between inadequate dietary intake and poor health due to three primary underlying factors: poor food security, sub-optimal household care practices, and limited access to health services, clean water, and sanitation. Readily available food, appropriate health systems and a “healthy” environment are ineffective unless they are used effectively. As a result, the absence of proper care in households and communities is the third necessary element of the underlying causes of malnutrition.¹² This study will focus on access to water, health facilities, and timeliness of reporting a child’s illness to the health facility, breastfeeding, complementary feeding and frequency of feeding as underlying factors of malnutrition.

2.2.5 Basic determinants of malnutrition:

Malnutrition (under nutrition) can also be referred to as the biological translation of a social disease with historical roots. Basic causes of hunger and malnutrition are conditioned by the overall policies that govern national economics. Basic causes are always related to international, national and village level constraints.¹³ Removing basic causes of malnutrition results in the creation of conditions under which interventions addressing the more immediate causes will have a better chance of having an impact.¹⁴ This study looked at monthly income, whether the mother is the primary caregiver and occupation as some of the basic causes of malnutrition.

Studies looking at risk factors for the prevalence of malnutrition in children under five in urban areas in Sub Saharan Africa have confirmed an association of severe acute malnutrition with inappropriate infant and young child feeding practices and lack of mother’s education.^{15,16} Other studies in Somalia have revealed that potential contributing

factors include lack of safe water (only 15% of the population have access), lack of sanitation facilities (25% of the population have access), lack of a functional health system for basic services (measles coverage estimated at 35%) and chronic food insecurity.¹⁷

In Zimbabwe, according to UNICEF's recently published Multiple Indicator Monitoring Survey (MIMS), thirty five percent of children under the age of five are chronically malnourished (stunted), and nearly twelve percent are underweight¹⁸ (UNICEF 2009, citing rates calculated using the WHO growth standards). Two point one percent of children between six and 59 months of age are acutely malnourished (wasting)¹⁹, and an estimated 15,300²⁰ children suffer from severe acute malnutrition at any one point in time.

Further to this, the nutrition situation in Zimbabwe is made more fragile by relatively high rates of HIV/AIDS. While the prevalence of HIV infection has declined considerably over the past decade, Zimbabwe still hosts one of the highest prevalence rates in the world of 15.6 percent. The epidemic is reversing the socio-economic and nutritional gains achieved in the early 1980's and diverting scarce resources away from other pressing developmental issues²¹.

A study in Mazowe in 1996 revealed that critical issues to improve nutrition in Zimbabwe were better access to health care as well as a higher income.²² It is in light of this evidence that we investigated the factors associated with acute malnutrition in Harare City.

2.3 Justification

Past research on Nutrition in Zimbabwe²³ has discussed the various determinants of malnutrition as they relate to the Zimbabwean context. This study looked at the basic,

underlying and immediate determinants of malnutrition and compared which determinants are more significant than others in order to begin to open avenues for designing and prioritizing various interventions accordingly.

3 CHAPTER 3

3.1 Materials and Methodology

3.1.1 Study design

A 1:1 matched case-control study by age groups six to 24 months and 25 to 59 months was conducted.

3.1.2 Research question

Which of the basic, immediate and underlying factors are most significantly associated with acute malnutrition in children under five years of age in Harare City?

3.1.3 Study variables

Table 1: Dependent and independent variables and the corresponding indicators

Variable	Indicator
Dependent variable / Outcome variable	Acute Malnutrition
Independent variables	Examples*
Basic causes	Age of child, Age of mother/guardian, Sex, Level of education Place of residence, Religion, Relationship of primary caregiver to child, Number of children in same household, Multiple births, Marital status, Occupation, Monthly income
Immediate causes	Fever, cough, diarrhoea and HIV, breast feeding, complementary feeding, dietary diversity and coping strategy index.
Underlying causes	Water, timeliness of reporting a child's illness to the health facility, breastfeeding and complementary feeding.

*See Appendix 1 for a full list of variables

3.1.4 Case definition

A case was defined as a child with a very low weight for height (less than -2 z-scores of the median), or a mid-upper arm circumference (MUAC) of less than 125mm or presence of nutritional oedema indicating that they have acute malnutrition.

A control was defined as a child with weight for height -2 z-scores of the median or more and a MUAC of 125mm or more, indicating that they are not malnourished.

3.1.5 Inclusion criteria

Children between the ages of six to 59 months presenting at the City Council health facilities in Harare with or without acute malnutrition during the period April 2011 to June 2011.

3.1.6 Exclusion criteria

Children who were not in the six to 59 months age group were excluded from the study. Also excluded, were children from the age of six to 59 months who had not lived in Harare at least from the first of January 2011 and children were not accompanied by their guardians or caregivers.

3.1.7 Study setting

The study took place in Harare City in the council clinics.

3.1.8 Sampling frame

A comprehensive list of all children identified with acute malnutrition is not available at the clinics, therefore a sampling frame was not utilised.

3.1.9 Study population

Children between the ages of six to 59 months seeking primary health care services in Harare City.

3.1.10 Study sample

Children between the ages of six and 59 months presenting at the nine selected clinics in Harare City.

3.1.11 Sample size calculation

Using Stat Calc (Epi Info 3.5.1 assuming an odds ratio of 1.96 in households with more than three children among cases and 25.5% of households with more than three children among controls²⁴, at 95% confidence interval and 80% power, the minimum sample size of children with acute malnutrition was calculated as **346 (173 cases and 173 controls)** based on a ratio of one case to one control. Assuming a response rate of 96%²⁵ our minimum sample size was **360 (180 cases and 180 controls)**.

3.1.12 Sampling technique

All nine City Council Health facilities in Harare that are implementing the management of acute malnutrition were purposively sampled. Sampling from each clinic was proportional to the size of the population with acute malnutrition being cared for at the clinic. Cases were sampled conveniently from children presenting with acute malnutrition at the health facilities. Controls were selected using systematic sampling from the same health facility and were matched according to age groups six to 24 months and 25 to 59 months. (See appendix 2)

3.1.13 Data collection tools

The data collection tools consisted of a structured interviewer administered questionnaire, a mid upper arm circumference tape and a check list containing a summary of the admission criteria for cross checking the nutritional status of children before classifying them as cases or controls.

3.1.14 Data collection and management

The interviewer administered questionnaire (See Appendix 3) was adapted from questionnaires used for the National Nutrition Survey of 2010 and the Nutrition Knowledge, Attitudes, Behaviour and Practices survey of 2008. The check list (See Appendix 4) was a list of criteria used to verify whether the child had acute malnutrition.

The questionnaire was pretested in Warren Park Polyclinic. After obtaining permission from the Nurse in charge of the clinic, parents or guardians with children in the six to 59 month age group were approached. The purpose of the study was explained and confidentiality was assured. If the parent or guardian of the child consented to participate in the study, he or she was asked to sign the consent form. The interviews were carried out in a private room which we had been assigned by the nurse in charge with attention being paid to whether the questionnaire was user friendly, the time which the interview took, appropriateness, simplicity and clarity of the language used. Adjustments were made where the translation of the questionnaire to the Shona language did not clearly convey the sense of the question as originated in English. Adjustments were also made to the flow of the questions; otherwise no major adjustments were made. Open ended questions were re-grouped and categorized according to the main classes of responses given.

After pretesting, the questionnaire was finalized and reproduced in bulk. Nurses in charge of the nine clinics selected for the study were approached and appointments were made in accordance with review dates for when children with acute malnutrition attend. On the day of the interviews caregivers of children with acute malnutrition were approached. The purpose of the study was explained and confidentiality was assured. Eligibility of the study was checked by asking the age of the child and whether the person with the child was the main caregiver of the child and also whether they were resident in Harare City at least from the first of January 2011. Upon fulfillment of criteria, if the parent or guardian of the child consented to participate in the study, he or she was asked to sign the consent form. The nutrition status of the child was double checked using the check list. The interviews were carried out in a private room which we had been assigned by the nurse in charge. The same process was followed for every third control in line at the clinic. The nutrition status of controls was double checked and re-classified where necessary. This was necessary as some children not yet admitted into the CMAM programme might also be acutely malnourished.

Questionnaires were checked for completeness at the point of collection. Any missing information was confirmed with the parent or caregiver of the child. At the end of every day, questionnaires were numbered and counted to double check how many cases and controls had been captured.

3.1.15 Data processing and analysis

Data was captured using Epi Info 3.5.1. All questions had been coded to minimize mistakes due to incorrect spelling and misclassification during data capture. Unusual or unexpected values were checked for and examined to see if there were any errors in data entry. Numbers of records were also checked against the number of questionnaires and duplicated

questionnaires were deleted. Miscoded and missing values were corrected. Epi info was used for univariate and bivariate analysis and also to identify independent variables while controlling for confounding using logistic regression.

3.1.16 Methodology for calculation of Coping Strategy Index²⁶

The Coping Strategy Index (CSI) tool relies on counting up coping strategies that are not equal in severity. Different strategies were ‘weighted’ – multiplied by a weight that reflects their severity before being added together. The individual strategies were grouped into four categories, where one is equal to the least severe category; eight is equal to the most severe, and four is intermediate. The CSI was then calculated according to the example in Appendix 5.

