UNIVERSITY OF THE WESTERN CAPE

Faculty of Community and Health Sciences

TITLE:

PREVALENCE OF MALNUTRITION IN HIV POSITIVE INFANTS (AGE<18MONTHS) ATTENDING A CLINIC IN WINDHOEK, NAMIBIA

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A Minithesis submitted in partial fulfillment of the requirement for the degree of Masters in Public Health in the School of Community and Health Sciences, University of the Western Cape

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KEY WORDS

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DECLARATION

I declare that *Prevalence of malnutrition in HIV positive Infants (age< 18 months) attending a clinic in Windhoek, Namibia* is my own work, that this work has not been submitted for any degree or examination in any university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Jebson Zingwari

Date: November 2010

Signed:

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ABBREVIATIONS

AFASS	Affordable, Feasible, Acceptable, Safe and Sustainable
AIDS	Acquired Immune-Deficiency syndrome
ART	Anti-Retroviral Therapy
BMI	Body Mass Index
CDC	Communicable Disease Clinic
CD4	Cluster Differentiation 4
FAO	Food and Agriculture Organization of the United Nation
HAART	Highly Active Antiretoviral Therapy
HFA	Height for Age
HPAC	Hospital Paediatric ARV Clinic (pseudo name for the clinic)
HIV	Human Immune Virus
MUAC	Mid Upper Arm Circumference
MOHSS	Ministry of Health and Social Services

NDHS	Namibian Demographic Health Survey
PMTCT	Prevention of Mother To Child Transmission
TB	Tuberculosis
UNAIDS	Joint United Nations Programme of HIV/AIDS
UNICEF	United Nations Children Fund
UWC	University of the Western Cape
VCT	Voluntary Counseling and Testing
WFA	Weight for Age
WFH	Weight for Height
WHO	World Health Organization

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

Background-Namibia has a high HIV and malnutrition burden. HIV increases the risk of malnutrition and malnutrition results in rapid progression of the disease and worsening malnutrition. Nutrition plays an important role in the management of an HIV positive child. Optimal nutrition delays disease progression, improves immune function and the effectiveness of antiretroviral drugs thereby improving the quality of life of the child. Early identification of children at risk of malnutrition is therefore essential to prevent malnutrition in HIV positive children.

Methodology-The study sought to determine the prevalence and the risk factors for malnutrition in 88 HIV positive children less than 18 months attending Hospital Paediatric ARV Clinic (HPAC). The study used quantitative methods. A questionnaire was administered to the child's caregiver to assess infant, caregiver and socio-economic risk factors for malnutrition after written consent had been obtained. The history of the patient was extracted from the HIV patient care booklet. Nutritional status was assessed using WHO standard growth charts in children and body mass index (BMI) in adults.

Results- The study showed that 56.8% of children were wasted (14.8% had severe wasting), 52.3% were stunted (18.2% had severe stunting) and 69.3% underweight (20.5% were severely

underweight). This level of malnutrition is much higher than the rates of 8% wasting, 29% stunting and 17% underweight in the general paediatric population. Malnutrition in children was associated with fewer number of working adults per family, frequent illnesses in the child, low level of caregiver education, caregiver unemployment, low household income and lack of adequate food in the family. Children of malnourished caregiver were more likely to be underweight.

Conclusions- The results showed a high prevalence of malnutrition (56.8%wasting, 52.3%stunting and 69.3% underweight) among HIV positive infants attending the HPAC. The study showed that poverty and food insecurity were strongly associated with malnutrition in children. This therefore highlights the urgent need to address poverty to reduce malnutrition in the community. Although the study did not show any statistically significant association between feeding practices and malnutrition in children, health workers should encourage HIV positive mothers to breastfeed their infants as per the WHO and Namibian antiretroviral therapy guidelines (2010).

Recommendations - There is need to train health workers to identify and manage malnourished children early. Linkages with social services must be improved and strengthened to help reduce poverty in the community.

CHAPTER 1-INTRODUCTION

1.1 INTRODUCTION

As is the case with many developing countries, Namibia has a high number of children with malnutrition. The Namibian Demographic and Health Survey (NDHS) 2006-07 showed that 29% of children were stunted defined as "insufficient height relative to age", 8% were wasted defined as "insufficient weight relative to height" and 17% were underweight defined as "insufficient weight relative to age" (MOHSS, 2008a). Wasting is a sign of acute malnutrition, stunting is a sign of chronic malnutrition and underweight takes into account both acute and chronic malnutrition (WHO, 1998).

AIDS is a leading killer disease globally and a primary cause of death in Africa, especially sub-Saharan Africa. Global statistics for 2007 estimated the number of children (age <15years) living with HIV to be 2.0 million, 1.8 million of these living in Sub-Saharan Africa (UNAIDS, 2008). HIV/AIDS is a major contributor of disease burden in Namibia with an estimated 14 000 children (age<15 years) infected with the disease (UNAIDS, 2008).

A complex association exists between malnutrition and HIV. The two potentiate each other. Malnutrition increases the risk of progression of HIV infection to AIDS while HIV increases the risk of malnutrition (Colecraft, 2008; AAHUK, Undated). The end result is progression of HIV infection and worsening malnutrition eventually leading to death.

HIV increases the risk of malnutrition in children in several different ways. Untreated HIV infection weakens the immune system predisposing the child to opportunistic infections, some of which contribute to malnutrition. In addition when the parent or caregiver of the child is ill, the

care and support given to the child is reduced. This increases the risk of malnutrition. Orphaned children are disadvantaged socially and economically. During the period 2006-07, 17% of children below 18years living in Namibia had lost either one parent or both (MOHSS, 2008a). Loss of a parent has an impact on the nutrition of the child (WHO, 2007).

Nutrition is an important component of care in a child with HIV. Nutrition improves immune function and effectiveness of medical treatment. Nutrition helps in delaying progression of HIV to AIDS (WHO, 2007). The delay in HIV disease progression improves the child's quality of life. Malnourished children have a higher risk of death (Pelletier, 1994; Black, Allen, Bhutta et al, 2008; Fawzi, Herrera, Spiegelman et al, 1997). It is important to screen and identify infants with malnutrition early so that they can be referred for care.

In an effort to improve the nutrition of people living with HIV, the Ministry of Health and Social Services (MOHSS) in Namibia developed guidelines on nutrition in HIV positive people including infants and children. This study sought to determine the prevalence of malnutrition in HIV infected children aged <18 months. The study assessed the risk factors for malnutrition in HIV positive infants. Information generated from the study will be used to improve strategies for identifying children at risk of malnutrition and to develop strategies for nutritional support.

1.2 STUDY CONTEXT

The study of the prevalence of malnutrition among HIV positive infants (age< 18 months) was conducted at a Hospital Paediatric ARV Clinic (HPAC)[1] in Windhoek, Khomas Region, Namibia.

[1] HPAC (Hospital Paediatric ARV Clinic) is a pseudonym chosen to represent the name of the clinic.

The hospital is located in Windhoek, Khomas Region in Namibia and is one of the 3 intermediate hospitals in Namibia. The hospital has a bed capacity of 831(MOHSS, 2008b). In addition to serving patients from Khomas Region, the hospital also receives patients from other hospitals throughout the country.

The HPAC is situated within the main hospital complex. In Namibia paediatric and adult ARV services are usually delivered in the same clinic but in this hospital, the paediatric ARV clinic operates separately from the adult ARV clinic. This enables staff working in the clinic to focus on clinical and social issues for the HIV positive children. Services offered at the paediatric ARV clinic include voluntary counseling and testing (VCT), antiretroviral therapy (ART), prevention and treatment of opportunistic infection, adherence counseling, HIV disclosure, health education to care givers and adolescent health services.

The clinic receives children referred from the PMTCT clinic, paediatric wards, outpatient department, primary health clinics and community based HIV organizations. The HPAC initiates children on HAART and monitors them. Initially monitoring schedules are frequent, but once a patient is stable on treatment they are monitored once every 3 months. In between the HPAC visits, the patients are treated for intercurrent illness at the primary health care centres near their residential place.

During the HPAC visit, children are assessed for malnutrition by measuring their weight, height and clinical examinations. Weights and heights are plotted on the growth charts. Children with severe acute malnutrition are admitted to the paediatric ward from the clinic for nutritional rehabilitation. In the paediatric wards, other children admitted with signs suggestive of advanced HIV disease including malnutrition are referred to the HPAC for HIV testing and those who are

HIV positive are registered for care. When children admitted for malnutrition are discharged from the hospital, they are referred to community based feeding centres. For children with mild to moderate malnutrition there are no feeding programmes present in the clinic, however the parents are given nutritional counseling and referred to the social worker to assess the socio-economic situation of the family.

At the time of the study the HPAC had 1200 registered patients. Infants (age <18 months) constituted 7.3% (88) of the registered patients (MOHSS, 2009a). HPAC manages about 8% of all HIV positive children in the country (MOHSS, 2010) .Management of patients is based on their HIV test results, clinical and immunological status as outlined in the Namibian ART guidelines.

1.3 PROBLEM STATEMENT

Discussions with health care providers working in the department of paediatrics suggested that the number of children admitted with malnutrition in the hospital is increasing. It was observed that many of these children were HIV positive. In addition, there is no data to quantify the problem of malnutrition in HIV positive children attending the HPAC. Nutritional interventions have been shown to improve immunity and reduce morbidity and mortality in HIV positive patients (WHO, 2007). Early identification of children at risk of malnutrition can lead to early referral for nutritional support. In such children early referral may prevent malnutrition.

The prevalence of malnutrition in HIV positive infants (age<18moths) in Namibia was not known. The available information on risk factors for malnutrition was observed in settings different from Namibia. The study therefore sought to determine the prevalence of and risk

factors associated with malnutrition in HIV positive infants (age <18months) attending a hospital paediatric ARV clinic in Windhoek, Namibia.

1.4 RATIONALE OF THE STUDY

The risk of malnutrition is higher in HIV positive children than in HIV negative children. Early identification and management of malnutrition in such children is likely to improve their health. The study sought to quantify the prevalence of malnutrition among HIV positive children aged <18 months attending HPAC and to identify the risk factors associated with malnutrition. Information generated from the study may help in formulating programmes for nutritional support for HIV positive children. Findings of the study will help in the training of staff working in ARV clinics in Namibia. The study will help provide data for advocacy to assist at-risk children with HIV.

CHAPTER 2-LITERATURE REVIEW

Malnutrition is a condition where an individual's function is impaired and can no longer maintain normal body performance due to inadequate or unbalanced diet (FAO, 2009). It can occur as a complication of HIV infection. In an HIV exposed infant, malnutrition may be a sign of HIV infection. In an HIV positive child, unexplained moderate malnutrition not adequately responding to standard treatment is a sign of advanced HIV disease (WHO, 2005).

An infant with malnutrition has a higher risk of morbidity than a child who is well nourished. In the absence of interventions, malnutrition can result in deterioration of the patient's condition and subsequent death (FAO, 2005; Schaible & Kaufmann, 2007). Malnourished children are susceptible to diarrhoea which subsequently tends to result in malabsorption and poor tolerance to medicines. Intolerance to medications affects the effectiveness of medications in the body which in turn worsens malnutrition.

Nutritional needs of a child with HIV are higher than for a child without HIV infection (Haddad & Gillespie, 2001). In a setting of food insecurity, this increases the child's risk of developing malnutrition. Early identification of malnutrition and appropriate interventions improves recovery in the child. It is therefore necessary to screen and refer early HIV positive infants at risk of malnutrition.

2.1 Malnutrition and HIV

It is estimated that one in every 3 children aged below 5 years in sub-Sahara Africa is under nourished (ANECCA, 2006). The prevalence of malnutrition in HIV positive children is high (Fergusson & Tomkins, 2009; Padmapriyadarsini, Pooranagangadevi, Chandrasekaran, et al,

2009; Naidoo, Rennert , Lung, Naidoo , McKerrow, 2010; Weigel, Phiri, Chiputula et al ,2010). In some settings, up to 63% of children with HIV are underweight (Padmapriyadarsini et al, 2009). In countries with high burden of HIV, the prevalence of HIV among malnourished children is high with rates above 20% (Angami, Reddy, Singh K, Singh N & Singh P, 2004; Bunn, Thindwa & Kerac, 2009). Though in Namibia malnutrition is also a common presentation in HIV positive children, data on the prevalence of malnutrition is not available.

In the absence of HIV, malnutrition is often seen at the time of introduction to complementary feeds. Early introduction of complementary feeds is associated with reduced breast milk intake (Cohen, Brown, Canahuati, Rivera and Dewey,1994).In breastfed infants, inadequate complementary feeds at the time of weaning increases the risk of stunting in children (Becquet, Leroy, Ekouevi , et al, 2006). Children who acquired HIV before birth tend to develop malnutrition early and it is associated with progressive growth failure (Bobat, Coovadia, Moodley, Coutsoudis & Gouws ,2001; Arpadi, 2000; Thea, St. Louis, Alido et al, 1993; Berhane, Bagenda, Marum et al, 1997).

Untreated HIV infected children tend to have repeated episodes of infections such as oral thrush and dental caries (ANECCA, 2006). These contribute to loss of appetite and difficulty in eating. Loss of appetite and difficulty eating leads to reduced food intake predisposing the child to malnutrition. Malnutrition leads to oxidative stress and immune suppression leading to acceleration of HIV disease progression (Haddad & Gillespie, 2001). Increased morbidity results in increased nutritional requirements (Semba &Tang, 1999; Schaible & Kaufmann, 2007). Malnutrition worsens disease progression to AIDS while AIDS worsens malnutrition and may lead to early death.

Children born to mothers with HIV are more likely to be underweight than those born to HIV negative mothers (Gangar, 2009). If the mother is frequently ill due to HIV, the care that the child receives may be compromised. When parents die, the responsibility of looking after children is often taken by relatives often the grandparents. The grandparents are often old and may not have adequate resources to care for the child, which puts the child at risk of developing malnutrition (WHO, 2007).

The benefits of breastfeeding in children are known and well documented. However HIV positive mothers face a dilemma in balancing between increasing the risk of transmitting HIV to the child through breastfeeding, the benefits of breastfeeding and the stigma in the community for not breastfeeding (Latham & Preble, 2000; Doherty, Chopra, Nkonki, Jackson & Greiner, 2006). Breastfeeding is associated with low prevalence of malnutrition (Mbori-Ngacha, Nduati, John et al, 2001). Although replacement feeding reduces HIV transmission, it is associated with increased risk of diarrhoea and pneumonia (Nduati, John, Mbori-Ngacha, et al, 2000; Embree, Njenga, Datta et al, 2000).

Exclusive breastfeeding for the first 6 months of life in HIV exposed infants is associated with reduced mortality in the first year of life when compared to replacement feeding. WHO therefore recommends exclusive breastfeeding in the first 6 months of life in HIV exposed infants with the additional complementary feeding after 6 months (WHO, 2010). HIV exposed infants can be breastfed up to 12 months with appropriate antiretroviral interventions. Prolonged breastfeeding reduces the risk of malnutrition and the antiretroviral treatment (ART) interventions will help reduce maternal to child transmission of HIV. In mothers who choose not to breastfeed, replacement feeding must be **a**ffordable, **f**easible, **a**cceptable, **s**afe and **s**ustainable **"AFASS"**

(WHO, 2010). Use of replacement feeding where it is not sustainable can lead to inadequate intake. This increases the risk of malnutrition. HIV positive infants should be breastfed for as long as possible (WHO, 2010).

Namibia has recently adopted the revised WHO 2010 infant feeding guidelines described above, recommending 6 months exclusive breastfeeding. The earlier antiretroviral therapy guidelines advised HIV positive mothers to breastfeed for 4 months then wean abruptly if the child was HIV negative (MOHSS, 2008c). A mother who chose not to breastfeed could use replacement feeding. If a child tested HIV positive while breastfeeding, the mother was advised to continue breastfeeding for as long as possible.

2.2 Risk factors for malnutrition

Causes of malnutrition can be classified as immediate and underlying causes (Black et al, 2008). Immediate causes of malnutrition are due to diseases and inadequate food intake while underlying causes include household food insecurity, inadequate care, unhealthy household environment and lack of health services (Black et al, 2008).

2.2.1 Immediate causes

Diseases increase the risk of malnutrition through diminished dietary intake, increased nutrient loss and increased nutritional requirements (Miller, Orav, Martin et al, 1991; Winter, 1996). Some diseases cause oesophagitis, nausea or vomiting. This in turn reduces food intake. Diarrhoeal diseases are associated with malabsorption resulting in increased nutrient loss (Miller et al, 1991; Winter, 1996).

Infections such as pneumonia and TB increase the nutritional requirement in the body (Chintu, Dupont, Kaile et al. 1998; Miller, Easley, Zhang et al, 2001). Infections are characterized by increased basal metabolic needs (ANECCA, 2006). Increased metabolic needs and poor food intake can lead to malnutrition. Malnutrition leads to further deterioration of immunity and accelerates progression of HIV to AIDS (Colecraft, 2008).

2.2.2 Underlying causes of malnutrition

Underlying risk factors for malnutrition can be grouped into three:- infant factors, maternal or caregiver factors and socioeconomic factors.

Infant factors

In infants, risk factors for malnutrition include frequency of illnesses, immunization status, immune status, birth order and birth interval.

Infant dietary intake is important in determining the nutritional status of the child. In developing countries where replacement feeding is not always affordable, feasible, acceptable safe and sustainable (AFASS), infants who are breastfed have better nutrition than those put on replacement feeding (Mbori-Ngacha et al, 2001). When recommended quantities of formula are not affordable, replacement feeding increases the risk of malnutrition in the child. Unhygienic prepared formula increases the risk of diarrhoea, further increasing the risk of malnutrition.

Illness increases the energy needs in the body of the child. As a result, children with higher morbidity have an increased risk of malnutrition than healthy children (Welch, Mock, Sorensen &Netrebenko, 1996; Saloojee et al, 2007). Infectious diseases such as pneumonia, diarrhoea and TB are associated with malnutrition in children (Miller et al, 2001; Chintu et al, 1998). Diarrhoea

can lead to malabsorption resulting in increased energy losses in the body. Ill children tend to have poor appetite resulting in reduced food intake (ANECCA, 2006). This further increases the risk of malnutrition in a sick child.

Immunization protects the child against vaccine preventable illnesses. Children not immunized are more likely to get recurrent infections increasing the risk of developing malnutrition and death. Thus low immunization rates increase the risk of malnutrition (Welch et al, 1996).

HIV infection in children leads to weakening of the immune system. As the immune system weakens, cells of the immune system such as CD4 cell become reduced. As the CD4 count drops, opportunistic infections affect the child. Thus children with lower CD4 counts are at risk of infections, increasing the risk of malnutrition (Miller et al, 2001).

The order of birth in the family can affect the nutritional status of the child. Studies show the rate of malnutrition increasing with birth order especially in birth order of 3 and above (Harishanker , Dwivedi, Dabral & Walia , 2004; Saloojee, Maayer, Garenne & Kahn, 2007). This could be because children born earlier receive better care than those born later. Also as the number of children increases, competition for food among siblings tends to increase.

The birth interval (spacing) between children has an inverse association with the degree of malnutrition in a child (Ahmad, Khan, Hasan & Sinha, 1982). When pregnancies are close, women do not have sufficient time to recover nutritionally and physically from the subsequent pregnancy (Rutstein, 2002). This can lead to maternal malnutrition and low birth weight. In addition children who are not well spaced are more likely to stop breastfeeding early. This can result in malnutrition. Thus children from families where birth intervals are long tend to have better nutrition.

Parent/Caregiver factors

Parent/ Caregiver factors include parent status, education level and health status of caregiver.

Children depend on their parent/caregiver for food and care. The state of health of a parent or caregiver has a bearing on the care the child receives. Ill health and malnutrition in a caregiver is associated with poor child care and hence increases the risk of malnutrition in the child (Islam, Rahman & Mahalanabis, 1994; Saloojee et al, 2007). A malnourished caregiver is more susceptible to infections, recovers slowly from illness and has reduced productivity at work (Haddad & Gillespie, 2001). This reduces both family income and quality of care given to the child, increasing the risk of malnutrition in the child.

Death of the parent affect the quality of care the child receives which in turn increases the risk of malnutrition (Saloojee et al, 2007). Orphaned and vulnerable children may have poor social and economic support. The traditional extended family system which supported orphans has been stretched by poverty given the fact that HIV/AIDS affects the productive members of the family (UNICEF, 2007). Some orphans who do not have relatives to care for them will end up in foster care. In West Africa children in foster homes experienced higher mortality due to poor care, malnutrition and reduced access to health care (Oni, 1995; Bledsoe, Ewbank & Isiugo-Abanihe, 1988).

The level of education of the caregiver contributes to the quality of care given to the child. Illiteracy in the caregiver is associated with increased risk of malnutrition in the child (Foster, 1998; Islam et al, 1994). An educated and literate caregiver is more likely to be employed, wealthier and more informed about health related issues than an illiterate caregiver (MOHSS, 2008a). These factors impact on the support and care given to the child.

Socioeconomic factors

Socioeconomic risk factors for malnutrition include family income, food security, family size and living conditions (Owor, Tumwine & Kikafunda, 2000).

Poverty is the lack of basic human needs because of the inability to afford them (Jauch, Edwards and Cupido, 2009). Poverty is an important risk factor for malnutrition (Islam et al, 1994; WHO, 1999; Harishankar et al, 2004). Poverty leads to household food insecurity (Black et al, 2008). Household food insecurity will lead to inadequate dietary intake resulting in malnutrition. Low household income is associated with malnutrition in the children of that family (Jeyaseelan & Lakshiman, 1997; Islam et al, 1994). The global financial crisis has led to increase in food prices (Brinkman, De Pee, Sanogo, Subran & Bloem, 2010). This makes it difficult for families with low income to afford adequate food increasing the risk of malnutrition.

Poor families may not have access to clean water and good sanitation. Children growing under such conditions are prone to diseases such as diarrhoea and TB (Black et al, 2008; Islam et al, 1994). As noted above, diarrhoea reduces absorption of the nutrients from the intestines increasing the risk of malnutrition in the child.

Family size is a risk factor for malnutrition. It has been observed that children from larger families are at higher risk of developing malnutrition than those from smaller families (Harishankar et al, 2004; Tomar & Srivastava, 1980; MacCorquodale & de Nova, 1977). This is probably because competition for food increases with family size especially if the family is poor.

Children receiving social support tend to be better nourished than those who do not because the finances their families receive can be used to buy food for the child. In a rural setting in South

Africa, children who were recipients of state support grants were better nourished than those who were not on the grant (Saloojee et al, 2007).

The prevalence of malnutrition in HIV positive children is high. HIV increases the risk of malnutrition while malnutrition accelerates progression of HIV to AIDS and subsequently may lead to death. Nutrition is an important component of care in a child with HIV. Risk factors for malnutrition include inadequate food intake, frequent illnesses, inadequate care, unhealthy household environments, household food insecurity and poverty. The data on malnutrition in HIV positive children in Namibia is not available. The study therefore sought to determine the prevalence of malnutrition in HIV positive infants and the risk factors for malnutrition in Namibia.

CHAPTER 3 RESEARCH DESIGN/ METHODOLOGY

3.1. Study Aim and Objectives

3.1.1 Aim of the study

The aim of the study was to measure the prevalence of and to describe the risk profile for malnutrition in HIV positive infants (age<18 months) at a Hospital Paediatric ARV clinic in Windhoek, Namibia.

3.1.2 Objectives of the study:

(i) To determine the prevalence of malnutrition among HIV positive infants (<18 months) attending HPAC in Windhoek, Namibia.

(ii) To describe the socio-demographic characteristics and nutritional risk profile of HIV positive infants and their caregivers attending HPAC.

(iii) To determine the association between nutritional risk factors [socio-demographic characteristics, infant factors and caregiver factors] and malnutrition in HIV positive infants attending the HPAC.

(iv) To model risk factors associated with current or potential malnutrition among HIV infants at HPAC in Windhoek, Namibia.

3.2. Study Design

A cross sectional descriptive-analytic study design was used. The study sought to determine the prevalence of malnutrition among the HIV infected infants attending a HPAC in Windhoek Namibia and to explore risk factors for malnutrition in this population. The study used

quantitative methods to assess the association between named risk factors and malnutrition in HIV positive infants.

The ARV staff, the doctors, nurses, and community counselors held a consultative meeting to discuss advantages of optimal nutrition in the care of HIV positive children. In the meeting, the benefits of the study were explained to the members and some were invited to contribute to the study. Ethical approval was obtained from the University of the Western Cape (UWC) Ethical Committee and from the Ministry of Health and Social Services (MOHSS) Namibia.

3.3 Study Population

The study recruited HIV positive infants below the age of 18 months attending the HPAC and their caregivers. The children who participated in the study had a confirmed HIV diagnosis and were registered for care at HPAC. The primary caregiver of each child was interviewed.

3.4 Sampling and Sample size

HIV positive children attending the HPAC are registered in both the electronic register and manual registers at the clinic. A list of 88 eligible children (age <18 months) was generated for sampling from the electronic register.

The prevalence of malnutrition among HIV positive infants was not known. The NDHS 2006-07 report showed that in the general population, 29% of children were stunted, 8% were wasted and 17% were underweight (MOHSS, 2008a). For purposes of sample size calculation, this study estimated prevalence of underweight in HIV positive infants aged < 18 months to be 20%. The confidence interval was set at 95% and the margin of error at 3%. Using the above parameters, Epi-info stat cal version 3.4.3 the estimated the sample size to be 78 subjects. Only 88 children

were available for sampling. Convenience sampling was used with all children included. Permission to conduct study was sought and obtained from all the 88 caregivers.

3.5 Data Collection

Data for the study was collected using a structured questionnaire, record review, clinical examination of the child and weight and height measurements of the child and caregiver. Data was collected from January 2010 to April 2010.

An information sheet explaining the rationale of the study was given to each caregiver. In addition the purpose of the study was verbally explained in detail to each caregiver in their local language. The caregivers gave a written consent in agreement to participating in the study.

A structured questionnaire which assessed;- infant, caregiver and socioeconomic factors was administered to each caregiver. HIV history of the infants was extracted from the patient booklet. The information included date of HIV test, most recent CD4 Count, WHO clinical stage before and after starting HAART and treatment history. Each child was examined and assessed for malnutrition. The child's weight and height was recorded and compared to WHO standard growth charts to determine nutritional status.

The weight and height of each caregiver was measured and the body mass index (BMI) was calculated to determine the nutritional status of the caregiver.

All caregivers were counseled on nutrition regardless of the nutritional status of the child.

3.6 Assessment of Nutrition

Nutritional assessment was performed by conducting a clinical examination and measuring weight and height of the child and the caregiver.

During clinical examination, the examiner checked for signs of severe wasting, loss of muscle bulk, sagging of skin on the buttock area and presence of oedema (pedal).

Nutritional status for children was assessed using 3 indices.

1) Weight for Height (WFH) - this index measures body mass in relation to height. It describes the current nutritional status in terms of thinness or "wasting". WFH between -2 and -3z-scores was classified as wasting and WFH<-3 z-scores as severe acute malnutrition/ severe wasting. Children with nutritional oedema were classified as having severe acute malnutrition.

2) Height for Age. This index identifies linear growth retardation and cumulative growth deficits. Children with Height for Age between -2 and -3z-scores were stunted and Height for Age < -3 z score were classified as severely stunted.

3) Weight for age. This is a composite index reflecting both wasting and stunting. A child with a Weight for Age between -2 and -3z-scores was underweight while a child with a Weight for Age < -3z score was classified as being severely underweight (WHO, 1997; WHO, 2006 a,b,c,d,e).

Nutritional status for adults was assessed using the body mass index (BMI).

$$BMI = \text{Weight (kgs)} / \text{Height}^2 \ (m^2).$$

The BMI for caregivers was classified as follows

[1] Severely Underweight (BMI <16).

[2] Moderate Underweight (BMI 16-<17)

[3] Mild Underweight (BMI 17.0-<18.5)

[4] Normal (BMI 18.5-<25)

[5] Overweight (BMI 25.0- <30)

[6] Obese (BMI ≥30) (WHO, 2006 f)

3.7 Description of variables and their measurement:

Family size, number of children and number of adults: -Family size was recorded as the number of people living in the same household at the time of the study. The number of children was recorded as the household members aged < 15 years while the number of adults was recorded as household members aged ≥15years.

Age of child: - The age of the child was calculated in months as the number of completed months from the date of birth to the date of interview.

Birth order: - In the study birth order was defined as the chronological order of birth of the child in the family including any neonatal deaths in the family.

Birth spacing: - birth spacing was defined as the interval in years between the children assessed during the survey and the most recent previous birth from the same biological mother regardless of whether the child is alive or dead.

CD4- CD4 can be reported as an absolute count or as a percentage. In children < 5years old, absolute CD4 counts are less constant and more age-dependent than CD4% (WHO, 2010). Therefore a CD4% which is more consistent is preferred for immunological staging in children below 5 years. In children below 5years, a CD4% ≤ 25% is suggestive advanced HIV disease (MOHSS, 2010). In the study CD4% was recorded as the most recent CD4% in the patient's record.

Clinical stage. -Clinical stage of the patients was assessed using the WHO clinical staging. The study recorded the pre ARV therapy and the current clinical stage for all patients. The WHO T-staging or "staging while on treatment" takes into consideration that most patients started on HAART will improve clinically. The current clinical stage is preceded by a T to indicate that the patient is on HAART.

History of TB contact: - the child was considered to have a positive TB contact if they were staying in the same house with a patient diagnosed with pulmonary TB at the time of diagnosis or at the time of treatment for TB. Thus children staying in families where other family member/s was/were recently diagnosed with pulmonary TB had a positive history of TB contact.

Number of diarrhoeal/ respiratory infections/other illnesses: these were assessed as the number of illnesses (diarrhoea /respiratory tract infection/other illnesses) during the 3 months prior to the interview. The caregiver was asked about the illnesses the child had in the 3 months prior to the interview and the number of episodes of illness was verified by checking in the patient's health passport when possible.

Immunization status: - Immunization status was checked by verifying with the health passport if the child had received his/ her immunizations as per Namibian immunization schedule. Children who had not missed any immunizations were recorded as immunization up to date.

Health status of caregiver: - this refers to the general clinical condition of the caregiver. A caregiver who is clinically well without or with minimal complaints was considered as "working". Caregivers who were chronically ill and were not able to take part in basic daily household chores were considered "bedridden" while those who fell between the two extremes were considered "ambulatory" (MOHSS, 2008c).

Weight: - Weights were measured using a baby scale (Crown Iso-9001 scale) in children less than 6 months while an Adam MDW-250L electronic scale was used in older children and adults. Children were weighed with minimal clothes without shoes. Weight was rounded off to the nearest 0.1 kg in both children and caregivers.

Height: - Length was measured in all children as their heights were less than 87 cm. Length was measured while the child was lying down in the recumbent position using a Shorr Productions measuring board. In adults, height was measures using a PanaMedic tape measure mounted on the wall. In children height was rounded off to the nearest 0.1cm while in adults it was rounded off to the nearest 1cm.

Oedema- pitting oedema was checked by applying gentle pressure over the dorsum of both feet for at least 5 seconds. Pitting is defined as the depression caused by the pressure applied and is usually absent in a normal patient. Only children with bilateral oedema were considered have possible nutritional oedema. All children with oedema were referred to the doctor for further assessment to rule out other causes of oedema. Malnourished children tend to have low albumin

levels (ANECCA, 2006). Hypoalbuminaemia state in malnutrition will lead to oedema. Children with nutritional oedema were classified as having severe acute malnutrition.

Body Mass Index (BMI)-: BMI was calculated using the formula below

$$BMI = Weight\ (kg) \div (Height)^2\ (m^2)$$

BMI was approximated to the nearest 0.1 kg/m^2.

3.8 Validity and Reliability

Validity determines the degree to which an instrument is able to measure what it is intended to while reliability refers to consistency or repeatability of a measure (Bonita, Beaglehole &Kjellstrom, 2006). To ensure the questionnaire collected the desired information, it was pretested on 10 caregivers of children aged >18months randomly selected from HPAC. The questionnaire was restructured based on the findings. The corrected questionnaire was then used for data collection in the study.

In the study, 2 nurses assisted in conducting interviews, measuring weights and heights of children and their caregivers. To minimize variations in the interpretation of the questionnaire and taking of measurements (weights and heights), nurses participating in the study as research assistants were trained on the use of the questionnaire and measuring weight and height. All questions on the questionnaire were explained to them to avoid different interpretations. Training of the research assistants helped to ensure standardization of the data collection therefore improving reliability.

All 88 HIV positive children aged < 18 months participated in the study. This reduced the sampling error increasing the validity.

3.9 Analysis

Data cleaning and Coding-Data cleaning ran concurrent with data collection. Questionnaires were checked for completeness after the nurses had finished conducting each interview. Questionnaires were rechecked for completeness before analysis. All questionnaires were completely filled in. Non numerical data on the forms was coded into numerical data [for example Yes was coded 1 and NO coded 2]. Data from the questionnaires was entered into computer using SPSS version 16. Twenty files (23%) were randomly selected and checked. These were found to be correctly entered. A master sheet indicating all the variables and responses was generated from SPSS. Each variable was re-checked for any anomaly. Data falling outside the expected range for the variable was verified with the original questionnaire and corrected. After cleaning the data analysis was conducted.

Data analysis- SPSS Version 16 was used to analyze the data. Descriptive statistics was used to determine the prevalence of malnutrition in the study population. Univariate and multivariate analysis were used to assess the association between risk factors and malnutrition. Assessment of nutrition in children was based on international growth standards and z-scores. Weights for height, height for age, weight for age were matched against WHO growth standards. In adults the body mass index [kg/ m^2] was used to determine the nutritional status of the caregiver.

As the sample size (88) was relatively small, analysis including all the levels in both dependent and independent variables would have led to most cells in the resulting contingency table having very low expected frequencies and in turn, giving inaccurate inference. Therefore dependant

variables were collapsed to 2 levels and independent variables were regrouped to 2 or 3 levels as shown in appendix 5.

3.10 Ethical Considerations

Participants for the study were informed about the purpose of the study. Each caregiver of HIV positive infants was given an information sheet which explained the aim and objective of the study. They were given an option to withdraw from the study with no reason and without consequences. A written consent was obtained from each caregiver.

Permission to obtain data from clinic registers was obtained from the hospital management. Ethical clearance for the study was obtained from the University of the Western Cape (UWC) and from the Ministry of Health and Social Services (MOHSS) Namibia.

The identity of the patient was protected by not using their names or other information identifying the patient. Results compiled from the data sheets excluded any personal information identifying an individual. All questionnaires were collected soon after each interview and they were kept by the researcher in a safe place.

Children identified to be severely malnourished were admitted to the hospital. These children were referred to community based organizations for nutritional support on discharge from the hospital.

Caregivers were informed on the nutritional status of their child after the interview and advised accordingly. The findings of the study were shared with doctors and nurses working at the Hospital Paediatric ARV clinic as well as the MOHSS research unit.

CHAPTER 4-RESULTS

This chapter present the results of the study that was conducted to determine the prevalence of and the risk factors associated with malnutrition in children aged <18 months attending HPAC. A lot of data will be presented in this chapter since little information is available for Namibia. The data presented will be compared with the findings from other studies in chapter 5.

The first section of the results will present the sample size and sample characteristics. The second section will present results on the nutritional assessment of children and their caregivers. The third section will look at risk factors for malnutrition. The section is subdivided into general factors, infant factors, caregiver factors, family income and food security. Finally the chapter will conclude with a summary of major findings.

4.1 SAMPLE SIZE AND SAMPLE CHARACTERISTICS

Sample size.

A total of 88 patients were interviewed. This represented all children age≤ 18 months registered at the HPAC. Eighty seven children were staying at home while 1 child was in foster care. The foster home had 25 children and 6 caregivers. As a result the family size and the number of children staying in the same house for this child in foster care appear as outliers. Financial support for children in foster care comes from different sources including government and other civic organizations. As a result food security analysis excluded the child who was in foster care.

Age and Sex of respondents

The ages of the children ranged from 2 to 17 months. Figure 1 shows the age distribution of children in the study.