3.1.17 Methodology for calculation of Household Dietary Diversity Score²⁷

Dietary diversity, the number of different foods or food groups consumed over a given reference period - is an attractive indicator for three reasons. First, a more varied diet is a valid outcome in its own right. Second, a more varied diet is associated with a number of improved outcomes in areas such as birth weight, child anthropometric status, improved hemoglobin concentrations, reduced incidence of hypertension, reduced risk of mortality from cardiovascular disease and cancer. Third, questions on dietary diversity can be asked at the household or individual level, making it possible to examine food security at the household and intra- household levels. See Appendix 6 for an example of how to calculate household dietary diversity score.

3.2 Permission to carry out the study and ethical considerations

Permission to conduct the study was sought from the Director of Health Services in the City of Harare, the Health Studies Office and the Nurse in Charge of each participating Health Center.

The study proposal was reviewed by the Institutional Research Board (IRB) of Harare City Health Department and reviewed by the Nutrition Department. Comments and feedback were taken into consideration while finalizing the proposal and resubmitted for approval. The final approval letter from Harare City Health IRB was attached to the application to the Medical Research Council of Zimbabwe and permission was given to proceed with the study. The objectives of the study were explained to study participants and informed written consent was sought from participants. Confidentiality was assured and maintained. Participants were informed of their right to refuse to participate or withdraw from the study at any given time.

4 CHAPTER 4

4.1 Results

4.1.1 Demographic characteristics of the study participants

One hundred and seventy three (173) cases and one hundred and seventy five (175) controls were interviewed. Sixty-seven percent (116) of cases and 65.7% (115) of controls were in the six to 24 month age group. Thirty two point nine percent (57) of cases and 34.3% (60) of controls were in the 25 to 59 month age group. The median age for cases was 18 months (Q1=11, Q3=27) and the median age for controls was 18 months (Q1=10, Q3=29). Table 2 below shows the socio-demographic information of the cases and controls.

Table 2: Socio-demographic variables of children under the age of five years and caregivers interviewed during the study period in Harare City

Variable	Cases		Controls		P-value
	n	%	n	%	
Age of Child					
6-24 months	116	67.1	115	65.7	
25-59 months	57	32.9	60	34.3	
<u>Median age:</u>	18 (Q1=11, Q3=27)		18 (Q1=10, Q3=29)		
Age of mother/guardian					
<u>Median age:</u>	26 (Q1=22, Q3=29)		27 (Q1=22, Q3=30)		
Sex of child					
Male	79	45.7	78	44.6	0.92
Female	94	54.3	97	55.4	
Level of education of mother/guardian					
None	4	2.3	2	10.5	0.49
Primary	49	28.3	55	31.4	
Secondary	118	68.2	113	64.6	
Tertiary	2	1.2	5	2.9	
Residence					
High density urban	148	85.5	154	88.0	0.70
Median density urban	8	4.6	8	4.6	
Low density urban	0	0	0	0	
Peri Urban	16	9.2	13	7.4	
Rural	1	0.6	0	0	
Religion					
Christian	165	95.4	170	97.1	0.33
Muslim	0	0	1	0.6	
Traditional African	2	1.2	0	0	
None	6	3.5	4	2.3	
Current marital status					
Married monogamous	144	83.2	149	85.1	0.73
Married polygamous	4	2.3	1	0.6	
Single – never married	13	7.5	14	8.0	
Cohabiting	5	2.9	4	2.3	
Widower	7	4.0	7	4.0	
Primary occupation					
Employed formally	1	6.4	9	5.1	0.83
Employed informally	40	23.1	44	25.1	
Unemployed	122	70.5	122	69.7	
Monthly family income					
Less than USD50.00	22	12.7	18	10.3	0.58
More than or 152 equal to USD50.00	151	87.3	157	89.7	

4.2 Bivariate analysis

4.2.1 Outcome of immediate determinants related adequate dietary intake

Children who stopped breastfeeding before the age of 18 months were more likely to have acute malnutrition [OR=1.82 (0.98-3.37)]. The median of the coping strategy index for cases, 110 (Q1=92, Q3=122) was significantly higher than that of the controls, 91 (Q1=78, Q3=112) with a p-value of 0.01 derived from the Mann Whitney/Wilcoxon Two sample test. The median of the dietary diversity score for cases 5 (Q1=5, Q3=7) was significantly lower than that of the controls 6 (Q1=5, Q3=7) with a p-value of 0.05 derived from the Mann Whitney/Wilcoxon Two sample test. The Mann Whitney/Wilcoxon Two sample test is a non-parametric statistical hypothesis test for assessing whether one of two samples of independent observations tends to have significantly larger values than the other. Table 3 below shows the outcome of the analysis of immediate determinants of malnutrition related to dietary intake.

Table 3: Analysis of immediate determinants of malnutrition related to adequate dietary intake

Variable	Cases		Controls		OR (95% CI)
	n	%	n	%	
Weaning age					
Below 18 months	42	51.9	32	37.2	1.82 (0.98-3.37)
Above 18 months	39	48.1	54	62.8	
Coping strategies index (CSI)					
<u>Median CSI:</u>	110 (Q1=92, Q2=122)		91 (Q1=78, Q2=112)		0.01*
Dietary diversity score (DDS)					
<u>Median DDS:</u>	5 (Q1=5, Q2=7)		6 (Q1=5, Q2=7)		0.05*

4.2.2 Outcome of analysis of underlying determinants related to care for children

Bivariate analysis revealed that there were no significant protective factors against acute malnutrition. Significant risk factors for acute malnutrition related to inadequate care were being breastfed less than eight times in the last 24 hours [OR=1.83 (1.05-3.20)], being offered less to drink during fever or cough [OR=2.12 (1.08-4.16)] and receiving solid or semi solid foods other than liquids less than three times in the last 24 hours [OR 2.16 (1.22-3.81)]. Table 4 illustrates the outcome of the analysis.

Table 4: Analysis of underlying determinants related to care for children

Variable	Cases		Controls		OR (95% CI)	p-value
	n	%	n	%		
Frequency of feeds						
Breastfed less than eight times in the last 24 hours:						
Yes	39	48.8	24	30.8	2.14 (1.12-4.10)	0.03*
No	41	51.3	54	69.2		
Received solid or semi solid foods other than liquids less than 3 times in the last 24 hrs:						
Yes	41	23.7	22	12.6	2.16 (1.22-3.81)	0.01*
No	132	76.3	153	87.4		
First food introduced at less than six months of age:						
Yes	102	59.0	89	50.9	1.39 (0.91-2.12)	0.16
No	71	41.0	86	49.1		
First food introduced at less than four months of age:						
Yes	56	32.4	44	25.1	1.42 (0.80-2.27)	0.17
No	117	67.6	131	74.9		
Child given less or nothing to drink during fever or cough						
Yes	38	52.1	24	33.8	2.12 (1.08-4.16)	0.04*
No	35	47.9	47	66.2		

*Statistically significant risk factors

4.2.3 Outcome of analysis of underlying and immediate determinants related to insufficient health services

Statistically significant risk factors for development of acute malnutrition related to insufficient health services and an unhealthy environment were; birth weight less than 2300g [OR=2.67 (1.01-7.06)] and being HIV positive [OR=7.89 (0.88-71.21)], which is only moderately significant. Table 5 below shows the outcome of the analysis.

Table 5: Analysis of underlying and immediate determinants related to insufficient health services and an unhealthy environment

Variable	Cases		Controls		OR (95% CI)	p-value
	n	%	n	%		
Having a child health card:						
Yes	163	94.2	169	96.6	0.58 (0.21-1.63)	0.43
No						
Birth weight less than 2500g:						
Yes	26	15.0	15	8.6	1.89 (0.96-3.70)	0.08
No	147	85.0	160	91.4		
Birth weight less than 2300g:						
Yes	15	8.7	6	3.4	2.67 (1.01-7.06)	0.06*
No	158	91.3	169	96.6		
Diarrhoea in the past month:						
Yes	64	37.0	52	29.7	1.39 (0.89-2.17)	0.18
No	109	63.0	123	70.3		
HIV status:						
Positive	6	24.0	1	3.8	7.89 (0.88-71.21)	0.04*
Negative	19	76.0	25	96.2		
Toilet shared by more than 5 households:						
Yes	16	9.2	9	5.1	1.88 (0.81-4.38)	0.20
No	157	90.8	166	94.9		

4.2.4 Outcome of analysis of basic determinants related to acute malnutrition in children under five in Harare City

There were no significant factors found during bivariate analysis of the basic determinants of acute malnutrition.