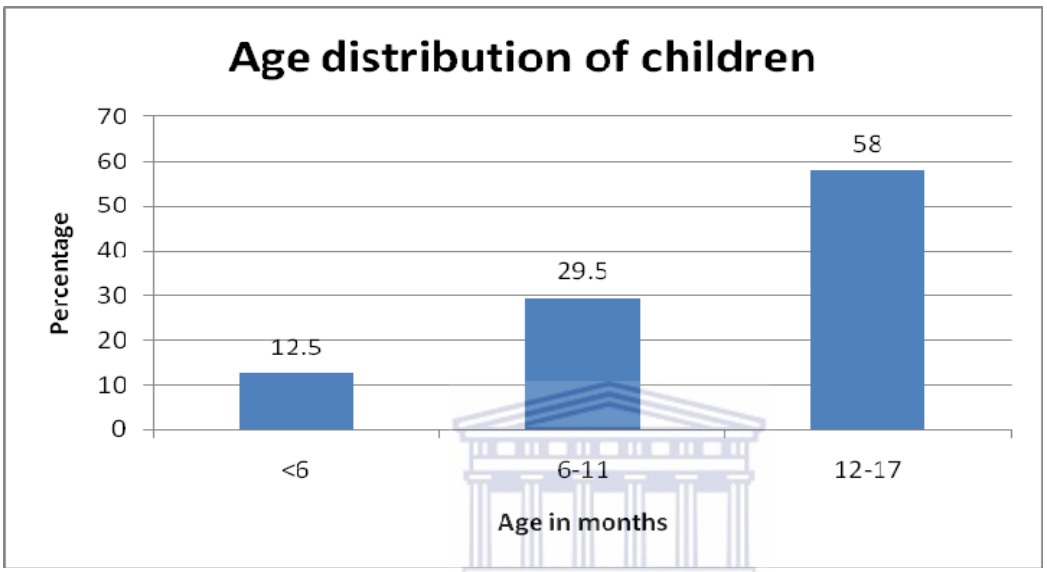

Figure 1: Age distribution among children

The average age for the children in the study was 11.8 ±4.5 months. Of the 88 children who participated in the study, 48 (54.5%) were boys while 40 (45.5%) were girls.

4.2Nutritional Assessment

4.2.1 Nutritional Assessment of Child

Figure 2 shows the weight distribution for the children in the study.

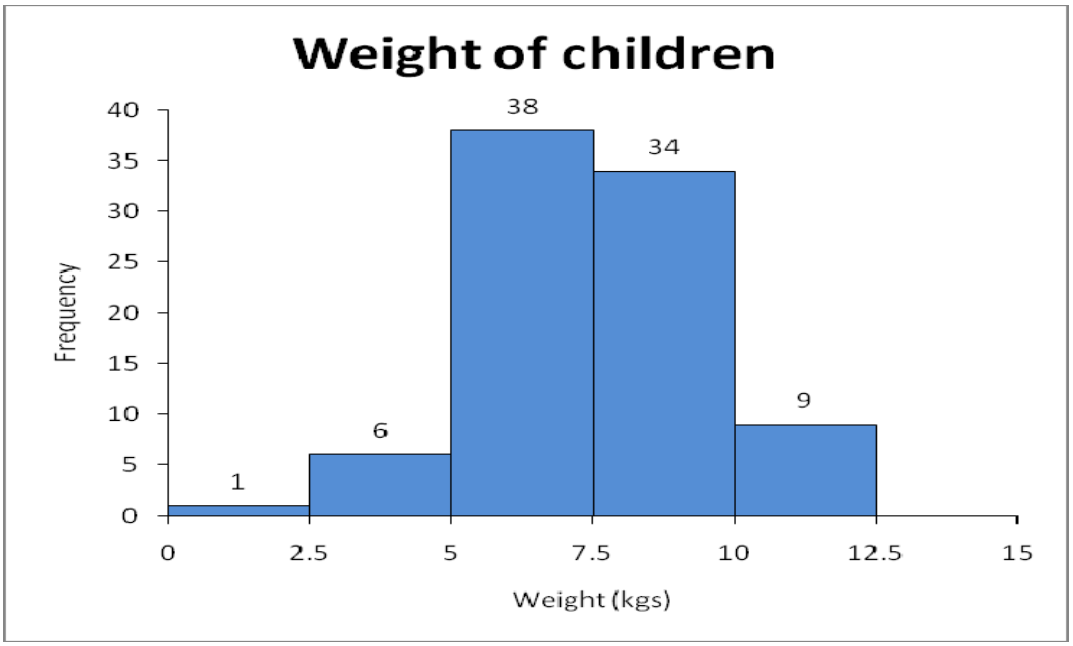

Figure 2: Histogram of weight of the children

The weight for the children ranged from 2.5 to 12.1 kg with a mean of 7.6± 1.9kg.

Fig 3 shows the length distribution of the children who participated in the study.

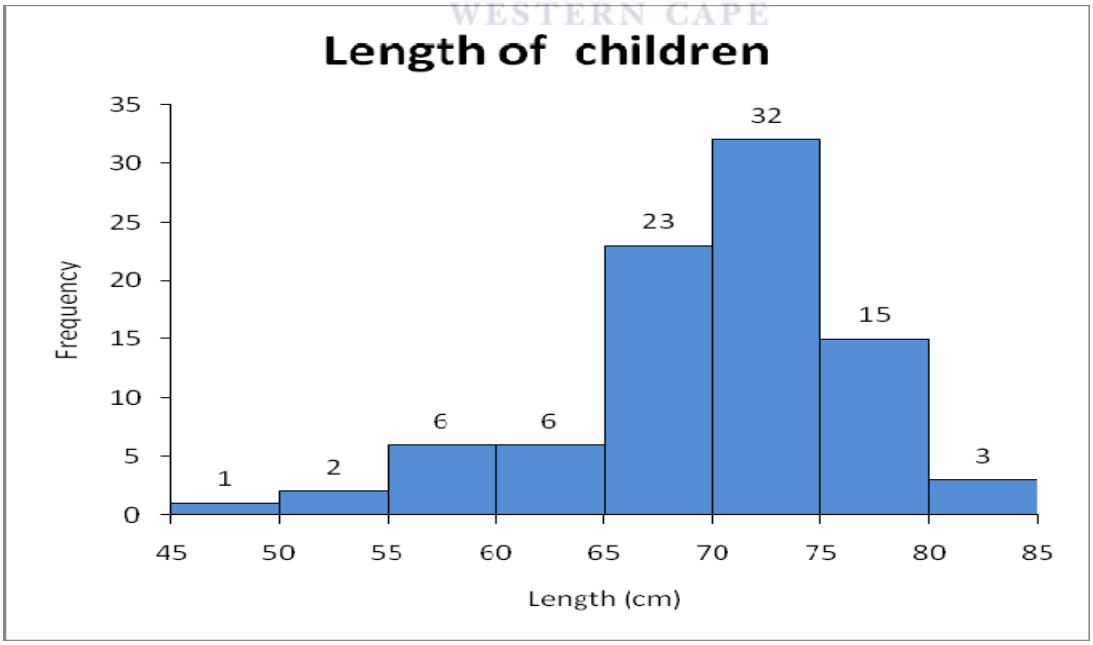

Figure 3: Histogram of length distribution of the children.

The height of children ranged from 49.0 to 82.0cm. The average height for the children who participated in the study was 70.7 ± 6.7 cm.

The nutritional classification of children is shown in Figure 4.

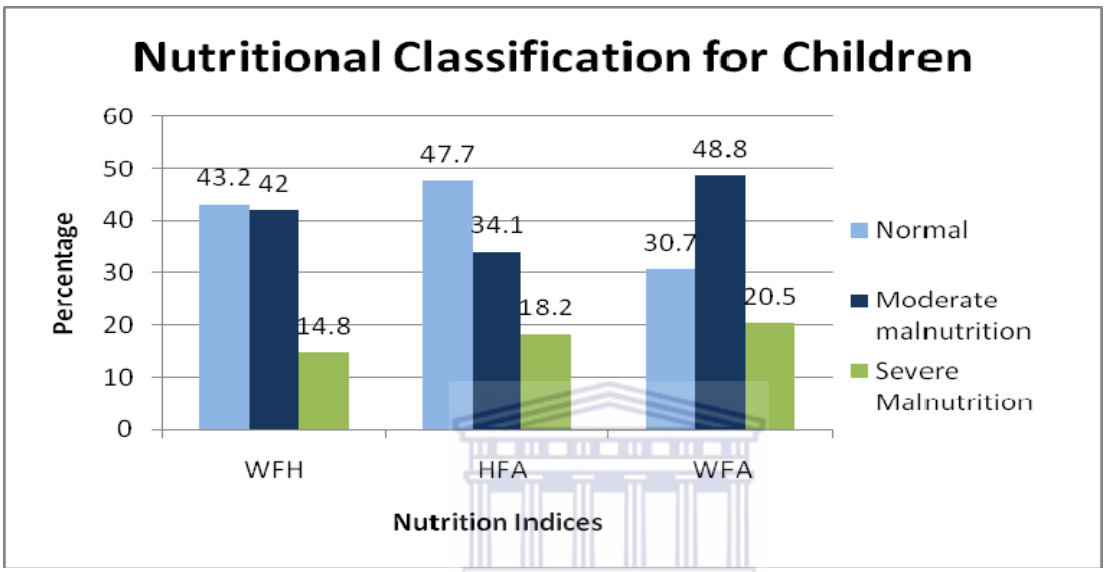

Figure 4: Nutritional Classification for children

Fifty (56.8%) of children were wasted, 52.3% were stunted and 69.3% were underweight. Three (3.4%) children had nutritional oedema. The 3 children with oedema were classified as having severe acute malnutrition.

In the survey 36 (40.9 %) children were referred for nutritional interventions. Of these 13 children with severe wasting were admitted to the hospital for nutritional rehabilitation. All caregivers received health education on nutrition regardless of the nutritional status of the child.

4.2.2 Nutritional assessment for caregivers

Caregivers weighed from 31.5 to 91.8 kg. The average weight of the caregivers was 57.6 kg ± 12.5kg. The height of caregivers ranged from 1.44m to 1.76m. The mean height for caregivers was 1.60 ±0.06m as shown in Table 1.

Body mass index of caregivers ranged from 13.8 to 40.8. The average BMI was 22.5 ± 4.7 kg/m^2. Figure 5 shows the BMI classification of caregivers.

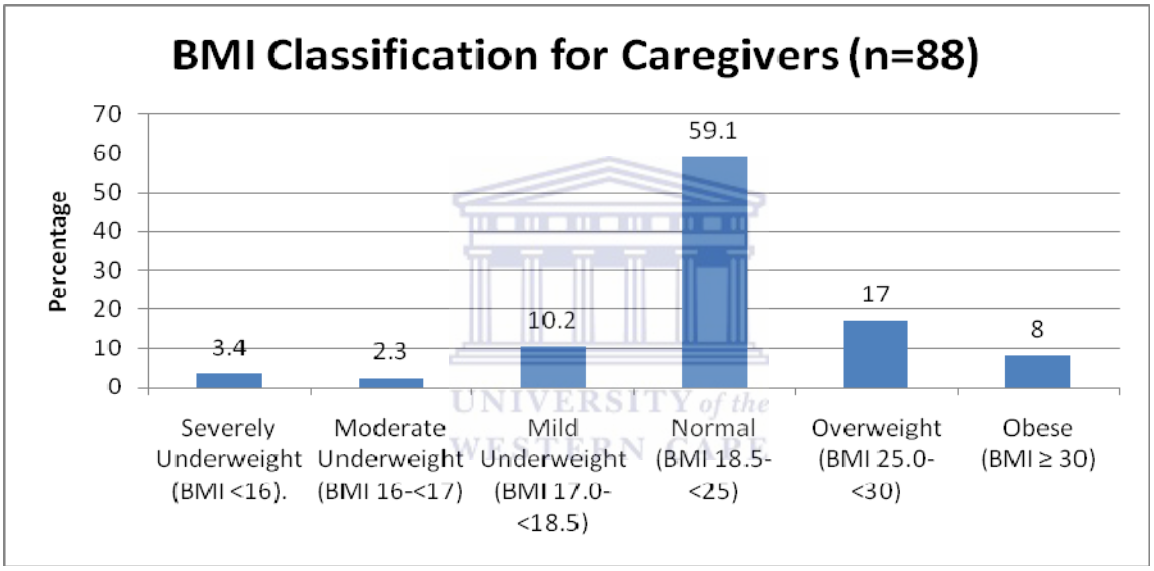

Figure 5: Body Mass Index of caregivers

Fourteen (15.9%) of caregivers were underweight while 21 were overweight. The proportion of children with severe malnutrition was higher in the caregivers who were underweight. Analysis showed significant association between nutritional status of caregivers and wasting in the child (χ^2=7.8684, p=0.0196).

Table 1 summarizes the weights, height and BMI for children and the caregivers.

Table 1: Summary of weight, height and BMI for study participants.

Variable	Mean	Standard Deviation	Median	Minimum Value	Maximum Value
Weight (kgs)-Children	7.6	1.9	7.5	2.5	12.1
Height (cm) Children	70.7	6.7	71.5	49.0	82.0
Weight (kgs) –Caregiver	57.6	12.5	55.7	31.5	91.8
Height (m)- Caregiver	1.60	0.06	1.60	1.44	1.76
BMI- Caregiver	22.5	4.7	21.5	13.8	40.8

4.3 General Characteristics.

4.3.1 Family Characteristics:

Figure 6 shows distribution of the family sizes for the children who were interviewed during the survey.

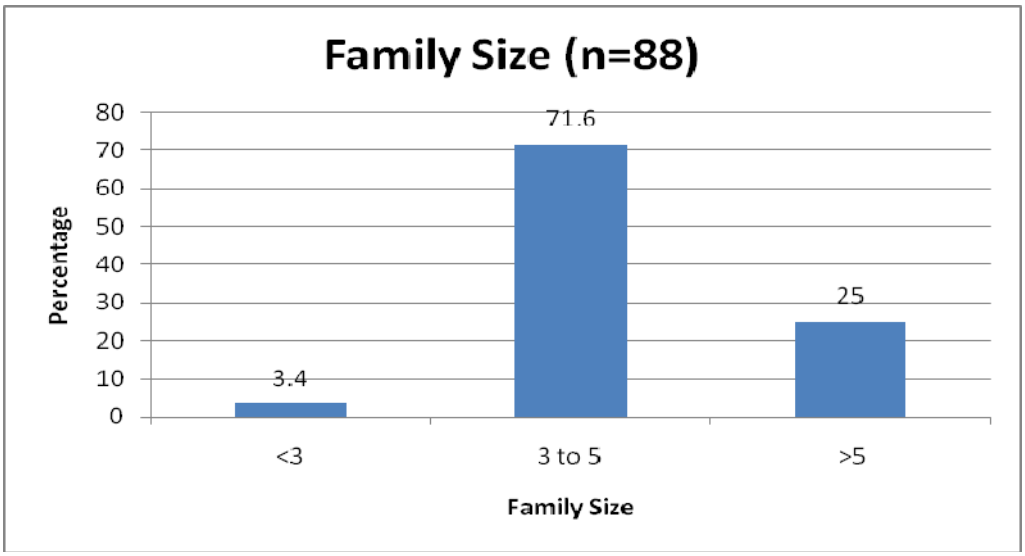

Figure 6: Number of people staying in the same house as the child

The median family size was 5 with a range of 2 to 31 as shown in Table 4.

Figure 7 and 8 shows the number of children and adults respectively living in the same house at the time of the survey.

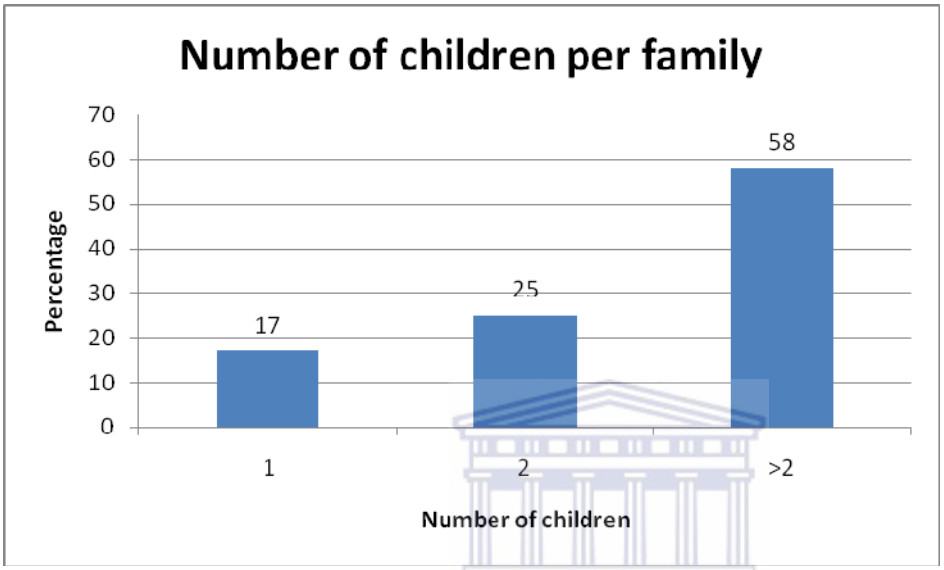

Figure 7: Number of children living in the same house

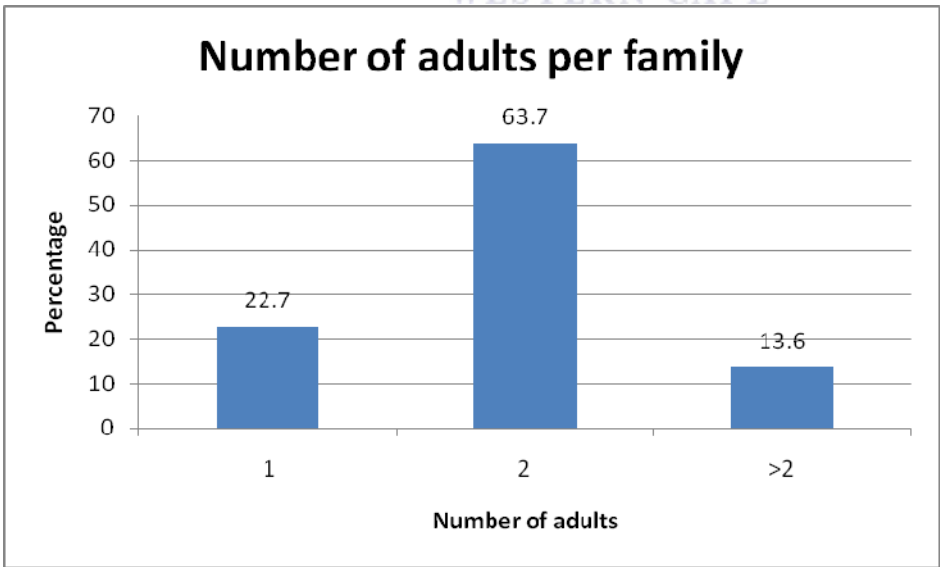

Figure 8: Number of adults living in the same house.

The number of children and adults per family ranged from 1 to 25 and 1 to 6 respectively. The median number of children per family was 3 with a inter quartile range of 2 to 4. The mean number of adults per family was 2 ± 1 (2.03 ±0.928).

The number of adult family members per family was inversely associated with malnutrition in children in that family (wasting, $\chi^2 = 6.0815$, p=0.0478; stunting, $\chi^2 = 8.0109$, p=0.0182; underweight, $\chi^2 = 8.1072$, p= 0.0174). In the study the number of children with malnutrition was higher among children from larger families. However, there was no statistically significant association between family size and nutritional status of the children (p=0.2844). The number of adults per family was associated with the number of people with a regular income per family ($\chi^2 = 53.2850$, p< 0.001).

4.3.2 Water Source and Sanitation

Most families who participated in the survey had access to clean water. Eight six (97.7%) used tap water while 2 families were using borehole water. In contrast, up to 24 (27.3%) families did not have sanitary facilities at their houses and they were using the bush system as shown in Table 2.

Table 2: Faecal disposal methods used by the families of children with severe malnutrition

Sanitary Facilities	Frequency	%	Severe Acute Malnutrition WFH< -3	Severe Stunting HFA<-3	Severe Underweight WFA<-3
Flush	63	71.6	7	12	11
Pit Latrine	1	1.1	0	1	1
Bush	24	27.3	6	3	6

The proportion of children with severe malnutrition was higher among children without sanitation facilities (6/24) when compared to those with sanitary facilities (7/64). The odds of stunting were lower in children from families with flush toilets when compared to those without sanitary facilities (OR 0.23, p=0.0085) as shown in Table 7.

Children without sanitary facilities are at risk of diarrhoeal illnesses. In the study poor sanitation was associated with increased frequency of diarrhoea (χ^2=7.2440, p= 0.0267).

4.4 Infant Characteristics

4.4.1 Age group

In the survey, 11 (12.5%) of the patients were aged below 6 months, 26 (29.5%) between 6 to <12 months and 51 children we aged ≥12 months. All 13 children with wasting were aged ≥ 6months. Stunting is a sign of chronic malnutrition, however severe stunting was observed even in children < 6months. Two of the 16 children with severe stunting were aged below 6 months. In the study, the number of children with severe malnutrition increased with increasing age as shown in Table 13 in the appendix 4. Risk of stunting was higher in older children when compared with younger children (χ^2=8.1839: p= 0.0167).

4.4.2 Gender

In the study, 46 children were male and 40 were female. The study showed that 56.3% of males and 57.5% of females were wasted. Twenty five (52.1%) male infants were stunted and 21 (52.5%) females were stunted. The prevalence of underweight in children was 68.8% in males

and 70% in females. Analysis showed no significant association between sex of the child and malnutrition (p=0.9160) as shown in Table 26 appendix 4.

4.4.3 Birth Order / Birth spacing

Figure 9 and 10 show the birth order and birth spacing of the children who participated in the study.

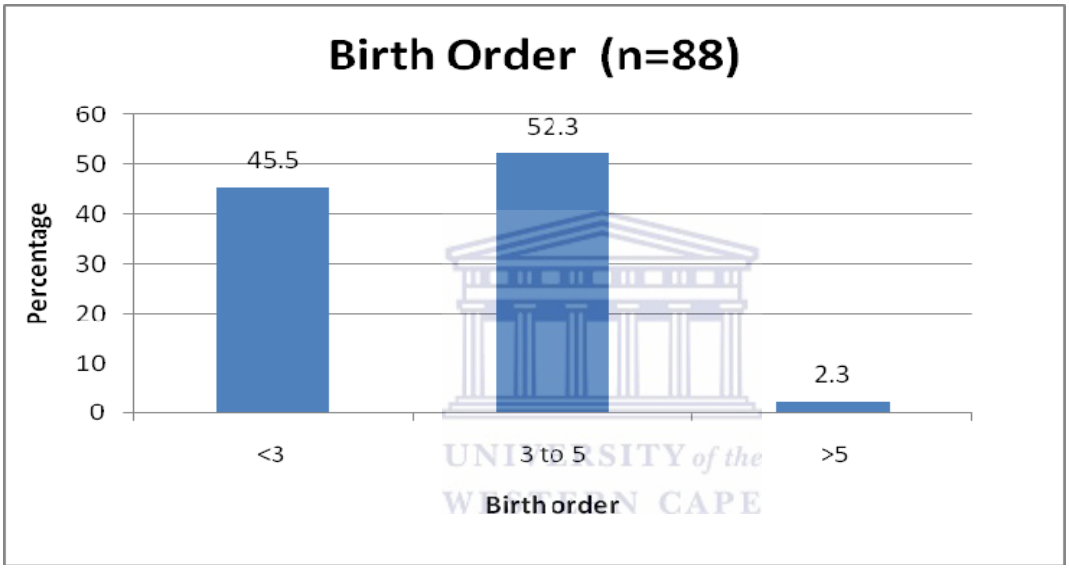

Figure 9: Birth order of children in the study.

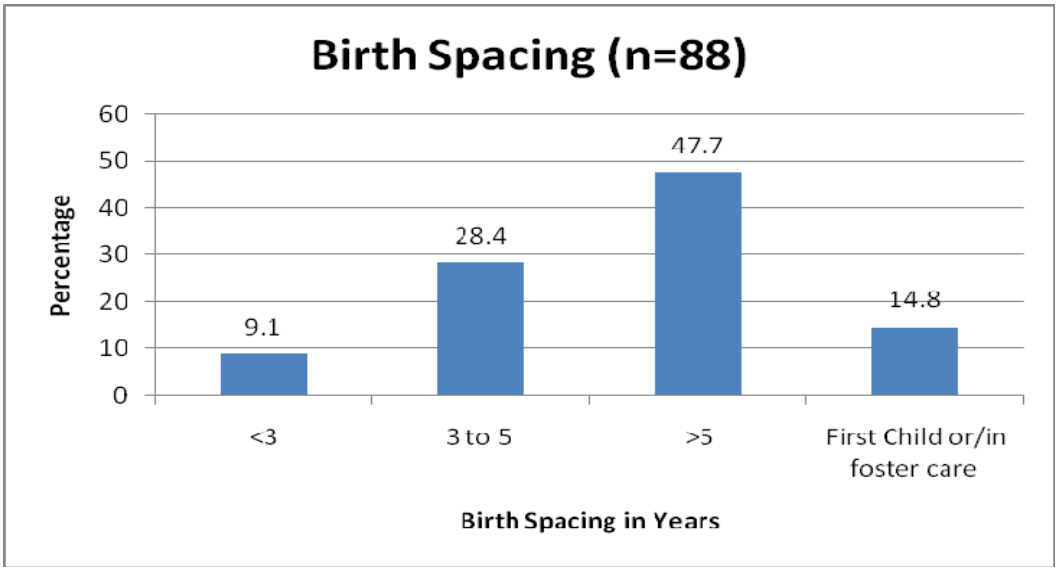

Figure 10: Birth Spacing of children in the study.

In the study, the number of children with severe malnutrition increased with increasing birth order and decreased with increasing birth spacing. The study found that 2 (2.3%) of the children whose birth order was reported as > 5 were stunted. However there was no statistically significant association between birth order and birth spacing with malnutrition in children as shown in Table 25 in appendix 4.

4.4.3 Feeding history

4.4.3.1 Past feeding method

During the study, 60 (68.2%) mothers had exclusively breastfeed their infants, 26 children had been on formula feeding while 2 children were on mixed feeding early in life.

In breastfed infants, the duration of exclusive breastfeeding ranged from 1 to 6 months with a mean of 3.45 ± 1.33 months. Only 18 of the 60 breastfeed children were exclusively breastfeed for 4 months as shown in Figure 11.

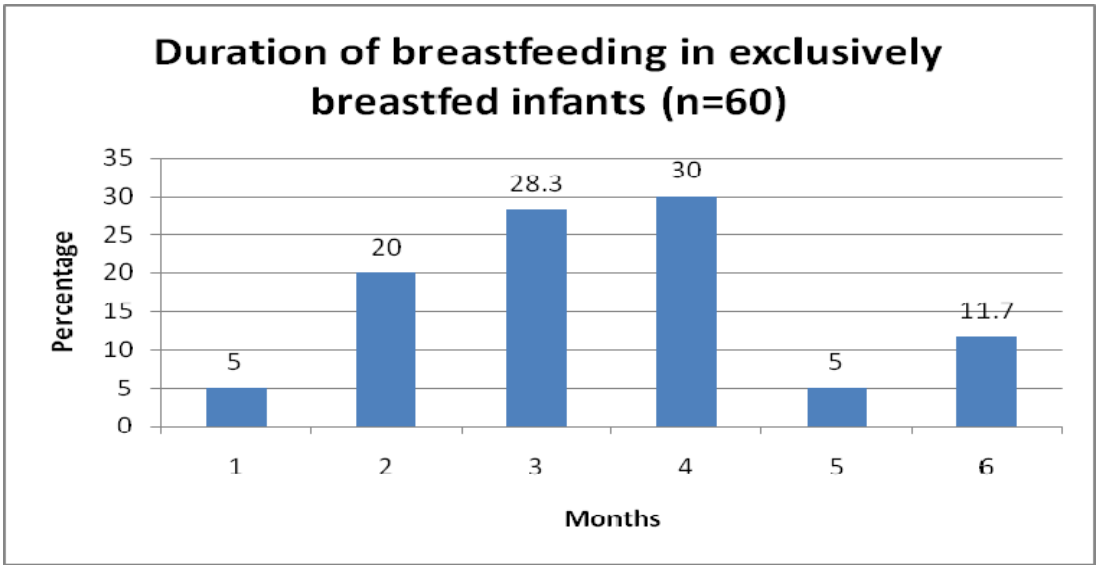

Figure 11: Duration of exclusive breastfeeding

Past feeding practices was not associated with malnutriton in children (p= 0.2240). In children who were exclusively breastfed, the study showed no association between the duration of breastfeeding and malnutrition (p=0.8722).

4.4.3.2 Current feeding Practice

Forty seven (53.4%) of the children had been weaned and taking solid feeds only as shown in Table 3. The proportion of children with severe malnutrition was higher among weaned children.

Table 3: Current feeding method for children with severe malnutrition

Current Feeding Method	**Frequency**	**%**	**Severe Acute Malnutrition WFH< -3**	**Severe Stunting HFA<-3**	**Severe Underweight WFA<-3**
Exclusive Formula Milk	5	5.7	0	1	1
Exclusive Breastfeeding	3	3.4	0	0	0
Mixed Feeding(Breastfeeding +other feeds)	4	4.5	0	1	1
Formula milk + other feeds	29	33.0	5	5	6
On solid Feeds	47	53.4	8	9	10

Eighty (91%) of the children have been introduced to solid feeds at the time of the survey. Age of introduction to solids feeds for both breastfed and replacement fed infants ranged from 2 to 8 months. The average age of introduction to solids was 4.46 ± 1.24 months. The study showed that 46 (52.3%) of the children had been introduced to solid feeds by age of 4 months.

The study showed that 10 of the 13 children with severe wasting had been introduced to solid feeds by age 4 months. However analysis showed no significant association between age of introduction to solid feeds and malnutrition in children (p=0.9514) as shown in Table 26 in appendix 4.

Table 4 shows a summary of the descriptive statistics for some of the risk factors for malnutrition in children.

Table 4: Summary of descriptive statistics for some risk factors.

Variable	Mean	Standard Deviation	Median	Minimum Value	Maximum Value
Family size	5	3	5	2	31
Duration of Breastfeeding (months)	3.5	1.3	3	1	6
Age of introduction to Solid Feeds (months)	4.5	1.2	4	2	8
CD4%	26.4	10.9	24.6	9	51

4.4.4 Past Medical History

4.4.4.1 Age of child at the time of HIV diagnosis.

The age of the children at the time of HIV diagnosis ranged from 6 to 70 weeks. The median age was 10 weeks and the inter-quartile range of 8 to 27 weeks. Only 4 children had been diagnosed HIV positive at 6 weeks. However the proportion of children diagnosed of HIV at 8 weeks was 33% (29) and 61.4% (54) had been diagnosed by 12 weeks. Thus the majority of the children are being tested early. In children aged<6 months 90.9 % (10) of the children were diagnosed of HIV by 12 weeks when compared with 59.1% in the children aged ≥ 6 months. The age of the child at HIV diagnosis was not associated with the nutritional status of the child (p=0.1560).

4.4.4.2 CD4 %Count

The CD4% for children in the study ranged from 9 to 51 % as shown in Figure 12.

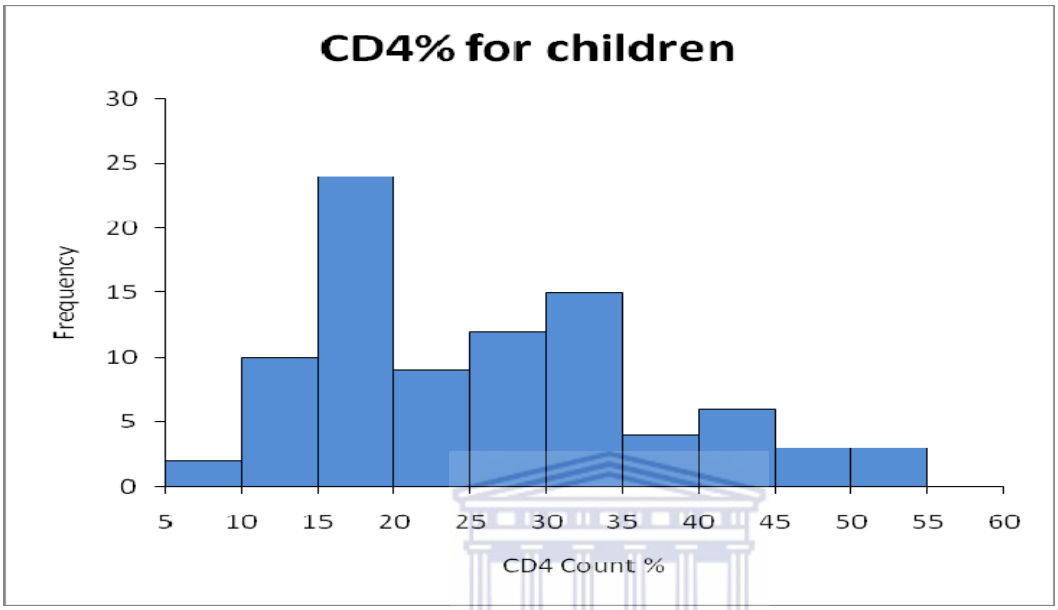

Figure 12: CD4% for HIV positive infants attending HPAC

The average CD4 % in the study participants was 26.4 ±10.9%. In an HIV positive child aged <5years, a CD4% ≤ 25% is a sign of advanced HIV infection. In the study children with CD4% ≤ 25% were more likely to be underweight than those with higher CD4% (OR 4.74, p=0.0035).

4.4.4.3WHO Clinical Stage

WHO Clinical Stage before ARV treatment

WHO clinical staging assesses the general clinical condition of the patient. Thirty eight (43.1%) of the children had advanced HIV disease when they were registered for HIV care. The proportion of children with severe malnutrition was higher among children with advanced HIV disease other than malnutrition when compared to those with early HIV disease (WHO clinical

stage I and II). In children with early HIV disease, the odds of being wasted were 0.22 (p=0.0023), being stunted 0.20 (p=0.0010) and underweight 0.14 (p<0.001) as shown in Table 7.

WHO Clinical staging at the time of the survey

Figure 13 shows the current clinical stage for children aged <18 months attending HPAC.

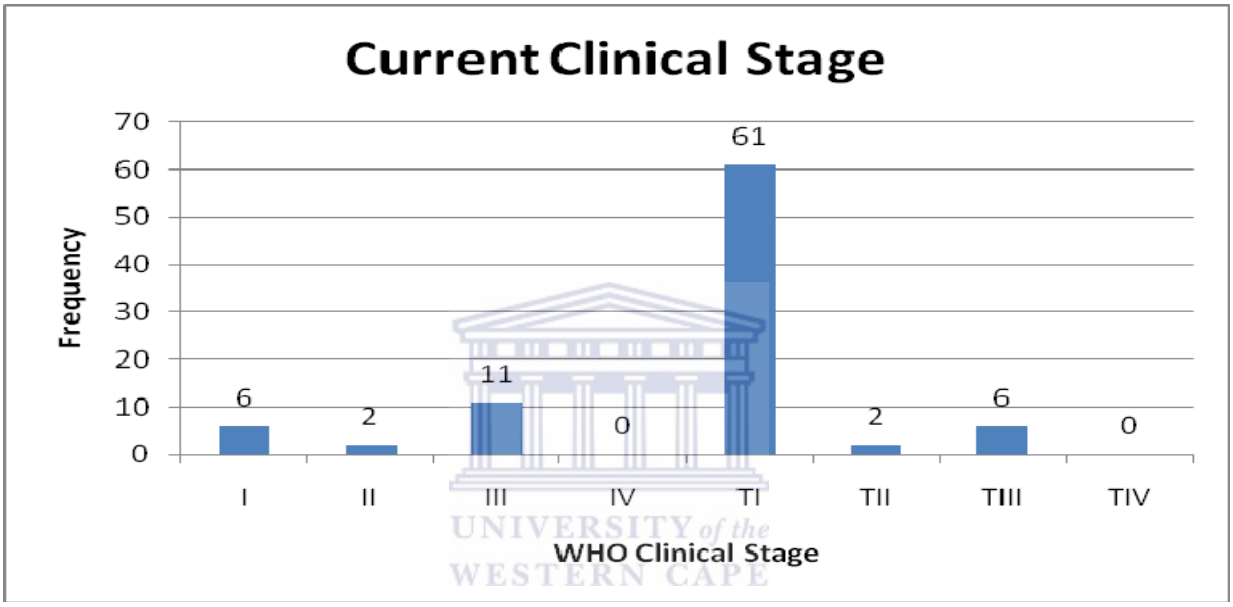

Figure 13: WHO Clinical Staging at the time of survey

Majority of patients on treatment were stage T1 as expected showing the effectiveness of antiretroviral medications.