4.3 Matched analysis by age group

Matched analysis was carried out for all the factors, by the age groups six to 24 months and 25 to 59 months. Being breast fed less than eight times in the last 24 hours and receiving solid or semi-solid foods less than three times in the last 24 hours was found to be a statistically significant risk factor for children between the ages of six and 24 months [OR=2.03 (1.11-3.68)] and [OR=2.43 (1.28-4.59)] respectively. Only one child between

the age of 25 and 59 months was still breastfeeding. Receiving tea or infusions during the previous day was found to be significantly protective for children in the 25 to 59 month age group [OR=0.34 (0.12-0.89)] and not a significant determinant for children in the six to 24 month age group. Table 6 shows the results of the analysis

Table 6: Results of matched analysis by age groups six to 24 months and 25 to 59 months

Age of Child	6-24 months			25-59 months		
	Cases N=116 (%)	Controls N=115 (%)	OR (95% CI)	Cases N=57 (%)	Controls N=60 (%)	OR (95% CI)
Breast fed less than 8 times in the last 24hrs?	Y 39 (34)	23 (20)	2.03 (1.11-3.68)	(Undefined) There was only one control and zero cases still breastfeeding in this age group		
	N 77 (66)	92 (80)				
Liquids received in last 24hrs? (Tea)	Y 48 (41)	45 (39)	1.10 (0.65-1.86)	41(72)	53(88)	0.34 (0.12-0.89)
	N 68 (59)	70 (61)		16(28)	7(12)	
Received solid or semi-solid foods less than 3 times in the last 24hrs?	Y 36 (31)	18 (16)	2.43 (1.28-4.59)	5 (9)	4 (7)	1.35 (0.34-5.29)
	N 80 (69)	97 (84)		52(91)	56 (93)	

4.4 Stratified analysis

Stratified analysis was carried out for a number of variables to check for effect modification and control for possible confounding by sex. None of the variables appeared to have biologically plausible effect modifiers nor was there any confounding as shown in Table 7 below.

Table 7: Stratified analysis to check for effect modification or confounding by sex

Variable	Crude OR (95% CI)	MH Adjusted OR (95% CI)	Comment
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Significant factors for children aged six to 24 months:

Breastfeeding less than eight times in last 24hrs	2.03 (1.11-3.68)	1.98 (1.10-3.58)	Similar
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Being given solid or semi-solid foods less than 3times in last 24hrs	2.43 (1.28-4.59)	2.43 (1.29-4.61)	Similar
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Significant factors found for children aged 25 to 59months:

Being given tea or infusions during diarrhoea	0.34 (0.13-0.90)	0.32 (0.12-0.86)	Similar
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4.5 Multivariate analysis

Multivariate analysis was done to allow for efficient estimation of measures of association between independent factors and acute malnutrition. Stepwise logistic regression analysis is

the technique that was used in our multivariate analysis. The logistic regression model accounted for all 348 participants. Independent risk factors for acute malnutrition in Harare City were having been breastfed less than eight times the previous day and having eaten solid or semisolid foods other than liquids less than three times the previous day. No protective factors were found to be significant. Table 8 below shows final results of our stepwise logistic regression analysis.

Table 8: Independent determinants of acute malnutrition in children under five years of age in Harare City, 2011

Term	OR (95% CI)	AOR (95%CI)	Coefficient	Z-Statistic	p-value
Breastfed less than eight times in last 24 hours	2.14 (1.12-4.10)	1.86 (1.03-3.38)	0.62	2.05	0.04*
Given solid or semi-solid foods other than liquids less than three times in the last 24 hours	2.16 (1.22-3.81)	2.15 (1.20-3.85)	0.77	2.58	0.01*

*Statistically significant independent factors

The logistic regression model accounted for all 348 participants. Independent risk factors for acute malnutrition in Harare City were having been breastfed less than eight times during the last 24 hours and having eaten solid or semisolid foods other than liquids less than three times during the last 24 hours.

5 CHAPTER 5

5.1 Discussion

Determinants of acute malnutrition in Harare City were found among underlying and immediate causes outlined in the malnutrition conceptual framework, but not among the basic causes. These include frequency of feeding and low birth weight. Families that have to resort to more coping strategies to find food and also families that consume a lower variety of foods in their diets are significantly more likely to have children with malnutrition. The public health implications are that improved feeding and care practices of children under five has the potential to decrease malnutrition which is an underlying cause in 35% of the top five causes of childhood mortality in Zimbabwe.

The study found the socio-demographic characteristics of cases and controls to be similar, with no significant differences in the suspected basic determinants of acute malnutrition such as education level of mother or guardian, monthly family income less than 50 United States Dollars (USD) and number of children under five in the household. These findings were contrary to a study by Amsalu S. and Tigabu Z. in Ethiopia in 2005 where the same basic causes were found to be significant risk factors for acute malnutrition. This is could be explained by the different socio-economic environments experienced in Zimbabwe and Ethiopia. These findings were also contrary to a study in Mazowe in 1996 which identified a higher income as critical issues to improve nutrition. It may be assumed that comparisons could have been made at higher levels such as 150 USD and 500 USD, maybe there would have been significant differences between cases and controls.

Number of children in a household was not found to be significantly associated with acute malnutrition. These findings were contrary to a study in Nigeria where children under five

from larger households were likely to be malnourished.²⁸ The lack of significance in this study may have been due to the fact that the median number of children under five in a household for both cases and controls was one (IQR 1-1) for both cases and controls.

Looking at underlying causes of acute malnutrition which refer to adequate care, access to health and a healthy environment and food security; frequency of feeding turned out to be an important risk factor for acute malnutrition. Breastfeeding less than eight times in the last 24 hours and being given solid or semi-solid foods other than liquids in the last 24 hours could be proxy indicators for the average number of times that a child is breast fed and fed respectively on a daily basis. This implies that children breast fed less than eight times a day or eating less than three times a day as per the National Infant Feeding Guidelines are significantly more likely to have acute malnutrition than children breastfed more than eight times a day and children having more than three meals a day. This was regardless of duration of each feeding session. Similarly, a report from South Africa revealed that the nutrition situation in the country is exacerbated by a lack of nutritional information and knowledge. Added to this were undesirable dietary habits and nutrition related practices, attitudes, perception and socio-cultural influences that could adversely affect nutritional status.²⁹ Breastfeeding is a norm in Zimbabwe over 98% of both cases and controls had ever been breastfed. A similar situation exists in Ethiopia.³⁰

Children who had received their first food before six months of age were 1.39 (0.91-2.12) times more likely to be malnourished. The findings were, however of moderate significance, contrary to a study in Ethiopia where a strong correlation was found between introduction of foods before six months and malnutrition.³¹ In China, the introduction of other diet before the age of six months increased the prevalence of pneumonia and diarrhoeal disease.³² A

similar study in Kenya also showed an increased risk of being underweight when complementary food was started early.³³

Being offered less or nothing to drink during fever or cough was also found to be significantly associated with acute malnutrition. According to a study published in the bulletin of the World Health Organisation in the year 2000, acute respiratory infections were found to be one of the most important causes of mortality among children and the results of the study suggested that malnutrition was an important associated factor in these deaths.³⁴ These findings emphasize the importance of correct caring practices during fever and acute respiratory infections as an important strategy for prevention of malnutrition and furthermore, prevention of death due to illness.

Immediate causes related to health and dietary intake were birth weight less than 2300g and being HIV positive which were both found to have a significant association with acute malnutrition. There was no significant association with acute malnutrition when the same comparison was done for birth weight less than 2500g. In South Africa infectious diseases constitute one of the major factors contributing to child malnutrition and also that malnutrition makes a child more susceptible to infectious diseases. HIV/AIDS was described as one of the most common infectious diseases in South Africa affecting the growth of children and which may lead to malnutrition and death.²⁸ Low birth weight has direct implications on maternal nutrition before and during pregnancy. HIV is a significant determinant of nutrition status. Despite a decrease in the prevalence of HIV, Zimbabwe still hosts one of the highest rates of HIV in the world. It is against this background that paediatric ART gains importance as a preventative measure for malnutrition.

Means of the CSI score and dietary diversity score were also significantly different between cases and controls. The mean of CSI score was significantly lower for controls as compared to cases suggesting that cases had needed to revert to more coping strategies during the past 30 days in order to find food for their families. The mean of the dietary diversity score for controls was significantly higher than for cases. This implies that controls generally had eaten more meals in the last 24 hours or the last seven days with included a greater variety of foods from the seven listed food groups. Nutrition education could be crucial in the fight against malnutrition.

Through the use of logistic regression analysis, significant determinants of acute malnutrition in Harare City are breast feeding less than eight times a day [AOR 1.86 (1.03-3.38)] and consumption of solid or semi-solid foods other than liquids less than three times per day [AOR 2.15 (1.20-3.85)]. These factors are underlying causes of malnutrition directly related to caring practices. The food may be there in the breast or without, but if not given to the child in the right frequency, nutrition status is likely to suffer.

6 CHAPTER 6

6.1 Conclusion

Determinants of acute malnutrition in children under five years of age in Harare City during 2011 are mainly from the underlying causes of the conceptual framework. Breast feeding less than eight times a day and being fed less than three times a day are underlying causes directly related to the caring practices of the mother or guardians. Feeding solid or semi-solid foods to children less than three times a day could be improved by increasing the of mothers and caregivers with regards to infant and young child feeding. The level of education of the mother was not a significant determinant of acute malnutrition. Level of education of the mother does not translate to increased knowledge of the mother with regards to infant and young child feeding.