4.4.4.4 Antiretroviral Therapy

Sixty nine (78.4%) patients were on antiretroviral treatment at the time of the survey. The duration on antiretroviral treatment varied from 1 month to 15 months. The median time on treatment was 7 months and inter-quartile range of 4 to 10 months. Eleven of the 19 patients who were not on treatment were aged below 12 months even though all children aged <12 months are

clinically eligible for ART treatment as per Namibia 2007 ART guidelines. The number of children with malnutrition was higher in children not on antiretroviral treatment. The study showed no significant association between the HIV treatment status of the child and malnutrition (p=0.061). All children on were on first line ARV treatment.

4.4.4.5 Vitamin Supplements

Multivitamin and Vitamin A Supplements- In the study 84 (95.5%) of the patients were on multivitamin syrup. Four children who were not on multivitamins were initiated after the interview. During the study 68.2% (60) of the children had received Vitamin A supplementation from the previous immunization campaigns. Children who received Vitamin A were less likely to be underweight that those who had not received it (OR 0.11, p=0.025).

4.4.4.6. PREVIOUS ILLNESSES

History of TB contact or treatment

Nine (10.2%) of the children had been in contact with a family member who was having active TB while 5(5.7%) had been/ were being treated for tuberculosis. The number of children with malnutrition was higher in children with a positive TB contact or previous history of TB treatment. However no significant association was observed between TB history and nutritional status in the child (p=0.3395) as shown in Table 26 in appendix 4. Children who had been in contact with a family member were screened for TB and managed appropriately.

Diarrhoea, Respiratory and Other Infections.

Figure 14 shows the frequency of infections in children during the three months period prior to the assessments. Other infections excluded diarrhea, respiratory tract infections and TB.

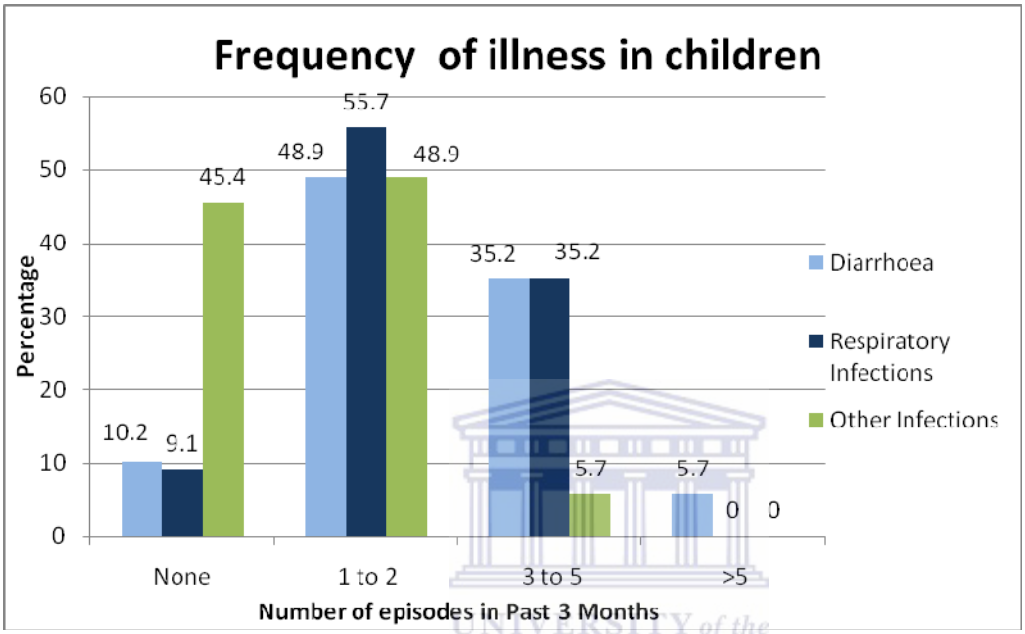

Figure 14: Frequency of diarrhoea, respiratory and other infections in children

The proportion of children with severe malnutrition increased with increasing number of episodes of each infection. The frequency of diarrhoea, respiratory tract infections and other infections were significantly associated with malnutrition in children as shown in Table 6.

During the survey 45.5% of children aged ≥6 months had more than 3or more episodes of diarrhoea when compared with 9.1% in children under 6 months old. However there was no association between age of introducing solids and frequency of diarrhoea illness (p= 0.1939).

Helmith Infections- No children in the study had been treated for helmith infections.

4.4.4.7 Immunization

Eighty (90.9%) children had received all their immunizations as per national immunization schedule while 8 (9.1%) children had missed 1 dose each. Of the 8 (9.1%) children who had missed their vaccination doses, 7 had missed measles while 1 had missed DPT vaccine. Although the number of children with severe malnutrition was high in children who had missed their vaccines, the study showed no significant association between missing vaccines and the nutritional status of the child (p= 0.1161). All 8 children were referred for vaccination after their interviews.

Hospital facilities visited

During the survey 84 patients reported they were using public health facilities while 4 reported using both public and private health services. The health service used by the patient is a proxy to the financial status of the family. In Namibia private medical services are expensive thus most people use government health facilities.

Feeding centres

At the time of the study 28 (31.8%) of the children were attending feeding centres where they were receiving nutritional support. The proportion of children with malnutrition was higher in children attending the feeding centres because most children are referred to these centres after being diagnosed with malnutrition to receive nutritional support. No children were receiving state or other social grants at the time of the survey. Some families had applied for the grants and they were waiting for approval.

4.5 Parent/ Caregiver Characteristics

4.5.1 Parents Status in relation to the support they provide to the child.

Results of the study showed that 57 (64.8%) of children were being cared for by both parents while 21(23.9%) were cared for by one parent though both parents were alive. Seven (8%) children were recorded as orphans having lost either one parent or both. Of the remaining 3(3.4%) children whose parents were recorded as others one child was in foster care. The parents of the remaining 2 children were alive but they were not supporting them. The 2 children were being cared for by other family members.

Children cared for by both parents were less likely to be stunted when compared to other children (χ^2=6.5061, p=0.0387).

4.5.2 Primary Caregiver

Mothers were predominately the primary care giver for the children accounting for 90.9 % (80) of the primary caregivers. Seven children were being cared for by other relatives and 1 child was in foster care. The study showed no significant association between who the primary caregiver was and nutritional status of the child (p= 0.4428).

4.5.3 Education of Primary Caregiver

Eight two (93.2%) care-givers interviewed in the study had some formal education having attended at least primary school as shown in Figure 15.

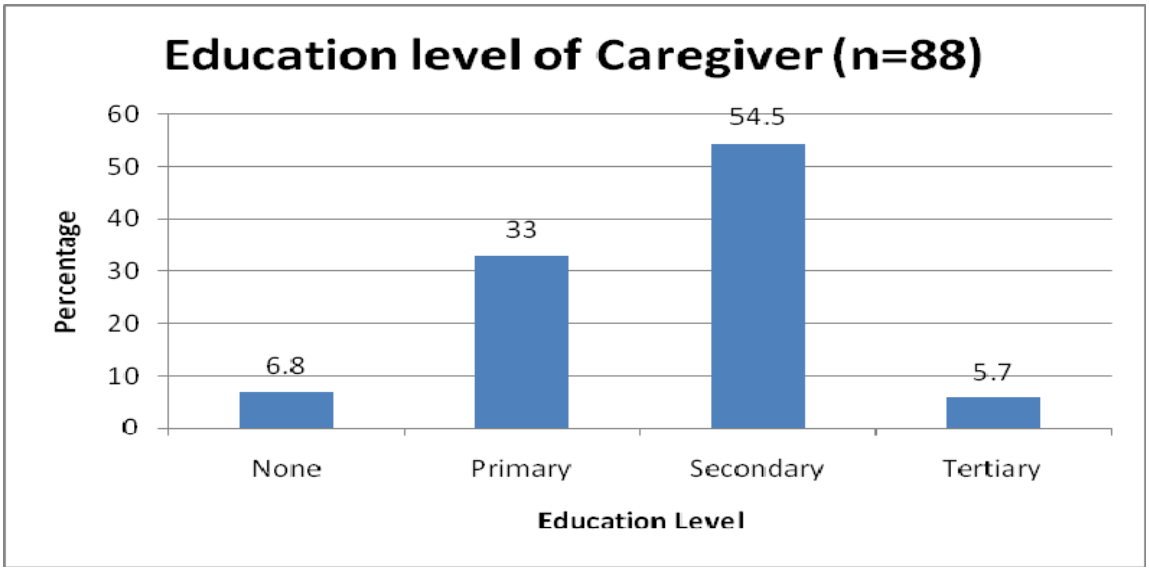

Figure 15: Education level of caregiver

The proportion of children with severe acute malnutrition was higher in the non- educated (3/6) as compared to the educated (10/82). Among the caregivers with tertiary education, there were no children with severe wasting, stunting or underweight. Analysis of the results showed that low level of education in the caregiver was significantly associated with malnutrition in the child as shown in Table 6.

Higher education level of the caregiver was associated with fewer number of children in the family (χ^2=9.7312, p=0.0452), increased birth spacing (χ^2=13.9137, p=0.0076) and children on being on HIV treatment (χ^2=7.2878, p=0.0261) as shown in Table 27 in appendix 4.

4.5.4 Employment status of the primary caregiver.

Forty Six (52.3%) of the caregivers were working while 42 were not employed. Thirty of the 46 employed caregivers were formally employed while 16 were self employed. The proportion of children with severe wasting was higher among the unemployed caregivers (10/42) when

compared to the employed caregivers (3/46). Analysis showed that caregiver unemployment was associated with wasting in the child (χ^2=7.5541, p=0.0229).

4.5.5 Health status of caregivers

Eighty-two (93.2%) of the caregivers were healthy while 6 were ill. As expected the proportion of children with severe malnutrition was higher in the sick caregivers than in healthy caregivers. However analysis showed no statistically significant association between health status of caregiver and nutritional status of child (p=0.2188).

4.6 Family income and food security

4.6.1 Family Income

Eighty seven families were assessed for family income while one child was excluded because he was staying in a children's home. Figure 16 shows the distribution of number of people in the house with regular income.

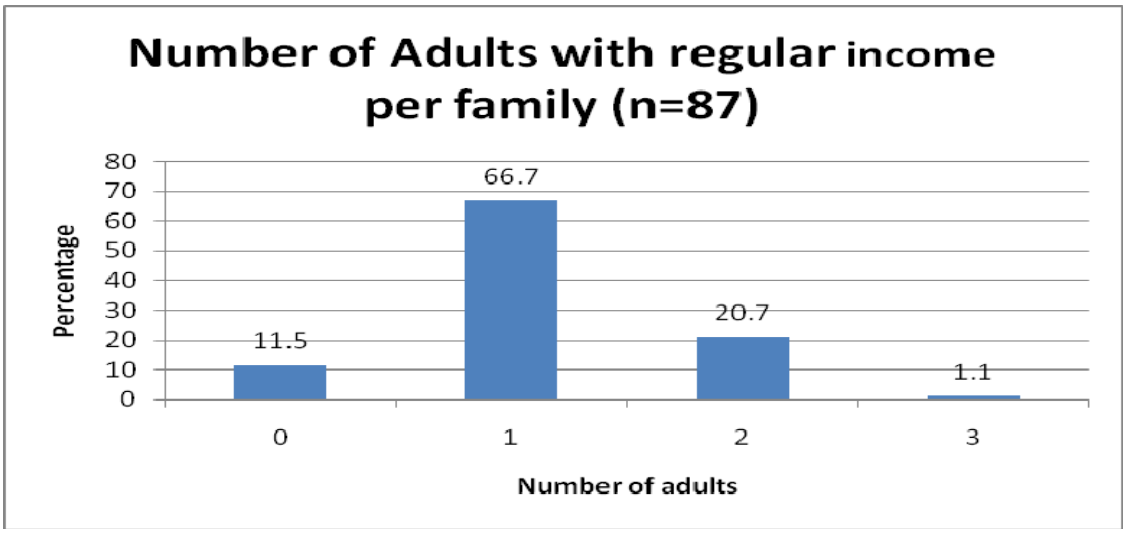

Figure 16: Number of adults with regular income per family

In 10 families there was no one with a regular income and these families relied on support from other sources. Number of working adults per family was inversely associated with wasting (χ^2=14.8836, p<0.001) and underweight (χ^2= 18.1971, p<0.001) in children.

Average household income

Thirty eight (42.3%) of the families were living on less than N$ 500 per month as shown in Table 5.

Table 5: Household income for children with severe malnutrition

Household Income Namibian Dollars N$	**Frequency**	**%**	**Severe Acute Malnutrition WFH< -3**	**Severe Stunting HFA<-3**	**Severe Underweight WFA<-3**
<500	38	42.3	9	7	12
500-999	21	23.9	2	7	3
1000-1499	13	14.8	0	1	1
≥ 1500	15	17.0	1	1	2

The proportion of children with severe malnutrition decreased with increase in family income as shown in Figure 17.

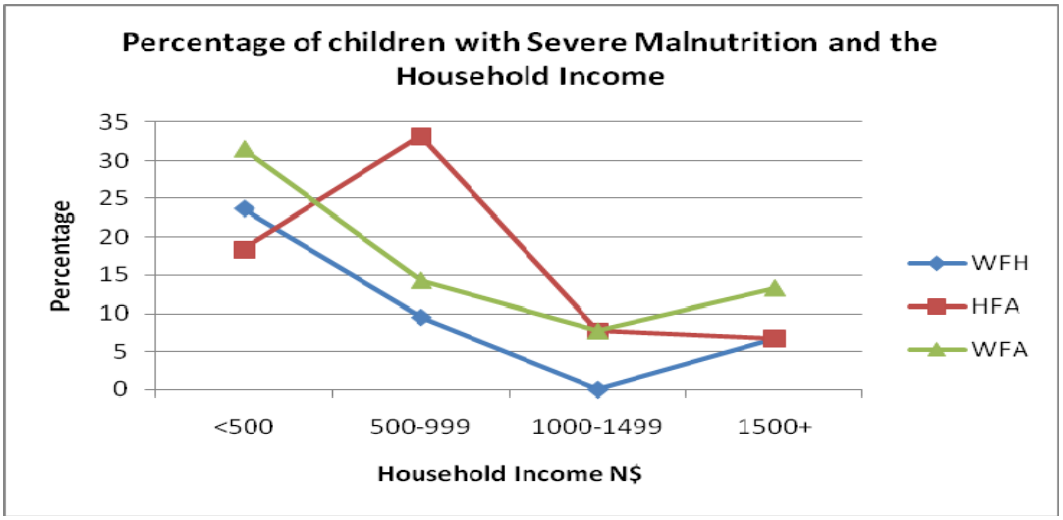

Figure 17: Distribution of children with severe malnutrition and household income.

Analysis showed that household income was inversely associated with malnutriton ($p<0.001$) in children as shown in Table 6.

4.6.2 Food Availability

During the survey, the number of meals consumed by the caregivers in the 24hours preceding the interviews ranged from 1 to 4. The average number of meals consumed by an adult family member per day ranged from 1 to 3. The proportion of children with malnutrition was statistically significantly lower in families with more meals per day ($p<0.001$) as shown in table 6 below.

Twenty one families had borrowed money in the last three months to buy food. Analysis showed no significant association between borrowing money and malnutrition in the child ($p= 0.1105$).

4.6.3 Food Sources.

During the survey all 88 families said they were buying food from the shops. In addition to purchasing food from the shop, 8 families supplemented their food through local production while 1 family occasionally borrowed food from the other community members. Four families received food aid in addition to the food they purchased in shops. Figure 18 shows the food sources for the families who participated in the study.

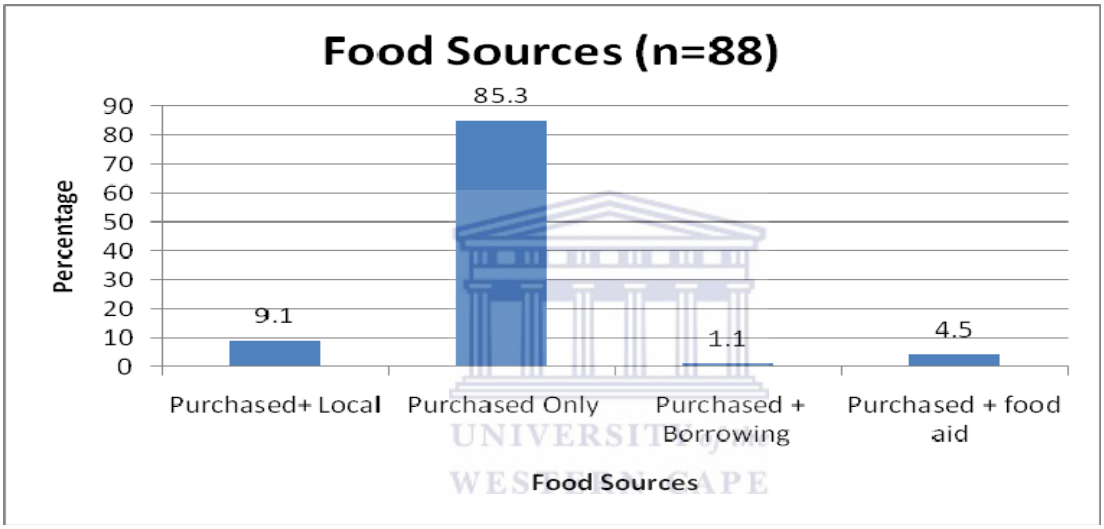

Figure 18: Food Sources for families who participated in the survey.

Food sources for the families were not associated with the nutritional status of the child (p=0.1639).

Table 6 and 7 show risk factors which were statistically associated with malnutrition.

Table 6: Risk factors for malnutrition in children – Chi square test.

Predictor	WFH (Weight for Height)			HFA (Height for Age)			WFA (Weight for Age)		
	χ^2	**Df**	**p-value**	χ^2	**Df**	**p-value**	χ^2	**Df**	**p-value**
Number of adults	***6.0815***	***2***	***0.0478***	***8.0109***	***2***	***0.0182***	***8.1072***	***2***	***0.0174***
Age group	3.6617	2	0.1603	***8.1839***	***2***	***0.0167***	2.3588	2	0.0727
Diarrhea	***8.7354***	***2***	***0.0127***	***12.980***	***2***	***0.0015***	***19.8531***	***2***	***0.0000***
Respiratory Infections	***6.1126***	***2***	***0.0471***	***6.9659***	***2***	***0.0307***	***12.3659***	***2***	***0.0021***
Other infections	4.5790	2	0.1013	***14.8442***	***2***	***0.0006***	***10.4818***	***2***	***0.0053***
Parent status (child cared for by either both biological parents, one parent or none)	2.4263	2	0.2973	***6.5061***	***2***	***0.0387***	2.5779	2	0.2756
Caregiver education	***9.8975***	***2***	***0.0071***	***13.5811***	***2***	***0.0011***	***6.8412***	***2***	***0.0327***
Caregiver employment	***7.5541***	***2***	***0.0229***	4.8186	2	0.0899	1.8660	2	0.3934
Number of adults with regular income	***14.8336***	***2***	***0.0006***	3.5299	2	0.1959	***18.1971***	***2***	***0.0001***
Household income	***17.7281***	***2***	***0.0001***	***9.0497***	***2***	***0.0108***	***25.5981***	***2***	***0.0000***
Average number of meals for adults	***22.7634***	***2***	***0.0000***	***7.1937***	***2***	***0.0274***	***23.3074***	***2***	***0.0000***
Nutritional status of caregiver	4.0900	2	0.1294	0.0771	2	0.9622	***7.8684***	***2***	***0.0196***

Table 7: Risk factors for malnutrition in children- Odds ratios.

Predictor	Acute Malnutrition/Wasting				Stunting				Underweight			
	OR	**95 % CI**	**χ^2**	**p-value**	**OR**	**95% CI**	**χ^2**	**p-value**	**OR**	**95% CI**	**χ^2**	**p-value**
Toilet (flush)	1.16	0.47-2.89	0.02	0.8803	***0.23***	***0.07-0.72***	***6.93***	***0.0085***	0.47	0.13-1.56	1.24	0.266
CD % <25%	2.30	0.89-5.99	2.87	0.0905	2.29	0.89-5.90	2.88	0.0895	***4.74***	***1.57-14.67***	***8.51***	***0.0035***
WHO Stage 1&2	***0.22***	***0.08-0.63***	***9.01***	***0.0023***	***0.20***	***0.07-0.55***	***10.83***	***0.0010***	***0.14***	***0.04-0.49***	***11.16***	***0.0008***
Received Vit A	0.40	0.14-1.15	2.75	0.0971	0.61	0.22-1.65	0.73	0.3931	***0.11***	***0.02-0.54***	***9.14***	***0.025***

*OR Odds ratio, *CI- Confidence interval

Summary of Results

In summary, the prevalence of malnutrition in HIV positive children<18 months attending at the HPAC in Namibia is high. The study showed that 56.8% of children were wasted (14.8% had severe wasting), 52.3% were stunted (18.2% had severe stunting) and 69.3 % underweight (20.5% were severely underweight). Malnutrition in children was associated with fewer number of working adults per family, frequent illnesses in the child, low level of caregiver education, caregiver unemployment, low household income and lack of adequate food in the family. Children of malnourished caregivers were more likely to be underweight. Further analysis showed association between poor sanitation and increased frequency of diarrhoea illness. Educated caregivers were more likely to have smaller families. The children of educated mothers had longer birth intervals and were more likely to be on HAART.

CHAPTER 5 – DISCUSSION

This chapter presents the discussion of the results of the study on prevalence of and risk factors for malnutrition in HIV positive infants attending HPAC.

Although the prevalence of malnutrition among HIV positive infants attending HPAC was higher than the prevalence in the general paediatric population in Namibia (MOHSS, 2008a), it was comparable to findings for HIV positive children in other countries (Padmapriyadarsini et al, 2009; Weigel et al ,2010). Factors such as nutritional status of caregiver, sanitation, past illness in the child, parent status, caregiver education, family income and food availability were found to be statistically associated with malnutrition. Similar results were observed in studies in many different settings (WHO, 2007).

It was interesting to note that with some factors such as family size, birth order, birth spacing, child's immunization status and health status of caregiver, trends in the results suggested a relationship between the factors and malnutrition. However statistical analysis showed no significant association between these factors and malnutrition in children. In a study, a small sample size may lead to inconclusive or imprecise results. A result is inconclusive if the sample size is small to declare observed effect statistically significant and a result is imprecise if a small sample size results in wide confidence limits for the population characteristic being estimated (Joubert & Katzenellenbogen, 2007). Thus lack of statistically significant association with the above factors despite the observed trends may be due to the small sample size giving inconclusive results.

It was surprising to note that feeding practices were not associated with nutritional status in children. This is in contrast to data from many studies suggesting an association (WHO, 2007). This point is discussed further below.

Nutritional Status

Nutritional Status of Children- The prevalence of malnutrition in HIV positive infants attending HPAC is high. In the study 56.8% of children were wasted, 52.3% were stunted and 69.3 % were underweight. The findings are comparable to the findings of a study in India which showed that the prevalence of underweight was 63%, stunting 58%, and wasting 16% (Padmapriyadarsini et al, 2009). In a similar study in Malawi, 52% of HIV positive children aged<15years were underweight while 69% were stunted (Weigel et al, 2010).

The prevalence of malnutrition observed at HPAC is higher when compared to the Namibian Demographic and Health Survey conducted from 2006 to 2007. The survey found the prevalence of underweight to be 8.8% in children under 1yr and 26.6% in children 1-2years. The same survey showed that in Khomas region, the region under which the HPAC falls, 14.9% of children were underweight.

Many reasons could be contributing to the high prevalence. HIV infected children are at higher risk of malnutrition and growth failure than their HIV negative peers (WHO, 2007). Some HIV positive patients present late to the clinic for diagnosis and treatment. Children presenting late are more likely to be chronically unwell. This study found that 36% of children had been diagnosed with HIV infection after 12 weeks instead of the recommended 6 weeks. HIV positive children presenting late for diagnosis and treatment tend to have frequent illnesses increasing the risk of malnutrition (ANECCA, 2006).

Nutritional assessment in children was done using z-scores. Z scores are more sensitive descriptors than percentiles thus their use implies that z score is able to identify more children who are actually malnourished (WHO, 1997). The accuracy of the z scores could be contributing to the high rates of malnutrition observed when compared to studies that used percentiles.

Children with severe malnutrition need intervention to reduce mortality. Thirty six children from the study children were referred for nutritional interventions. Of these 13 children with severe wasting were admitted to the hospital.

Nutritional status of the caregivers- The study showed that 15.1% of the caregivers were underweight. Malnutrition in the caregiver was associated with underweight in the child. The findings are similar to observations in a study in Bangladesh in which maternal malnutrition was found to be associated with malnutrition in the child (Rayhan and Khan, 2006). Malnourished caregivers are more likely to be sick. Ill health in a caregiver affects the ability of a caregiver to care for the child.

Risk Factors for Malnutrition

General Factors

Family Characteristics- In the study, the number of children with malnutrition was higher among children from larger families. However there was no statistically significant association found between family size or number of children in the family with malnutrition. In contrast, a study by Khattak and Ali (2010) showed a strong association of malnutrition with family size. The lack of association could be due to the small sample size of the study population resulting in

inconclusive results. As the family size increases, competition for available food is likely to increase. In cases of shortage of resources, less food becomes available for the children predisposing them to malnutrition.

As the number of adults in the family increases, it is expected that the number of working adults increase. In the study the number of adults per family was associated with number of people with regular income, thus malnutrition was less in families with more adults ($p<0.005$).

Water and Sanitation: - In Windhoek, the local authorities have improved water access to the residents in high density suburbs and in the informal settlements by installing communal water taps hence the good water access observed in the study. Access to safe sanitary facilities is lower because there are few communal toilets. The proportion of children with malnutrition was higher in families who did not have toilets at home. Similar findings were observed by Islam et al, (1994) who reported high levels of malnutrition among families with unsafe sanitation. Poor sanitation can lead to fecal contamination of water which can increase the episodes of diarrheal illnesses subsequently leading malnutrition.

Infant Factors

Birth order: - In the study birth order was not statistically associated with malnutrition ($p=0.0727$) even though observations showed that the number of children with malnutrition was higher among children with higher birth order. This could be because of a small sample size giving inconclusive results. In contrast, studies by Jeyaseelan & Lakshiman (1997) and Kurup & Khandekar (2004) showed an association between higher birth order and malnutrition. As the birth order increases, so does the number of children and the family size. Children from bigger families have an increases the risk of malnutrition than children from smaller families.

Birth spacing: - Although children with longer birth intervals were found to have better nutrition than children with shorter birth intervals, there was no significant association observed between birth spacing and malnutrition (p=0.4457). The lack of association could be due to small sample size giving inconclusive results. Demographic health surveys from most developing countries have shown a drastic reduction in the risk of malnutrition as birth interval increases (Rutstein, 2002). Longer intervals are associated with better quality of care given to the child when they are young. In families were birth spacing is short, parents have to divide attention and resources between the young children. This can compromise the quality of care given to the infant increasing the risk of malnutrition.

Infant feeding practices- Most children in the study came from a poor economic background. Despite the poor economic background in most families, some families opted to use replacement feeding even if it was not affordable. Complementary feeds were being introduced early. The study results showed no statistical association between past or current feeding practices and malnutrition. This is in contrast to many studies which showed breast feeding infants to be less malnourished than infants on replacement feeding (WHO, 2010). The lack of statistical association could be due to small size or other factors. Therefore there is need for a further study to assess infants' feeding practices as a risk factor for malnutrition.

Even though feeding practices were not associated with malnutrition, it was interesting to note that more than half (53.7%) of breastfed infants had stopped breastfeeding before 4 months recommended in the 2007 Namibian ART guidelines. In addition, 52.3% of infants had been introduced to solid feeds early by 4 months. In breastfed infants, early introduction of complementary feeds has been found to be associated with reduced breast milk intake (Cohen et

al, 1994).This increases the risk of malnutrition. Although majority of the children in the study were introduced to solids early, there was no statistical association between age of introducing solids and frequency of diarrheal illnesses. In contrast many studies have shown higher prevalence of diarrhoeal illnesses in children introduced to complementary feeds early especially when the feeds are introduced before 6 months (WHO, 1998).

Most children who had been breastfeed early in life had been weaned at the time of study. In breastfed infants who are diagnosed HIV positive, the mothers should be encouraged to continue breastfeeding for as long as possible. This is because stopping breastfeeding in such a child does not give extra protection to the child since the child is already HIV positive.

Past Medical History:-

During the study, the severity of HIV infection in the child was assessed using WHO clinical stage and CD4 %. Results showed a higher proportion of children with advanced HIV infections other than malnutrition were malnourished. The clinical staging of the child prior to initiation of antiretroviral therapy was associated with malnutrition. CD4% was however not associated with malnutrition. When a child is infected with HIV, HIV replicates in the body destroying the immune system. As the immune system becomes weaker the body loses its ability to fight infections. Children with advanced HIV infection tend to be chronically unwell increasing the risk of malnutrition (ANECCA, 2006).

The study showed that 21.6% (19) of the children were not yet on antiretroviral treatment. HIV treatment status in the child was not statistically associated with malnutrition. It was noted that 11 of the 19 children not on treatment were less than 12 months old even though they were eligible for HAART. Late initiation of treatment was due to late diagnosis in some children. In

children whose mothers were not in the PMTCT programme, the children are only referred for HIV testing if the child presents with symptoms suggestive of AIDS in the paediatric wards. Some children had been lost from the PMTCT programme and only presented at the hospital after the child had become sick. In some families late presentation was caused by lack of resources to bring the child to the hospital for care.

Vitamin Supplements-In the study, 68% of patients had received vitamin A supplements and 95.5% were on multivitamin supplements. Children who had not received vitamin A supplement were more likely to be underweight than those who had received vitamin A. These findings support those of a study by Carlier, Moulia-Pelat, Ceccon et al (1991) which showed an association between vitamin A deficiency and malnutrition. Diets of most children lack vitamin A thus its periodic dosing is recommended to prevent vitamin A deficiency (MOHSS, 2009b). Multivitamin is routinely given to all HIV positive children together with cotrimoxazole prophylaxis while vitamin A is given to all children during the immunization campaigns Micronutrients are essential in the function of the immune system. Vitamin A deficiency increases severity of infections like measles and diarrhoea and can led to eye damage. This increases the risk of malnutrition.

Previous Illnesses:-The study showed higher proportion of malnutrition in children with TB, diarrhoea, respiratory tract infections and other infections. History of TB contact, frequency of diarrhea, respiratory tract infections and other infections were associated with malnutrition. Similar findings were observed by Chintu et al (1998) who showed that prevalence of malnutrition was higher among HIV positive children and adults with chronic diarrhoea and persistent cough. Infections increase the metabolic demands in the body. Sick children tend to

feed poorly and this combined with malabsorption and increased nutritional needs led to malnutrition.

In the study, caregivers were asked the frequency of different illnesses over the 3 months prior to the interview. The 3 months was chosen so that the caregivers could report only the significant illnesses over that period as they are unlikely to recall all the minor illnesses.

Immunization: - The immunization coverage among HIV positive infants in the study was higher (90.9%) compared to 69% reported among children aged 12-23 months in the 2006- 07 NDHS report. HIV positive children are routinely followed up at the clinics for medications thus if a child miss a vaccine dose, they are more likely to be identified early and referred for vaccination.

Immunization status of the child was associated with malnutrition. Children who had missed doses of vaccines were more likely to be malnourished that children who had received all their vaccines. Similar finding were observed in Uganda where the prevalence of malnutrition was high among the children who had missed their vaccines (Kikafunda, Walker, Collett and Tumwine, 1998). Immunization of children helps reduce morbidity and mortality from childhood preventable illnesses (UNICEF, 2007).

Feeding Centres: - The study showed that the proportion of children with malnutrition was higher among those attending feeding centres. If an HIV positive child has severe malnutrition, they are admitted to the hospital for nutritional rehabilitation. Upon discharge from the hospital, they are referred to feeding centres for nutritional support. The centres are mainly for malnourished children. These centres reassess the children after 6 months and if nutrition has improved the child is discharged from the programme. Thus children attending the centres are

more likely to be malnourished. None of the children in the study were on state grants or other social grants though some of the families had applied for these grants.

Caregiver Factors

Parent status: - The study showed that children being cared for by both parents were less likely to be malnourished than children being cared for by one or no parents. All HIV positive children are at risk of malnutrition. Orphans and children in foster homes are considered as vulnerable children and they are at risk of malnutrition independent of their HIV status. Thus a child who is HIV positive and is an orphan has a much higher risk of malnutrition. In Malawi, young orphanage children were more likely to be undernourished and more stunted than other children in the village children (Panpanich, Brabin, Gonani and Graham, 1999).The findings are in contrast to a study by Zidron, Juma and Ice, (2009). Their study found no difference in nutritional status between the ophans and non orphans and concluded that it was the socioeconomic status that determined the nutritional status. In Namibia most orphans are living under poor economic conditions. This increases the risk of malnutrition among orphans.

Primary caregivers:-. In the study the proportion of children with severe wasting and underweight was lower in children cared for by the biological mothers. However further analysis did not show any significant association between the primary caregiver and malnutrition in the child.

Education of primary caregiver: - In this study literacy was assessed based on the level of education. The level of literacy observed in the study (93.2% of women) is comparable to the findings the NDHS report findings. Ninety one percent of men and 89% women were shown to be literate in the 2006-07 NDHS report. Educated mothers are more likely to have more

information on health issues and have better jobs therefore better incomes than non-educated mothers.

The study showed that infants of educated caregivers especially those with secondary education or more had better nutrition when compared with infants of less educated caregivers. Education level of the caregiver was associated with nutritional status of the child. In addition educated caregivers had smaller families and they had better household income. Birth intervals between children were longer among educated caregivers. Children of educated mothers were more likely to be on antiretroviral treatment. These results are consistent with findings from many studies which showed better nutrition in children of educated caregivers (Rayhan & Khan, 2006; Jeyaseelan & Lakshiman, 1997; Islam et al, 1994).

Health Status of caregiver: - The study showed a higher proportion of malnutrition among children of sick caregivers. However statistical analysis showed no significant association (p=0.2188) between the health status of the caregiver and malnutrition in the child. Lack of statistical association could be due to the small sample size giving inconclusive results. Ill health of the primary caregiver has a direct impact on the care given to the child. Sickness in caregivers affects their ability to work and earn for the family. This reduces the resources available to care for the child increasing the risk of malnutrition.

Food security

Food security is determined by many factors including family income, food availability and food sources (Jacobs, 2009). Family income is determined by the number of working adults per family and the nature of their jobs. As the number of working adults increases in the family, so does the

family income. In the study, the number of children with malnutrition reduced as the number of working adults increased.

The study showed that 42.3% of the families survived on less than N$ 500.00 per month. These finding are comparable to the findings of the NDHS 2006-07 which showed that 50% of people living with HIV earned less than N$500.00 per month. Malnutrition was more common in families who earned less money. Similar results were reported in India where low family income was associated with malnutrition in children (Jeyaseelan & Lakshiman, 1997).

Jauch, Edwards and Cupido (2009) describe Namibia as a rich country with poor people. High levels of poverty are attributed to inequalities that exist in the country. Though Namibia is categorized as a middle income country, the proportion of the population living in poverty is high (Jauch et al, 2009). Poverty is a key underlying factor in malnutrition. Poverty leads to food insecurity in the family predisposing the children to malnutrition. The population worst affected by HIV/AIDS is the poor. People with HIV tend to have frequent illnesses. This will increases expenditure through medical bills reducing money available food increasing the risk of malnutrition.

The study showed that malnutrition was higher in children from families with food shortages. In the study food availability was approximated by assessing the number of meals an adult family has per day. An attempt was made to assess the number of meals the child had per day. Most parents responded by saying they feed their children as per need. This is common in younger children as they tend to feed frequently. Food availability was further assessed by checking if the families had borrowed money to buy food in the 3 months prior to the interview. Food shortages in a home will led to reduced food intake leading to the development of malnutrition.