Low birth weight was the only significant immediate determinant of acute malnutrition found during the bivariate analysis. Children born below 2300g were significantly more likely to have acute malnutrition. Maternal nutrition is an area that requires more attention, not just during pregnancy, but also in the pre-pregnancy years. The lifecycle approach to nutrition becomes important as a malnourished child is more likely to become a malnourished mother.

The findings of the study again emphasize that investing in prevention is critical. Preventive interventions need to include: improving access to high-quality foods and to health care; improving nutrition and health knowledge and practices; effectively promoting exclusive breastfeeding for the first six months of a child's life and promoting improved complementary feeding practices for all children aged six to 24 months — with a focus on ensuring access to age-appropriate complementary foods using locally available foods.

6.2 Recommendations

6.2.1 Short term recommendations

- There is need for primary health care staff to provide more education on infant feeding guidelines with emphasis on frequency of breastfeeding and frequency of giving solid foods is required for all pregnant mothers during antenatal visits.
- There is also need for more educational outreach by the Nutrition department in conjunction with primary health care staff on infant feeding with the same emphasis on frequency of feeding also needs to be done in the community including training of traditional birth attendants to cater for the populations which deliver at home.
- More emphasis is required on monitoring of nutritional status of pregnant mothers by primary health care staff in the antenatal wards and those involved in Prevention of Mother to Child Transmission (PMTCT) through the introduction of adult MUAC tapes in primary health care facilities.
- There is also need for nutritional counseling of pregnant mothers by primary health care staff with emphasis on the risks of having low birth weight babies given the assumption that low birth weight maybe influenced by nutritional status of the mother.

6.2.2 Long term recommendations

- Health service training institutions could consider the introduction of more detailed Infant Feeding Guidelines such as the 40 hour course for Infant and Young Child Feeding in the pre-service and in-service training curricula for health staff with regards to Infant Feeding Guidelines.
- The National Nutrition department may consider the development of more programmes focusing on the lifecycle approach to nutrition with emphasis on maternal nutrition as part of a strategy to prevent low birth weight.

6.3 Study limitations

Though frequency of feeding was looked at, information on the amount and duration of feeding could have shed more light. The study was done in urban settings, but excluded low density areas as the clinics treating acute malnutrition are all in the high to medium density areas. Representativeness of the study was therefore limited to medium and high density areas in Harare City. Participants were not asked about higher levels of income than 50 USD. Higher levels of income were not included in the questionnaire due to an oversight with the setting out of questions in the questionnaire, which only allowed for two options: below USD50.00 and above USD50.00. Had the question included higher levels of income, significance might have been seen at higher levels for instance 150 USD or 500 USD as the economic situation in Zimbabwe is different from Ethiopia where the comparison using 50 USD was done.

7 REFERENCES

1. Bhutta ZA, Ahmed T, Black RE, Cousens S, Dewey K, Giugliani E, Haider BA, Kirkwood B, Morris SS, Sachdev HPS, Shekar M. Maternal and Child Undernutrition: What works? Interventions for maternal and child undernutrition and survival. *Lancet Maternal and Child Undernutrition Series* 2008; 371: 417-440
2. United Nations Children's Fund State of Africa's children 2008. New York; 20v 08. p. 9.
3. Community Based Management of Severe Acute Malnutrition. A Joint Statement by the World Health Organization, the World Food Programme, the United Nations System Standing Committee on Nutrition and the United Nations Children's Fund
4. UNICEF Harare. Calling for accelerated action, UN and Zimbabwe Government launch nutrition survey results HARARE, Zimbabwe, 30 July 2010. UNICEF global web-site. Available at: http://www.unicef.org/infobycountry/zimbabwe_55385.html. Accessed August 3, 2010.
5. Food and Nutrition Council. Zimbabwe national nutrition survey – Jan-Feb 2010 Preliminary findings. 2010.p.79,90.
6. Tagwirei J, Greiner T. Nutrition in Zimbabwe An Update, Washington D.C: The international bank for reconstruction and development/The World Bank; 1994. 40-72.
7. Hunger and malnutrition. Kids Health Website. Available at: <http://kidshealth.org/parent/growth/feeding/hunger.html>. Accessed March 26, 2010
8. The Mother and child Education trust. Mother and child nutrition. Available at: <http://motherchildnutrition.org/malnutrition/about-malnutrition/underlying-causes-of-malnutrition.html>. Accessed March 26, 2010.

9. World hunger facts 2009. Hunger notes Website. Available at: <http://www.worldhunger.org/articles/Learn/world%20hunger%20facts%202002.htm>. Accessed March 28, 2010.
10. Waterlow JC, Tomkins A, Grantham SM. London School of Hygiene and Tropical Medicine, University of London, United Kingdom. [http://www.docstoc.com/docs/18305839/Protein energy malnutrition](http://www.docstoc.com/docs/18305839/Protein%20energy%20malnutrition). Accessed March 28, 2010.
11. Jamison D. Disease control priorities in developing countries. New York, Oxford University Press, 1993. p. 34.
12. Lambrechts T, Bryce J, Orinda V. Integrated management of childhood illness: a summary of first experiences. Bulletin of the World Health Organization, 1999, 77: 582–94.
13. Council for Agricultural and Rural Development. Food security in Cambodia – Conceptual Framework of malnutrition. Food Security and Nutrition Website. Available at: <http://www.foodsecurity.gov.kh/ConceptualFramework.aspx>. Accessed January 13, 2010.
14. N. Makhoul, "Agricultural Research and Human Nutrition: A Comparative Analysis of Brazil, Cuba, Israel and the US". Intl. J. of Health Services. 13, 1:15-24 (1983).
15. C. Schuftan, et al., Recommended national food and nutrition plan for Liberia, mimeo (Interministerial technical committee on food and nutrition planning, Monrovia, 1982)
16. Rikimaru T, Yartey JE, Taniguchi K, Kennedy DO, Nkrumah FK. Risk factors for the prevalence of malnutrition among urban children in Ghana. J Nutri SCI Vitaminol (Tokyo). 1998;44(3):391-407
17. Salah E.O. Mahgou B, Nnyepi M, Bandeke T. Factors affecting prevalence of malnutrition among children under three years of age in Botswana. AJFAND Online. Available at: <http://www.ajfand.net/Issue-X-files/pdfs/AJFANDvol6no1PRA5.pdf>. Accessed March 28, 2010.

18. Mwaura WJ, Moloney G. Somali KAP Study on Infant and Young Child Feeding and Health Seeking Practices. FSAU nutrition surveys database (n=105) from 2000 to 2007. ENN website. Available at: <http://fex.ennonline.net/33/somali.aspx>. Accessed March 30, 2010.
19. UNICEF 2009, citing rates calculated using the WHO growth standards. Rates using the NCHS reference population are 29 and 16 percent respectively.
20. United Nations Children's Fund, 2008, Countdown to 2015. p. 28.
21. ZDHS, 2006, extrapolated using population figures from Unicef, 2008
22. Zimbabwe Nutrition and HIV and AIDs Strategy (ZHHAS) 2008 -2010, Ministry of Health and Child Welfare. p. 27.
23. Radebe BZ, Brady P, Siziya S, Todd H. Maternal risk factors for child malnutrition in the Mazowe District of Zimbabwe. PubMed.gov website. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/8990569>. Accessed March 28, 2010.
24. Amasulu S, Tigabu Z. Risk Factors for severe acute malnutrition in children under the age of five: A case-control study. Available at: <http://ejhd.uib.no/ejhd-v22-n1/21%20Risk%20factors%20for%20severe%20acute%20malnutrition%20in%20children%20un.pdf>. Accessed March 21, 2010.
25. Sachdeva S, Amir A, Alam S, Khan Z, Khlique N. Potentially modifiable micro-environmental and co-morbid factors associated with severe wasting and stunting in children below 3 years of age in Aligarh district. ISUPUB.com. The Internet Journal of Epidemiology ISSN 1540-2614 website. Available at: http://www.ispub.com/journal/the_internet_journal_of_epidemiology/volume_7_number_2_25/article/potentially-modifiable-micro-environmental-and-co-morbid-factors-associated-with-severe-wasting-and-stunting-in-children-below-three-years-of-age-in-aligarh-district.html. Accessed April 6, 2010.