Food sources- In the study all families reported that they purchased food. In addition to purchasing food a few families supplemented their diets with locally grown foods while other borrowed or received food aid. Majority of the families relied on purchasing food only. Supplementation with local foods improve the variety of the diet and reduces money spend on food. Findings from the study however showed no association between food sources and malnutrition in children.

Limitations-

The research was conducted among HIV infected children attending HPAC which is a public health facility. Most patients accessing the public health system are from poor families. Thus the study sample is not reflective of the wealthier part of the Namibian population. HIV positive children managed by private practitioners as well as HIV positive children registered in other HIV clinics in Windhoek were not included in the study population. Thus the study population might not be representative of all HIV positive infants aged <18 months.

The study to determine the prevalence of malnutrition in HIV positive infants age<18 months was done as a cross sectional study. This meant the study assessed the risk of malnutrition during a specified season. The prevalence of malnutrition in a population varies throughout the year depending on seasons, rainfall patterns and harvest. This study was done in summer were the risk of infections such as diarrhoeal illnesses is higher. Seasonal variations in the nutritional status of children during the year will therefore affect the prevalence of malnutrition observed. Thus the prevalence and risk factors for malnutrition observed may change with seasons.

The study sought to model risk factors associated with current or potential malnutrition among HIV infants at HPAC in Windhoek, Namibia. Modeling was attempted using the logistical

regression method. However due to the small sample size the model was not valid. Therefore there is need for a follow up study with a larger sample size to model the risk factors for malnutrition in HIV positive infants. However it is important to note that the results included ALL HIV positive infants in care at HPAC.

CHAPTER 6-CONCLUSION AND RECOMMENDATIONS

CONCLUSION

The study investigated the prevalence of malnutrition in HIV infants and the associated factors.

The results showed a high prevalence of malnutrition (56.8%wasting, 52.3%stunting and 51.2% underweight) among HIV positive infants. Though stunting is a sign of chronic malnutrition it was observed in children below 6 months. Malnutrition should be targeted early to reduce morbidity and mortality in children.

In addition to HIV infection, traditional risk factors (infant, caregiver and economic factors) for malnutrition in the general population were found to be contributing to malnutrition in HIV positive children. However these factors were more pronounced due to the direct and indirect effects of HIV on the child and the family.

Most children with malnutrition came from a poor economic background. It was worrying to note that despite the high prevalence of poverty, no children were receiving social grants at the time of the survey. This highlights the urgent need to address poverty in the community. Addressing poverty will increase the resources available for the family. This will improve food security and ensure that children receive frequent nutritious meals. This will reduce malnutrition in the community.

Although the study did not show any statistically significant association between feeding practices and malnutrition in children, health workers should continue to encourage HIV positive mothers to feed their infants as per the Namibian antiretroviral therapy guidelines (2010). There

is need for a further quantitative and qualitative studies with larger a sample size to further assess feeding practices as a risk factor for malnutrition.

The study recognizes that the sample size was small and not fully representative of all HIV positive infants in Namibia. Therefore the study cannot be generalized to all HIV positive infants in Namibia. There is need for a broader study looking at prevalence of and risk factors in the HIV infants from both public and private health sectors.

RECOMMENDATIONS

Health workers should be trained to screen and identify children with malnutrition early and manage malnutrition as per national guideline to prevent the complications of malnutrition in children. Health workers should assess for malnutrition at each clinic visit regardless of the child's presentation.

Currently there are no feeding programmes for children with mild to moderate malnutrition at the clinic. There is need to introduce supplementary feeding programmes for such children to prevent them from developing severe malnutrition.

There is need to strengthen health education given to the HIV positive mothers. Health workers should promote exclusive breastfeeding for six months as per the national antiretroviral therapy guidelines. Mothers should be encouraged to delay introducing complementary feeds until after six months. In addition, health education sessions should include information on general nutrition, basic hygiene and management of minor illnesses like diarrhoea. Health education should be given on every clinic visit.

The HPAC is working with community based organizations in tracing treatment defaulters. These community based workers can be trained to assess for malnutrition in children using simple methods such as the mid upper arm circumference. This will help in early identification of children with malnutrition at the community level. Children found to have malnutrition can be referred early for management.

There is need to improve linkages with social services to assist the families. These will include linkages to local councils, social welfare services and other services that can assist the families. This will help to address poverty in the community.

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APPENDICES

APPENDIX 1- QUESTIONNAIRE

Date: **NO:**

1A) General information

1.1 Patient code: _____

1.2 Parent/ Guardian's Initials (primary caregiver) _____

1.3 Family

1.3.1 Family Size_____

1.3.2 Number of children living in the same house_____

1.3.3 Number of adults living in the same house_____

1.4 Water source [1] Tape water [2] Borehole [3] Unprotected well [4] River [5] other_____

1.5 What type of toilet do you have? [1] Flush [2] Pit Latrine [3] Bucket Toilet [4] Other____

2B) Infant characteristics

2.1.1 Date of birth ___/____ /_____ 2.1.2 Age _____Months

2.1.3 Age group [1] 0-<6months [2] 6-<12months [3] 12-<18 months

2.2 Sex [1] M [2] F

2.3 Birth Order [1] 1-2 [2] 3-5 [3] >5

2.4.1 Birth Spacing form the youngest child (include any children who may have died in infancy or later)

[1] 1-2years [2] 3-5years [3] >5years [4] N/A if first child or/ in foster care

2.4.2 Any children being cared in foster care [1] Yes [2] No

2.5 Feeding History

2.5.1Past feeding (from birth)

[1] Exclusive breastfeeding until ____months

[2] Exclusive replacement feeding

[3] Mixed feeding (Specify_____)

2.5.2 Current Feeding Method [1] Replacement feeding (Formular Milk Only)

[2] Exclusive Breastfeeding

[3] Mixed feeding (Breast milk +other feeds)

[4] Formular Milk + Other feeds

[5] Weaned on solid food

2.5.3. Age at introduction of solid feeds _____months

2.6 Past Medical history

2.6.1 HIV history

2.6.1.1 Date of HIV test___/___/_____

2.6.1.2 Most recent CD4 Count-_____/ _____%

2.6.1.3 Clinical stage Pre-HAART _____

2.6.1.4 Current clinical Stage _____

2.6.1.5 On HAART [1] Yes [2] No

2.6.1.5.1 **If yes** Date of starting HAART _____/____/_____

2.6.1.5.2 Duration on HAART_____Months

2.6.1.5.3 HAART regimen [1] D4T/3TC/NVP

[2] AZT/3TC/NVP

[3] D4T/3TC/LPV/r

[4] AZT/3TC/LPV/r

[5] Other Specify_____

2.6.2.1 History of TB treatment [1] Yes [2] No

2.6.2.2. History of TB contact [1] Yes [2] No

2.6.3 Diarrhoea episodes in the last 3 months [1] None [2] 1-2 [3] 3-5 [4] >5

2.6.4 Episodes of respiratory tract infections in the past 3 months

[1] None [2] 1-2 [3] 3-5 [4] >5

2.6.5 History of treatment of Helminthic infections [1] Yes [2] No

2.6.6 Episodes of other infections in the past 3 months

[1] None [2] 1-2 [3] 3-5 [4] >5

2.6.7. Immunization status (please check on the patient's passport to verify immunizations)

[1] Immunization up-to-date

[2] Missed 1dose (Specify_____)

[3] Missed ≥2 doses (Specify_____)

2.6.7 Type of Hospitals visited

[1] Public Hospitals/Clinics [2] Private Hospital [3] Public & Private

2.6.8 Is the child attending any feeding centres- [1] Yes [2] No

2.6.8.1 If yes name of centre _____

2.6.9Is the child receiving any other feeding support [1] Yes [2] No

2.6.10 Is child receiving a state support grant [1] Yes [2] No

3) Parent/Guardian characteristic

3.1 Parents Status [1] Both parents alive and supporting the child together

[2] Both parents alive but only one parent supporting the child

[3] Mother alive/ Father deceased

[4] Father alive/ Mother deceased

[5] Both parents deceased

[6] Other (specify) _____

3.2 Primary Caregiver [1] Mother

[2] Father

[3] Other family relatives

[4] Forster care

3.3 Education of Primary Caregiver [1] None

[2] Primary

[3] Secondary

[4] Tertiary

3.4 Caregiver Employment status [1] Unemployed

[2] Employed (formal employment)

[3] Self employed

3.5 Health status of caregiver [1] Working [2] Ambulatory [3] Bedridden

3.6 Food Security

3.6.1 Family Income

3.6.1.1 How many people in the house have a regular income? _____

3.6.1.2 Is the household receiving any financial or food support? [1] Yes [2] No

If yes state source/s _____

3.6.1.3 Is the household income used to support other people not staying in the house?

[1] Yes [2] No

If yes approximately what percentage is used to support other people._____%

3.6.1.4 Average Household Income/ Month (Namibian Dollars)

[1] < 500

[2] 500-999

[3] 1000-1499

[4] ≥1500

[5] N/A if in foster care

3.6.2 Food Availability

3.6.2.1 In the last 24 hours how many meals did you have: _____

3.6.2.2 Average number of meals an adult member of the family has per day _____

3.6.2.3 Average number of meals a child in the family has per day _____

3.6.2.4 During the last 3 months have you ever borrowed food or money to buy food?

[1] Yes [2] No

3.6.2.4.1 If yes, how many times _____

3.6.3 Food Sources

3.6.3.1 The food consumed at home comes from which of the following sources (*circle the applicable answers*)

[1] Home production (Locally produced)

[2] Purchased in the shops

[3] Borrowed from other people

[4] Food aid

4) Nutritional Assessment

4.1 Weight of child _____kg

4.2 Height of child _____cm

4.3 Oedema present [1] Yes [2] No

4.4 Is the child receiving multivitamins? [1] Yes [2] No

4.5 Did the child receive Vitamin A during the last Expanded Programme for Immunization?

[1] Yes [2] No

4.6 Nutrition classification of child

4.6.1 Weight for height : z score_____

Classification [1] Normal

[2] Acute Malnutrition/ wasted (-2 to -3 z score)

[3] Severely Acute Malnutrition/ severe wasting (< -3 z score)

4.6.2 Height for Age : z score_____

Classification [1] Normal

[2] Stunted (-2 to -3 z score)

[3] Severe Stunting (< -3 z score)

4.6.3 Weight for age : z score_____

Classification [1] Normal

[2] Underweight (-2 to -3 z score)

[3] Severe underweight (< -3 z score)

4.6.4.1 Child referred for nutritional support [1] Yes [2] No

4.6.4.2 Caregiver received nutritional counseling [1] Yes [2] No

4.7 Weight of caregiver ----------kg

4.8 Height of caregiver ---------- m

4.9 BMI ----------

4.10 Nutrition classification of care giver

[1] Severely Underweight (BMI <16).

[2] Moderate Underweight (BMI 16-<17)

[3] Mild Underweight (BMI 17.0-<18.5)

[4] Normal (BMI 18.5-<25)

[5] Overweight (BMI 25.0- <30)

[6] Obese (BMI > 30)

APPENDIX 2 -INFORMATION SHEET
UNIVERSITY OF THE WESTERN CAPE
School of Public Health

Private Bag X17 ● **BELLVILLE** ● 7535 ● South Africa
Tel: 021- 959 2809, Fax: 021- 959 2872

INFORMATION SHEET

Dear Participant

Thank you for your willingness to hear about this research project. Below is the outline of the project and your potential involvement. The research is being conducted for a mini thesis. This is a requirement for the Masters in Public Health which l am studying at the University of the Western Cape. If there is anything you don't understand or are unclear about, please ask me. My contact details and those of my supervisor are recorded at the end of this memo.

Title of Research

Prevalence of malnutrition in HIV positive Infants (age< 18 months) attending a clinic in Windhoek, Namibia.

What is this study about?

This is a research project being conducted by Jebson Zingwari, an MPH student at the University of the Western Cape. We are inviting you to participate in this research project because you are the caregiver of an HIV positive child aged <18 months attending Katutura State Hospital Paediatric CDC clinic.

Good nutrition in an HIV positive child slows progression to AIDS and improves the body's ability to fight infections thus improving the child's quality of life. Malnutrition worsens HIV and HIV worsens malnutrition resulting in death. The purpose of the study is to determine the prevalence and assess tthe risk of malnutrition in HIV positive infants(age<18months). Information generated will help health workers in identifying children at risk of malnutrition and refer them appropriately.

What will I be asked to do if I agree to participate?

You will be asked some questions about the health of the child, your personal health and socio-economic history using a prepared questionnaire. Additional information on the child's health will be extracted from your child's HIV patient care booklet. The weight and height your child and yourself will be measure and recorded.

Would my participation in this study be kept confidential?

We will do our best to keep your personal information confidential. To help protect your confidentiality, patient initials and identification codes will be used on data forms. Data form will be stored in a secure place. If we write a report or article about this research project, your identity will be protected to the maximum extent possible.

What are the risks of this research?

There are no known risks associated with participating in this research project.

What are the benefits and costs of this research?

You may not get any direct benefits from this study. However information generated from the research will be used to identify HIV positive children at risk of malnutrition and refer them for nutritional assessment before malnutrition develops. This will improve the quality of care given to HIV exposed infants.

There are no costs for participating in this study other than time spent during the interview.

Do I have to be in this research and may I stop participating at any time?

Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.

Informed Consent

Your signed consent to participate in this research study is required before we proceed with the interview.

What if I have questions?

Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please contact me :

Jebson Zingwari

Student Number 2816174

Cellphone 0813356335

Work 061-2034043

E-mail jebbyzing@yahoo.com

I am accountable to my supervisor Prof Christina Zarowsky, MD, PhD . Her contact details are

Professor Christina Zarowsky, MD, PhD,

Director, UWC HIV Research Centre

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web: www.uwc.ac.za/publichealth

APPENDIX 3 -CONSENT FORM

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CONSENT FORM

Title of Research Project: Prevalence of malnutrition in HIV positive Infants (age<18months) attending a clinic in Windhoek Namibia.

The study has been described to me in language that I understand and I freely and voluntarily agree to participate. My questions about the study have been answered. I understand that my identity will not be disclosed and that I may withdraw from the study without giving a reason at any time and this will not negatively affect me in any way.

Participant's name……..

Participant's signature……

Witness…….

Date……

Should you have any questions regarding this study or wish to report any problems you have experienced related to the study, please contact the study coordinator:

Study Coordinator's Name: Prof Christina Zarowsky, MD, PhD

University of the Western Cape

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APPENDIX 4-RESULTS

Table 8: Weight for Height for children

Weight for Height	Sex		Total Frequency	Percentage
	Male	Female		
Normal	21	17	38	43.2
Mild to Moderate Acute Malnutrition	21	16	37	42.0
Severe Acute Malnutrition	**6**	**7**	**13**	**14.8**

Table 9: Height for Age classification for children

Height for Age	Sex		Total Frequency	Percentage
	Male	Female		
Normal	23	19	42	47.7
Stunted	16	14	30	34.1
Severe Stunting	**9**	**7**	**16**	**18.2**

Table 10: Weight for Age classification for children

Weight for Age	Sex		Total Frequency	Percentage
	Male	Female		
Normal	15	12	27	30.7
Underweight	24	19	43	48.9
Severe Underweight	**9**	**9**	**18**	**20.5**