26. Maxwell D, Watkins B, Wheeler R, Collins G. The coping strategy index: field methods manual. Nairobi: Eastern and Central Africa Regional Management Unit; 2003. p, 12-16.
27. Hoddinott J, Yohannes Y. Diversity as a household food security indicator. Washington, D.C.:food and Nutrition Technical Assistance Project, Academy for Educational Development: 2002. p. 3-4.
28. Ighogboja SI. Some factors contributing to protein-energy malnutrition in the middle belt of Nigeria. East Africa Medical Journal, 1992; 69 (10): p. 566-571.
29. National Food Consumption Survey, South Africa, 1999.
30. Ethiopia demographic and health survey 2005, September 2006. Central Statistical Agency, Addis Ababa, Ethiopia, ORC Macro Calverton, Maryland, USA.
31. Yimer G, Malnutrition among children in Southern Ethiopia: levels and risk factors. Ethiopian Journal for Health and Development. 2000; 14 (3): 283-292.
32. Wang X, Wang Y, Kang C. Feeding practices in 105 counties of rural China. Child Health Care Health Development. 2005; 31 (4):417-423
33. Bloss E, Wainaina F, Bailey RC. Prevalence and predictors of underweight, stunting and wasting among children aged 5 and under in western Kenya. Journal of tropical Pediatr. 2004; 50 (50): 260-270.
34. Rice AL, Sacco L, Hyder A, Black RE. Malnutrition as an underlying cause of child deaths associated with infectious diseases in developing countries. Bulletin of the World Health Organisation, 2000, 78 p. 1207-1221.

8 APPENDICES

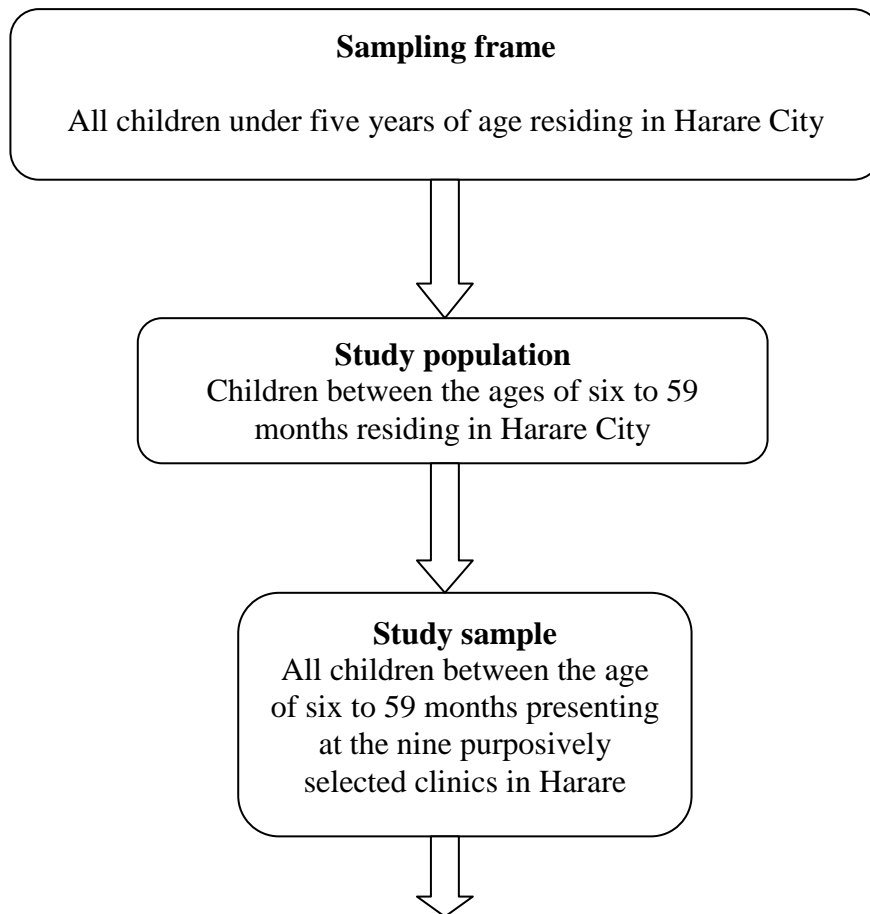
8.1 Appendix 1: List of variables

Dependent and independent variables and the corresponding indicators

	<u>Type</u>	<u>Description</u>	<u>Indicators</u>	<u>Data Collection Tool</u>	<u>Source of data</u>	
Dependent variable / Outcome variable		Acute Malnutrition	Weight for height below -2SD	Check list	Patient records	
			Mid Upper arm circumference less than 125mm	Check list	Patient records	
			Bilateral pitting oedema	Check list	Patient records	
Independent variables	Socio-demographic	Age of child	Age in years and months	Questionnaire	Participant	
		Age of mother/guardian	Age in years and months	Questionnaire	Participant	
		Sex	Male or Female	Questionnaire	Participant	
		Level of education	Last grade attained	Questionnaire	Participant	
		Place of residence	Address where child has spent most time in the last month	Questionnaire	Participant	
		Religion	Religious affiliation			
		Relationship of primary caregiver to child	Relationship of primary caregiver to child	Questionnaire	Participant	
		Number of children in same household	Greater than 3 Less than or equal to 3	Questionnaire	Participant	
		Marital status	Married Single	Questionnaire	Participant	
		Occupation	Primary activity of caregiver that provides the main source of income	Questionnaire	Participant	
		Breastfeeding (Inadequate care for children)	Whether the child has ever been breastfed	Yes/No	Questionnaire	Participant
			How soon after birth the child began to feed	Time of first feed	Questionnaire	Participant
			Frequency of feeds	Number of times per day that the child breastfeeds	Questionnaire	Participant
			Exclusive breastfeeding	Yes/No	Questionnaire	Participant
		Complementary feeding (Inadequate care for children)	What child gets and how much (quantity). (Focus on children above 6 months)	What other foods are being given besides breast milk	Questionnaire	Participant
Child health (Insufficient health services)	Does the child have a Health Card	Yes/No	Questionnaire	Participant		
	Vitamin A received	Yes/No	Questionnaire	Participant		

and an unhealthy environment)		in the past 6 months Diarrhoea / fever / cough in the past 3 months	Yes/No	Questionnaire	Participant
		Food intake while the child had diarrhea/cough/fever	Food intake as compared to normal while child had diarrhoea	Questionnaire	Participant
	(Inadequate care for children)	Advice or treatment sought	Type of treatment sought outside the household was sought for the illness and after how many days from onset of illness	Questionnaire	Participant
	(Insufficient health services and an unhealthy environment)	Treatment received	Type of treatment that the child was given after seeking advice	Questionnaire	Participant
	Supplementary feeding	Enrollment in the past 3 months and type of programme	Questionnaire	Participant	
Water and Sanitation (Insufficient health services and an unhealthy environment)	Source	Main source of drinking water	Questionnaire	Participant	
	Availability	Yes/No/ Don't know	Questionnaire	Participant	
	Alternate source	When water from the primary source is not available	Questionnaire	Participant	
	Water safety	Type of treatment	Questionnaire	Participant	
	Source of water for other purposes beside drinking	Source of water for purposes other than drinking	Questionnaire	Participant	
	Toilet facilities	Type used	Questionnaire	Participant	
Food security (Inadequate access to food)	Main cereal consumed	Type	Questionnaire	Participant	
	Availability	Yes/No	Questionnaire	Participant	
	Food Aid at present	Yes/No	Questionnaire	Participant	
	Food Aid in the past 3 years	Yes/No	Questionnaire	Participant	
	Own food production	Yes/No	Questionnaire	Participant	
	Coping strategies index	Low, Moderate, High vulnerability	Questionnaire	Participant	
	Household dietary diversity score	Low, Medium and High scores	Questionnaire	Participant	

8.2 Appendix 2: Sampling technique used in study



Health Center	Population with acute malnutrition cared for at clinic as at date of study	Number of cases selected (convenience sampling)	Number of controls selected (consecutive sampling)
Rutsanana	31	36	34
Rujeko	40	40	44
Mabvuku Sat.	29	29	31
Hattcliffe	10	12	10
Kambuzuma	16	18	18
Mbare	5	6	6
Hoplea	16	18	18
Hafield	2	2	2
Mufakose	11	<u>11</u>	<u>12</u>
	Total	173	175

8.3 Appendix 3: Questionnaire for acute malnutrition in Harare City

Identification information

Questionnaire no..... Date...../...../.....
 District..... Health Center.....
 Name respondent would like to use during the
 interview.....
 Initials of Interviewer.....
 Category of Study participant (Circle one): CASE CONTROL

1. Informed written consent

Hello, my name is and I am collecting data as part of a research project under the Health Studies Office in the Department of Community Medicine at the University of Zimbabwe. The purpose of this research is to understand factors associated with acute malnutrition in Harare. Your participation would be very much appreciated. All of the information that you provide will remain confidential.

The interview usually takes 30 minutes to complete.

Would you be willing to participate?.....YES.....NO

(If YES) Please place your signature

here.....

SECTION A: Analysis of basic causes of acute malnutrition

1. Socio demographic variables

What is the name of the child? _____		
1.1. Are you the mother of _____? (Name Of child) [If “Yes”, proceed to 1.6.]	1=Yes	2=No
1.2. Are you the primary caregiver of _____? (Name of child) [If “No”, proceed to 1.4.]	1=Yes	2=No
1.3. Who is the primary caregiver of _____? (Name of child) *[If “Mother”, request when you can come back and interview her. If any other response besides “Mother”, ask questions 1.5. first, then ask when you can come back and interview primary caregiver.]	1=Mother 2=Father 3=Sibling 4=Grandmother 8=Other (specify) _____	
1.4. Why isn't the mother the primary caregiver of the child? [End here for now and make appointment to return and interview primary caregiver, or find a replacement]	1=Died 2=Too ill 3=Working away from home 8=Other _____	
1.5. Sex of respondent [Observe]	8.3.1.1.1.	2=Female
1.6. How old are you? (What was your age at your last birthday?- Age in completed years) Mune makore mangani ekuberekwa akazara? Uleminyaka emingaki yokuzalwa egcweleyo?	Years _____	

1.7. Area of residence. (Circle one) (Probe to find out where the child has stayed for most of the past month)	1=High density urban 2=Medium density urban 3=Low density urban 4=Peri-urban 5=Rural
1.8. What is your religion? Chitendero chenyu ndechipi? Ulandela luphi ukholo? Choose one answer only. [Do not prompt responses. If not Christian, skip to 1.10.]	1=Christian 2=Muslim 3=Traditional African 4=None 8=Other (specify) _____
1.9. If Christian, please specify? [Choose one answer only.] [Do not prompt responses.]	1=Catholic 2=Protestant 3=Pentecostal 4=Apostolic 8=Other (specify) _____
1.10. What is the highest level of education that you have completed? Makasvikapapi nechikoro? [Circle highest level completed]	1=None 2=Primary 3=Secondary 4=Tertiary
1.11. How old is _____? (Name of child) Age in months completed [Record first in years and months if easier then calculate later: years _____ months _____]	Months _____
1.12. What is (NAME'S) sex?	1=Male 2=Female
1.13. Are you pregnant now? [Choose N/A if respondent is male]	1=Yes 2=No 9=N/A
1.14. Have you delivered a child besides _____ (name of child) at anytime in the past 2 years? ☼[This question refers to live births]	1=Yes 2=No 10=Don't know
1.15. What is your current marital status? Parizvino makaroora kana kuroorwa here? [Only one response required]	1=married monogamous 2=married polygamous 3=single never married 4=cohabiting 5=divorced/separated 6=widow/widower 8=Other (specify) _____
1.16. What is your primary occupation? Basa ramunoita ndereyi? [Choose one answer only. Do not prompt responses.]	1=Employed formally 2=Employed informally 3=Unemployed
1.17. What is your monthly family income? Mungazive here, kuti semhuri munowana mari yakadii pamwedzi yoga yoga?	1=Less than USD50 2=More than or equal to USD50 10=Don't know
1.18. How many children do you have in your household?	1=Less than or equal to 3 2=Greater than 3
1.19. Of these, how many are between the ages of 0 and 5 years? Pakati pevana ava, pane vangani vari pasi makore mashanu? [If "No" proceed to 2.]	1=Yes 2=No
1.20. How many children under the age of five are in your household?	_____

SECTION B: Analysis of immediate causes of malnutrition

2. Breastfeeding

2.1. Has [NAME] ever been breastfed? → [If NO or DON'T KNOW, SKIP to 2.8] ☼ [Breastfeeding includes wet nursing and/or feeding of expressed milk]	1=Yes 2=No 10=Don't know
2.2. How long after birth was [NAME] first put to the breast?	1=< 1 hour

	6=Left in the open 7=Other (specify) _____ 10=Don't know																												
4.5. Has [NAME] had diarrhoea in the last month? ✨ [Diarrhoea is defined as three (3) or more runny stools in a day] → [If NO or DON'T KNOW, SKIP to 4.13]	1=Yes 2=No 10=Don't Know																												
4.6. When [NAME] had diarrhoea, was he/she given less than usual to drink, about the same amount or more than usual to drink? ✨ [Circle only ONE (1) response]	1=Less 2=About the same 3=More 4=Nothing to drink 10=Don't know																												
4.7. When [NAME] had diarrhoea, was he/she given less than usual to eat, about the same amount, more than usual to eat? ✨ [Circle only ONE (1) response]	1=Less 2=About the same 3=More 4=Nothing to eat 10=Don't know																												
4.8. Did you seek advice or treatment for the diarrhoea from any source? → [If NO or DON'T KNOW, SKIP to 4.13.]	1=Yes 2=No 10=Don't know																												
4.9. Where did you seek advice or treatment for the diarrhoea? ✨ [Record all choices]	1=Hospital 2=Clinic 3=Health promoter 4=Private Doctor/Nurse 5=Pharmacy 6=Traditional Healer 8=Other (specify) _____																												
4.10. How many days after the diarrhea began did you seek advice or treatment?	1=Less than 1 day Number of days _____																												
4.11. Was [NAME] given any of the following to drink at any time since he/she started having diarrhoea? ✨ [Read each item aloud and record response before proceeding] <ul style="list-style-type: none"> • Breast milk • An ORS sachet • An ORS sachet with zinc • A homemade sugar-salt water solution • Any other liquid, such as rice water, teas, or infusions ✨ [Show samples of ORS and ORS with zinc]	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;">Y</th> <th style="text-align: center;">N</th> <th></th> </tr> </thead> <tbody> <tr> <td>DK</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Breast milk</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> <td style="text-align: center;">8</td> </tr> <tr> <td>ORS</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> <td style="text-align: center;">8</td> </tr> <tr> <td>ORS plus zinc</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> <td style="text-align: center;">8</td> </tr> <tr> <td>Sugar-salt-water</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> <td style="text-align: center;">8</td> </tr> <tr> <td>Other liquid</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> <td style="text-align: center;">8</td> </tr> </tbody> </table>		Y	N		DK				Breast milk	1	2	8	ORS	1	2	8	ORS plus zinc	1	2	8	Sugar-salt-water	1	2	8	Other liquid	1	2	8
	Y	N																											
DK																													
Breast milk	1	2	8																										
ORS	1	2	8																										
ORS plus zinc	1	2	8																										
Sugar-salt-water	1	2	8																										
Other liquid	1	2	8																										
4.12. Was [NAME] given zinc tablets like these for treatment of diarrhea? ✨ [Show an example of the zinc tablets]	1=Yes 2=No 3=Don't Know																												
4.13. In the last month has (name) been ill with a fever?	1=Yes 2=No 8=Don't Know																												
4.14. In the last two weeks has (name) been ill with a cough? → [If NO or DON'T KNOW for questions 4.13 AND 4.14. SKIP to 4.20.]	1=Yes 2=No 8=Don't Know																												
4.15. When [NAME] had a fever (specify) or cough, was he/she given less than usual to drink, about the same amount, or more than usual to drink? ✨ [Probe: if 'less'; was he/she given much less or somewhat less] ✨ [Circle only ONE (1) response]	1=Less 2=About the same 3=More 4=Nothing to drink 10=Don't know																												
4.16. When [NAME] had fever or cough, was he/she given less than usual to eat, about the same amount, more than usual to eat? ✨ [Probe: if 'less'; was he/she given much less or somewhat less?] ✨ [Circle only ONE (1) response]	1=Less 2=About the same 3=More 4=Nothing to eat 10=Don't know																												
4.17. Did you seek advice or treatment for the fever or cough from any	1=Yes																												

source? →[If NO, SKIP to 4.20.]	2=No 10=Don't Know
4.18. Where did you seek advice or treatment for the fever or cough? ✨[Do not prompt responses. Circle all mentioned]	1=Hospital 2=Clinic 3=Health promoter 4=Private Doctor/Nurse 5=Pharmacy 6=Traditional Healer 8=Other (specify) _____
4.19. How many days after the illness began did you seek advice or treatment? Makazotsvaga rubatsiro kwapera mazuva mangani?	Number of days _____
4.20. Has [NAME] been enrolled in a supplementary feeding program at any time during the last three months?	1=Yes 2= No 8=Don't know
4.21. Has [NAME of child] ever been tested for HIV? → [If NO or Don't Know, then skip to 4.24.]	1=Yes 2= No 8=Don't know
4.22. What was [NAME's] result? → [If Negative or Don't Know, then skip to 4.24.]	1=Positive 2=Negative 8=Don't know
4.23. Is [NAME] on ART?	1=Yes 2= No 8=Don't know
4.24. Was [NAME] admitted to hospital as a result of diarrhea, cough, fever? → [If "No" or "Don't know", proceed to 5.]	1=Yes 2= No 8=Don't know
4.25. What was the main reason for admission? ✨ [Try to establish the diagnosis on admission]	Diagnosis: _____ —

SECTION C: Analysis of underlying causes of acute malnutrition

5. Water and Sanitation

5.1. What is the main source of drinking water for members of this household? ✨ [Circle only ONE (1) response]	1=Piped into dwelling 2=Piped into yard or plot 3=Piped into public tap or standpipe 4=Borehole 5=Protected well 6=Unprotected well 7=Protected spring 8=Unprotected spring 9=Surface water (river/dam/stream) 10=Rainwater harvester 11=Water trucking 12=Bottled Water 13=Other (specify) _____
5.2. Is water from the main source (refer to 5.1.) available at this time? ✨ [On the day of the interview]	1=Yes 2= No 8=Don't know
5.3. When water from the main source of drinking water is NOT available, what is the primary alternative source of drinking water for members of this household? ✨ [Circle only ONE (1) response]	1=Piped into dwelling 2=Piped into yard or plot 3=Piped into public tap or standpipe 4=Borehole 5=Protected well 6=Unprotected well 7=Protected spring 8=Unprotected spring 9=Surface water (river/dam/stream)

	10=Rainwater harvester 11=Water trucking 12=Bottled Water 13=Other (specify)_____
5.4. Do you treat your drinking water from either source in any way to make it safer to drink? → [If NO or DON'T KNOW, SKIP to 5.6]	1=Yes 2= No 8=Don't know
5.5. What do you usually do to make the water from your either source safer to drink? ✪ [Circle only ONE (1) response]	1=Boil 2=Add bleach or chlorine (Jik) 3=Add water treatment tablets 4=Strain it through a cloth 5=Use water filter 6=Solar disinfection 6=Let stand and settle 7=Add water treatment tablet 8=Don't treat it 9=Other 10=Don't know
5.6. What is the main source of water used by this household for purposes other than drinking, such as washing clothes or bathing? ✪ [Circle only ONE (1) response]	1=Piped into dwelling 2=Piped into yard or plot 3=Piped into public tap or standpipe 4=Borehole 5=Protected well 6=Unprotected well 7=Protected spring 8=Unprotected spring 9=Surface water (river/dam/stream) 10=Rainwater harvester 11=Water trucking 12=Bottled Water 13=Other (specify)_____
5.7. What kind of toilet facility do members of this household usually use? ✪ [Circle only ONE (1) response. →[If BUSH, SKIP to 6.]	1=Flush toilet 2=Blair Latrine (VIP) 3=Pit latrine with slab (non VIP) 4=Pit latrine with no slab 5=Composting Toilet 6=Bush 8=Other(specify)_____
5.8. Does this household currently share this toilet facility with any other households? → [If NO, SKIP to 6.]	1=Yes 2= No 8=Don't know
5.9. Including your household, how many households use this toilet facility? [If less than 10, please fill in number. If more than 10, circle the appropriate code]	Number of households (if less than 10) [] 1=More than 10 households 9=N/A 10=Don't Know

6. Coping Strategies Index (CSI)

6.1. In the past 30 days, have there been times when you did not have enough food or money to buy food? → [If NO, SKIP to 7.]	1 = Yes	2 = No			
6.2. In the past 30 days, how frequently did your household resort to using one or more of the following strategies in order to have access to food?					

Circle One Answer Per Strategy		Never	Seldom (1-3 days / month)	Sometimes (1-2 days / week)	Often (3-6 days a week)	Daily	Raw score (Relative frequency score)	Severity weight	Score = Relative frequency X severity weight	
1	Skip entire days without eating?	1	2	3	4	5		8		
2	Limit portion size at mealtimes?	1	2	3	4	5		2		
3	Reduce number of meals eaten per day?	1	2	3	4	5		2		
4	Borrow food or rely on help from friends or relatives?	1	2	3	4	5		4		
5	Rely on less expensive or less preferred foods?	1	2	3	4	5		4		
6	Purchase/borrow food on credit?	1	2	3	4	5		4		
7	Gather unusual types or amounts of wild food / hunt?	1	2	3	4	5		8		
8	Harvest immature crops (e.g. green maize)?	1	2	3	4	5		8		
9	Send household members to eat elsewhere?	1	2	3	4	5		8		
10	Send household members to beg?	1	2	3	4	5		8		
11	Reduce adult consumption so children can eat?	1	2	3	4	5		4		
12	Rely on casual labour for food?	1	2	3	4	5		2		

7. Household Dietary Diversity Score (DDS)

No.	Questions and filters	Coding categories				Food Group	Raw score
7.1.	<p>Now I would like to ask you about the types of foods [Name of child] ate yesterday during the day and at night, and over a period of the past 7 days</p> <p>⚙ [READ each question completely and remind people of timeframe each time you ask. If item was not consumed in the past 24 hours, ask whether the item was consumed in the past 7 days. If response is YES for 24 hours, DON'T ask for the past 7 DAYS.]</p>	<u>Past 24 Hours</u> (Yesterday during the day and Night)		<u>Past 7 Days</u>			If "YES", for either the past 24 hours or past seven days for any of the foods mentioned in the relevant
		YES	NO	YES	NO		

					food groups, give a score of one.
A	Was yesterday a usual day for this household in terms of food consumption? ✨ <i>Start each of the following questions with: "Did you consume..."</i> ✨ [IF NO, ONLY ASK USING DAY RECALL]	A...1.....2	N/A		
B	Any sadza, bread, rice, noodles, biscuits, or any other foods made from millet, sorghum, maize, rice, wheat, or other cereals?	B...1.....2	B....1.....2	Carbohydrates	
C	Any potatoes, yams, cassava or any other foods made from roots or tubers?	C...1.....2	C....1.....2		
D	Any green vegetables?	D...1.....2	D....1.....2	Vegetables (green)	
E	Any pumpkin, carrots, squash, yams or sweet potatoes or other vegetables that are yellow or orange inside?	E....1.....2	E....1.....2	Vegetables (Orange/yellow)	
F	Any fruits?	F...1.....2	F....1.....2	Fruits	
G	Any beef, pork, lamb, goat, rabbit, wild game, chicken, duck, or other birds, liver, kidney, heart, other organ meats?	G...1.....2	G...1.....2	Animal and vegetable protein	
H	Any eggs?	H...1.....2	H...1.....2		
I	Any edible insects, or fresh or dried fish, or shell fish?	I...1.....2	I...1.....2		
J	Any foods made from beans, peas, lentils, or nuts?	J...1.....2	J...1.....2		
K	Any cheese, yogurt, milk or other milk products?	K...1.....2	K....1.....2	Diary	
L	Any foods made with oil, fat, or butter?	L...1.....2	L....1.....2	Fats	
TOTAL		Sum all scores (Maximum should be seven indicating that household consumes food from all food groups above)			

END

[Thank the participant and ask if he/she has any questions]

8.4 Appendix 4: Checklist used to verify whether child had malnutrition

Check list for verification of child's nutritional status

	Description	Yes* / No
Mid upper arm circumference	Less than 125mm	Yes No
Weight for height	Z-score less than -2standard deviations	Yes No
Nutritional oedema	Bilateral pitting starting at the lower limbs	Yes No

*If yes to any of the above, then the child has acute malnutrition and can be classified as a case

8.5 Appendix 5: Measurement of coping strategy index

Example – Calculating a household CSI index score

	In the past 30 days, if there have been times when you did not have enough food or money to buy food, how often has your household had to:	Never	Seldom (1-3 days / month)	Sometimes (1-2 days / week)	Often (3-6 days a week)	Daily	Raw score (Relative frequency score)	Severity weight	Score = Relative frequency X severity weight
	Relative frequency score	1 (0)	2 (0.5)	3 (1.5)	4 (3.5)	5 (7)			
1	Skip entire days without eating?	X					1	8	8
2	Limit portion size at mealtimes?			X			3	2	6
3	Reduce number of meals eaten per day?			X			3	2	6
4	Borrow food or rely on help from friends or relatives?	X					1	4	4
5	Rely on less expensive or less preferred foods?	X					1	2	4
6	Purchase/borrow food on credit?		X				2	4	8
7	Gather unusual types or	X					1	8	8

	amounts of wild food / hunt?								
8	Harvest immature crops (e.g. green maize)?	X					1	8	8
9	Send household members to eat elsewhere?	X					1	4	4
10	Send household members to beg?	X					1	8	8
11	Reduce adult consumption so children can eat?			X			3	2	12
12	Rely on casual labour for food?	X					1	6	2
TOTAL HOUSEHOLD SCORE		Sum of the totals for each individual strategy							78

The hypothetical household in the above table has a CSI score of 78. By itself, the score doesn't tell much. By looking at the actual results, it is possible to see that the household depicted actually has fairly moderate levels of food insecurity—none of the most severe coping behaviors are noted, and only moderate levels of most of the others. While the number itself doesn't mean much, if another household has a score of 132, one could state fairly unambiguously that the household with a score of 78 is less food insecure (i.e. more food secure) than the household with a score of 132, provided that they are both from the same community, location or culture for which this CSI tool was adapted.

8.6 Appendix 6: Measurement of household dietary diversity

Table three below illustrates how Household Dietary diversity score will be measured for the purpose of this study.

Table 3: Calculation of Household Dietary Diversity Score

No.	Questions and filters	Coding categories		Food group	Score
1.1.	<p>Now I would like to ask you about the types of foods you or anyone else in your household ate yesterday during the day and at night or over a period of the past 7 days</p> <p>⚙️ [READ each question completely and remind people of timeframe each time you ask. If item was not consumed in the past 24 hours, ask whether the item was consumed in the past 7 days. If response is “YES” for 24 hours, DON’T ask for the past 7 DAYS.]</p>	<p><u>Past 24 Hours (Yesterday during the day and Night)</u></p> <p>YES NO</p>	<p><u>Past 7 Days</u></p> <p>YES NO</p>		<p>If “YES”, for either the past 24 hours or past seven days for any of the foods mentioned in the relevant food groups, give a score of one.</p>
A	<p>Was yesterday a usual day for this household in terms of food consumption?</p> <p>⚙️ <i>Start each of the following questions with: “Did you consume...”</i></p> <p>⚙️ [IF NO, ASK USING 7 DAY RECALL]</p>	A...1.....2	N/A		
B (2)	Any sadza, bread, rice, noodles, biscuits, or any other foods made from millet, sorghum, maize, rice, wheat, or other cereals?	B.....1.....2	B.....1.....2	Carbohydrates	
C (2)	Any potatoes, yams, cassava or any other foods made from roots or tubers?	C....1.....2	C...1.....2		
D (1)	Any vegetables?	D...1.....2	D.....1.....2	Vegetables	
E (1)	Any fruits?	E....1.....2	E.....1.....2	Fruits	
F (4)	Any beef, pork, lamb, goat, rabbit, wild game, chicken, duck, or other birds, liver, kidney, heart, other organ meats?	F....1.....2	F.....1.....2	Animal protein	
G (4)	Any eggs?	G.....1.....2	G....1.....2		
H (4)	Any edible insects, or fresh or dried fish, or shell fish?	H...1.....2	H.....1.....2		
I (3)	Any foods made from beans, peas, lentils, or nuts?	I...1.....2	I.....1.....2	Vegetable protein	
J (4)	Any cheese, yogurt, milk or other milk products?	J ...1.....2	J1.....2	Diary	
K (0.5)	Any foods made with oil, fat, or butter?	K...1.....2	K....1.....2	Fats	
TOTAL SCORE		Sum all scores (Maximum should be seven indicating that household consumes food from all food groups above.)			

The higher the score for the household, the more food groups they eat from therefore the higher the dietary diversity of the household. The maximum score for any household should not exceed seven as the different food groups have been divided into 7.

REFERENCES

1. Bhutta ZA, Ahmed T, Black RE, Cousens S, Dewey K, Giugliani E, Haider BA, Kirkwood B, Morris SS, Sachdev HPS, Shekar M. Maternal and Child Undernutrition: What works? Interventions for maternal and child undernutrition and survival. *Lancet Maternal and Child Undernutrition Series* 2008; 371: 417-440
2. United Nations Children's Fund State of Africa's children 2008. New York; 2008. p. 9.
3. Community Based Management of Severe Acute Malnutrition. A Joint Statement by the World Health Organization, the World Food Programme, the United Nations System Standing Committee on Nutrition and the United Nations Children's Fund
4. UNICEF Harare. Calling for accelerated action, UN and Zimbabwe Government launch nutrition survey results HARARE, Zimbabwe, 30 July 2010. UNICEF global web-site. Available at: http://www.unicef.org/infobycountry/zimbabwe_55385.html. Accessed August 3, 2010.
5. Food and Nutrition Council. Zimbabwe national nutrition survey – Jan-Feb 2010 Preliminary findings. 2010.p.79,90.
6. Hunger and malnutrition. Kids Health Website. Available at: <http://kidshealth.org/parent/growth/feeding/hunger.html>. Accessed March 26, 2010
7. The Mother and child Education trust. Mother and child nutrition. Available at: <http://motherchildnutrition.org/malnutrition/about-malnutrition/underlying-causes-of-malnutrition.html>. Accessed March 26, 2010.
8. World hunger facts 2009. Hunger notes Website. Available at: <http://www.worldhunger.org/articles/Learn/world%20hunger%20facts%202002.htm>. Accessed March 28, 2010.
9. <http://www.docstoc.com/docs/18305839/PROTEIN-ENERGY-MALNUTRITION>

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10. Jamison D. Disease control priorities in developing countries. New York, Oxford University Press, 1993.
 11. Lambrechts T, Bryce J, Orinda V. Integrated management of childhood illness: a summary of first experiences. *Bulletin of the World Health Organization*, 1999, 77: 582–94.
 12. Council for Agricultural and Rural Development. Food security in Cambodia – Conceptual Framework of malnutrition. Food Security and Nutrition Website. Available at: <http://www.foodsecurity.gov.kh/ConceptualFramework.aspx>. Accessed January 13, 2010.
 13. N. Makhoul, "Agricultural Research and Human Nutrition: A Comparative Analysis of Brazil, Cuba, Israel and the US". *Intl. J. of Health Services*. 13, 1:15-24 (1983).
 14. C. Schuftan, et al., Recommended national food and nutrition plan for Liberia, mimeo (Interministerial technical committee on food and nutrition planning, Monrovia, 1982)
 15. Rikimaru T, Yartey JE, Taniguchi K, Kennedy DO, Nkrumah FK. Risk factors for the prevalence of malnutrition among urban children in Ghana. *J Nutri SCI Vitaminol (Tokyo)*. 1998;44(3):391-407
 16. Salah E.O. Mahgou B, Nnyepi M, Bandeke T. Factors affecting prevalence of malnutrition among children under three years of age in Botswana. *AJFAND Online*. Available at: <http://www.ajfand.net/Issue-X-files/pdfs/AJFANDvol6no1PRA5.pdf>. Accessed March 28, 2010.
 17. Mwaura WJ, Moloney G. Somali KAP Study on Infant and Young Child Feeding and Health Seeking Practices. FSAU nutrition surveys database (n=105) from 2000 to 2007. ENN website. Available at: <http://fex.ennonline.net/33/somali.aspx>. Accessed March 30, 2010.
 18. UNICEF 2009, citing rates calculated using the WHO growth standards. Rates using the NCHS reference population are 29 and 16 percent respectively.
 19. United Nations Children’s Fund, 2008, Countdown to 2015

-
20. ZDHS, 2006, extrapolated using population figures from Unicef, 2008
21. Zimbabwe Nutrition and HIV and AIDs Strategy (ZHHAS) 2008 -2010, Ministry of Health and Child Welfare.
22. Radebe BZ, Brady P, Siziya S, Todd H. Maternal risk factors for child malnutrition in the Mazowe District of Zimbabwe. PubMed.gov website. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/8990569>. Accessed March 28, 2010.
23. Tagwirei J, Greiner T. Nutrition in Zimbabwe An Update, Washington D.C: The International Bank for Reconstruction and Development/THE WORLD BANK; 1994. 40-72.
24. Amasulu S, Tigabu Z. Risk Factors for severe acute malnutrition in children under the age of five: A case-control study. Available at: <http://ejhd.uib.no/ejhd-v22-n1/21%20Risk%20factors%20for%20severe%20acute%20malnutrition%20in%20children%20un.pdf>. Accessed March 21, 2010.
25. Sachdeva S, Amir A, Alam S, Khan Z, Khlique N. Potentially modifiable micro-environmental and co-morbid factors associated with severe wasting and stunting in children below 3 years of age in Aligarh district. ISUPUB.com. The Internet Journal of Epidemiology ISSN 1540-2614 website. Available at: http://www.ispub.com/journal/the_internet_journal_of_epidemiology/volume_7_number_2_25/article/potentially-modifiable-micro-environmental-and-co-morbid-factors-associated-with-severe-wasting-and-stunting-in-children-below-three-years-of-age-in-aligarh-district.html. Accessed April 6, 2010.
26. Maxwell D, Watkins B, Wheeler R, Collins G. The coping strategy index: field methods manual. Nairobi: Eastern and Central Africa Regional Management Unit;2003. p, 12-16.
27. Hoddinott J, Yohannes Y. Diversity as a household food security indicator. Washington, D.C.:food and Nutrition Technical Assistance Project, Academy for Educational Development: 2002. p. 3-4.

-
28. Ighogboja SI. Some factors contributing to protein-energy malnutrition in the middle belt of Nigeria. *East Africa Medical Journal*, 1992; 69 (10): p. 566-571.
 29. National Food Consumption Survey, South Africa, 1999.
 30. Ethiopia demographic and health survey 2005, September 2006. Central Statistical Agency, Addis Ababa, Ethiopia, ORC Macro Calverton, Maryland, USA.
 31. Yimer G, Malnutrition among children in Southern Ethiopia: levels and risk factors. *Ethiopian Journal for Health and Development*. 2000; 14 (3): 283-292.
 32. Wang X, Wang Y, Kang C. Feeding practices in 105 counties of rural China. *Child Health Care Health Development*. 2005; 31 (4):417-423
 33. Bloss E, Wainaina F, Bailey RC. Prevalence and predictors of underweight, stunting and wasting among children aged 5 and under in western Kenya. *Journal of tropical Pediatr.* 2004; 50 (50): 260-270.
 34. Rice AL, Sacco L, Hyder A, Black RE. Malnutrition as an underlying cause of child deaths associated with infectious diseases in developing countries. *Bulletin of the World Health Organisation*, 2000, 78 p. 1207-1221.