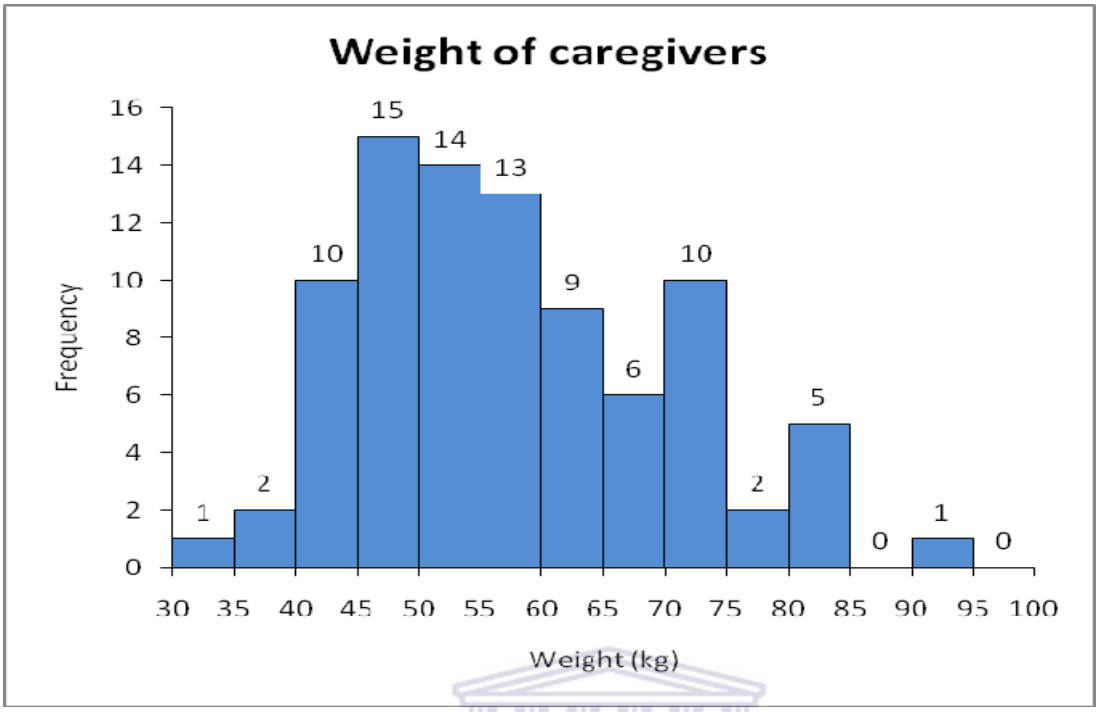

Figure 19: Weight distribution of caregivers

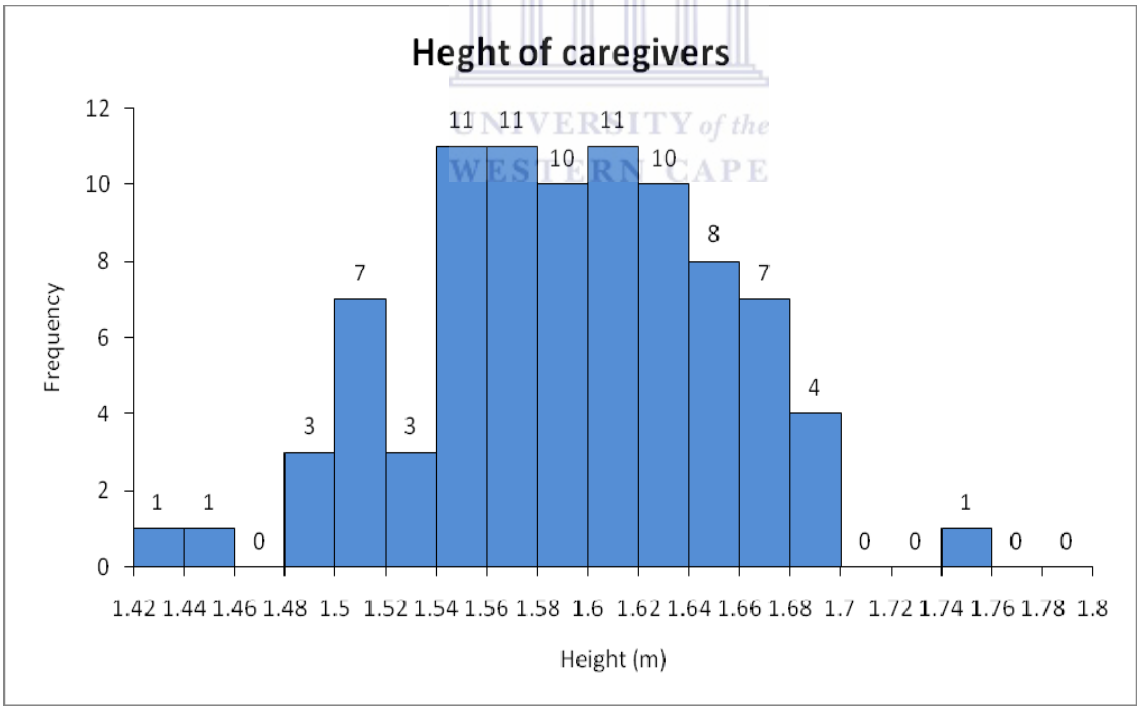

Figure 20: Height of caregivers

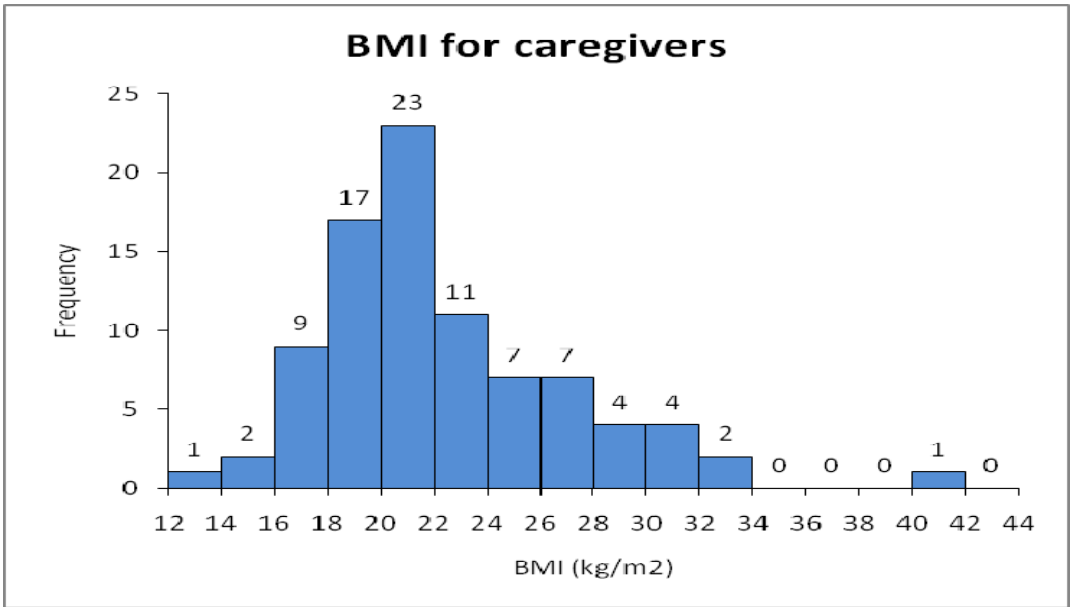

Figure 21: Histogram showing distribution of Body Mass Index for caregivers.

Table 11: BMI classification for caregivers of children with severe malnutrition.

Body Mass Index	**Frequency**	**%**	**Severe Acute Malnutrition**	**Severe Stunting**	**Severe Underweight**
Severely Underweight (BMI <16).	3	3.4	1	0	2
Moderate Underweight (BMI 16-<17)	2	2.3	1	1	1
Mild Underweight (BMI 17.0-<18.5)	9	10.2	1	3	3
Normal (BMI 18.5-<25)	52	59.1	9	8	10
Overweight (BMI 25.0- <30)	15	17.0	1	4	2
Obese (BMI > 30)	7	8.0	0	0	0

Table 12: Number of adult members in families of children with severe malnutrition

Number of Adults	Frequency	%	Severe Acute Malnutrition WFH< -3	Severe Stunting HFA<-3	Severe Underweight WFA<-3
1	20	22.7	6	8	10
2	56	64.8	5	6	6
3	5	5.7	0	0	0
4	4	4.5	0	2	1
5	2	1.1	1	0	1
6	1	1.1	1	0	0

Table 13: Children with severe malnutrition by age group

Age Group (Months)	Frequency	%	Severe Acute Malnutrition WFH< -3	Severe Stunting HFA<-3	Severe Underweight WFA<-3
0-<6	11	12.5	0	2	2
6- <12	26	29.5	5	2	6
12- <18	51	58.0	8	12	10

Table 14: Birth order for children with severe malnutrition

Birth Order	Frequency	%	Severe Acute Malnutrition WFH< -3	Severe Stunting HFA<-3	Severe Underweight WFA<-3
1-2	40	45.5	4	5	4
3-5	46	52.3	7	11	12
>5	2	2.3	2	0	2

Table 15: Severe malnourished children and their birth spacing

Birth Spacing	Frequency	%	Severe Acute Malnutrition WFH< -3	Severe Stunting HFA<-3	Severe Underweight WFA<-3
1-2	8	9.1	3	2	5
3-5	25	28.4	5	4	5
>5	42	47.7	3	6	5
First child or/ in foster care	13	14.8	2	4	3

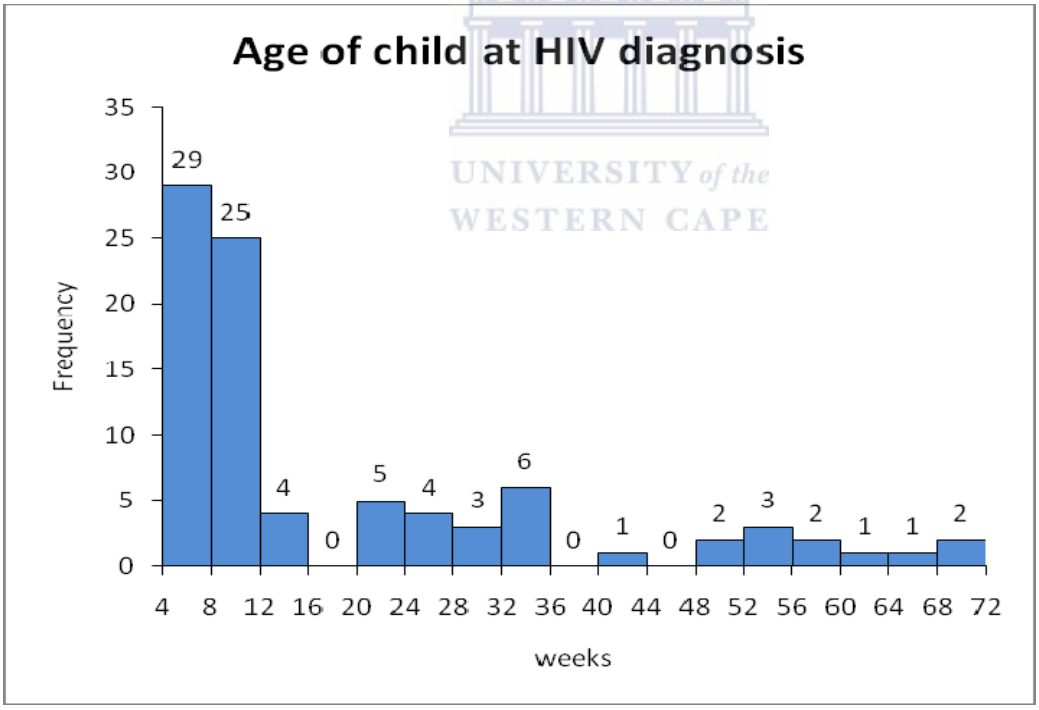

Figure 22: Age of child at time of HIV diagnosis

Table 16: Pretreatment Clinical stage for Infants attending HPAC

WHO Clinical Stage	Frequency	%	Severe Acute Malnutrition WFH< -3	Severe Stunting HFA<-3	Severe Underweight WFA<-3
I	39	44.3	3	5	3
II	11	12.5	0	3	2
III	37	42.0	9	8	13
IV	1	1.1	1	0	0

Table 17: Antiretroviral treatment status for children with severe malnutrition

On HAART	Frequency	%	Severe Acute Malnutrition WFH< -3	Severe Stunting HFA<-3	Severe Underweight WFA<-3
Yes	69	78.8	9 (13.0%)	11 (15.9%)	13 (18.8%)
No	19	21.6	4 (21.1%)	5 (26.3%)	5 (26.3%)

Table 18: Diarrhoeal episodes for children with severe malnutrition

Number of Diarrhoea Episodes	Frequency	%	Severe Acute Malnutrition WFH< -3	Severe Stunting HFA<-3	Severe Underweight WFA<-3
None	9	10.2	0	1	1
1-2	43	48.9	1	7	5
3-5	31	35.2	8	7	8
>5	5	5.7	4	1	4

Table 19: Respiratory Infection in the last 3 months in children with severe malnutrition

Number of Respiratory tract Infections	Frequency	%	Severe Acute Malnutrition WFH< -3	Severe Stunting HFA<-3	Severe Underweight WFA<-3
None	8	9.1	0	0	0
1-2	49	55.7	4	7	4
3-5	31	35.2	9	9	14
>5	0	0	0	0	0

Table 20: Immunization status in children with severe malnutrition.

Immunization	Frequency	%	Severe Acute Malnutrition WFH< -3	Severe Stunting HFA<-3	Severe Underweight WFA<-3
Up to date	80	90.9	9	13	14
Missed 1 Dose	8	9.1	4	3	4
Missed ≥ 2 Doses	0	0.0	0	0	0

Table 21: Status of parents in children with severe malnutrition

Parent Status	Frequency	%	Severe Acute Malnutrition WFH< -3	Severe Stunting HFA<-3	Severe Underweight WFA<-3
Both parents alive and supporting the child together	57	64.8	8	7	9
Both parents alive but only one parent supporting the child	21	23.9	1	5	5
Mother alive/ Father deceased	3	3.4	2	0	1
Father alive/ Mother deceased	3	3.4	1	0	0
Both parents deceased	1	1.1	1	1	1
Other	3	3.4	0	3	2

Table 22: Caregiver education and malnutrition in children

Highest level of Education of Caregiver	Frequency	%	Severe Acute Malnutrition WFH< -3	Severe Stunting HFA<-3	Severe Underweight WFA<-3
None	6	6.8	3	1	3
Primary	29	33.0	7	8	9
Secondary	48	54.5	3	7	6
Tertiary	5	5.7	0	0	0

Table 23: Employment status for caregivers of children with severe malnutrition.

Employment status for Caregiver	Frequency	%	Severe Acute Malnutrition WFH< -3	Severe Stunting HFA<-3	Severe Underweight WFA<-3
None	42	47.7	10	6	10
Formal Employment	30	34.1	3	7	4
Self Employed	16	18.2	0	3	4

Table 24: Health status of caregivers of children with severe malnutrition.

Health status of Caregiver	Frequency	%	Severe Acute Malnutrition WFH< -3	Severe Stunting HFA<-3	Severe Underweight WFA<-3
Working	82	93.2	9	14	12
Ambulatory	6	6.8	4	2	6
Bed ridden	0	0.0	0	0	0

Table 25: Analysis of risk factors for malnutrition- Chi-square test

Predictor	WFH (Weight for Height)			HFA (Height for Age)			WFA (Weight for Age)		
	χ^2	**df**	**p-value**	χ^2	**df**	**p-value**	χ^2	**df**	**p-value**
Family Size	4.3699	2	0.1125	3.1494	2	0.2071	2.5146	2	0.2844
Number of children	1.9623	2	0.3749	0.3758	2	0.8287	1.7779	2	0.4111
Number of adults	***6.0815***	***2***	***0.0478***	***8.0109***	***2***	***0.0182***	***8.1072***	***2***	***0.0174***
Age group	3.6617	2	0.1603	***8.1839***	***2***	***0.0167***	2.3588	2	0.0727
Birth order	5.1197	2	0.0773	5.8607	2	0.0534	5.2418	2	0.0727
Birth spacing	0.2761	2	0.8709	4.2828	2	0.1175	1.6161	2	0.4457
Past feeding history	0.1876	2	0.9104	1.8888	2	0.3889	2.9924	2	0.2240
Breastfeeding duration	2.3457	2	0.3095	1.7575	2	0.4153	0.2734	2	0.8722
Current feeding	1.7432	2	0.4183	2.3039	2	0.3160	0.2482	2	0.8833
Age at testing	2.6647	2	0.2639	4.7637	2	0.0924	3.7154	2	0.1560
Diarrhea	***8.7354***	***2***	***0.0127***	***12.980***	***2***	***0.0015***	***19.8531***	***2***	***0.0000***
Respiratory tract infection	***6.1126***	***2***	***0.0471***	***6.9659***	***2***	***0.0307***	***12.3659***	***2***	***0.0021***
Other infections	4.5790	2	0.1013	***14.8442***	***2***	***0.0006***	***10.4818***	***2***	***0.0053***
Parent status	2.4263	2	0.2973	***6.5061***	***2***	***0.0387***	2.5779	2	0.2756
Caregiver education	***9.8975***	***2***	***0.0071***	***13.5811***	***2***	***0.0011***	***6.8412***	***2***	***0.0327***
Caregiver employment	***7.5541***	***2***	***0.0229***	4.8186	2	0.0899	1.8660	2	0.3934
Number of adults with regular income	***14.8336***	***2***	***0.0006***	3.5299	2	0.1959	***18.1971***	***2***	***0.0001***
Household income	***17.7281***	***2***	***0.0001***	***9.0497***	***2***	***0.0108***	***25.5981***	***2***	***0.0000***

Average number of meals for adults	***22.7634***	***2***	***0.0000***	***7.1937***	***2***	***0.0274***	***23.3074***	***2***	***0.0000***
Food sources	0.1803	2	0.4138	3.7459	2	0.1537	3.6169	2	0.1639
Nutritional Classification of caregiver	4.0900	2	0.1294	0.0771	2	0.9622	***7.8684***	***2***	***0.0196***

Predictor	Acute Malnutrition/Wasting				Stunting				Underweight			
	OR	**95 % CI**	**Chi-square**	**p-value**	**OR**	**95% CI**	**Chi-square**	**p-value**	**OR**	**95% CI**	**Chi-square**	**p-value**
Water source (tape)	1.32	0.0-50.42	0.28	0.5995	0.00	0.00-4.52	0.42	0.5151	0.00	0.00-9.52	0.03	0.8601
Toilet(flush)	1.16	0.47-2.89	0.02	0.8803	***0.23***	***0.07-0.72***	***6.93***	***0.0085***	0.47	0.13-1.56	1.24	0.266
Sex (male)	1.05	0.45-2.46	0.01	0.9217	1.01	0.44-2.36	0.03	0.8608	1.06	0.43-2.64	0.01	0.9160
Age of introducing solids<4months	0.80	0.29-2.19	0.06	0.8094	0.97	0.36-2.59	0.03	0.8741	1.09	0.38-3.15	0.00	0.9514
CD Count <25%	2.30	0.89-5.99	2.87	0.0905	2.29	0.89-5.90	2.88	0.0895	***4.74***	***1.57-14.67***	***8.51***	***0.0035***
WHO Stage 1&2	***0.22***	***0.08-0.63***	***9.01***	***0.0023***	***0.20***	***0.07-0.55***	***10.83***	***0.0010***	***0.14***	***0.04-0.49***	***11.16***	***0.0008***
On HAART(yes)	0.72	0.22-2.27	0.14	0.7125	0.75	0,24-2.33	0.09	0.7682	0.21	0.03-1.06	3.50	0.0614
HAART(nonLPV/r)	0.48	0.11-1.99	0.69	0.4067	0.39	0.09-1.60	1.38	0.2406	0.46	0.09-2.14	0.60	0.4383
TB Rx (Yes)	3.22	0.31-78.96	0.38	0.5401	1.40	0.18-12.71	0.01	0.9166	1.82	0.18-45.05	0.00	0.9728

TB contact (Yes)	7.05	0.82-157.30	2.87	0.0901	1.95	0.39-10.71	0.31	0.5753	3.92	0.45-88.08	0.93	0.3359
Immunization up to date	0.17	0.01-1.46	2.14	0.1434	1.11	0.21-5.76	0.06	0.8133	0.00	0.00-1.44	2.47	0.1161
Primary caregiver (mother)	0.41	0.05-2.45	0.51	0.4749	0.63	0.11-3.33	0.06	0.8133	0.30	0.01-2.64	0,59	0.4428
Health status CC (well)	0.24	0.01-2.32	0.87	0.3516	0.20	0.01-1.90	1.33	0.2482	0.00	0.00-2.08	1.51	0.2188
Borrowed money	3.11	0.92-11.05	3.25	0.072	1.08	0.36-3.25	0.01	0.9225	3.35	0.81-15.98	2.55	0.1105
Received Vit A	0.40	0.14-1.15	2.75	0.0971	0.61	0.22-1.65	0.73	0.3931	***0.11***	***0.02-0.54***	***9.14***	***0.025***

Table 26: Analysis of risk factors for malnutrition- Odds ratios

- OR:-Odds ratio
- CI: - Confidence Interval

Table 27: Association of risk factors for Malnutrition- Chi-square test

Predictor	χ^2	**Df**	**p-value**
Family size vs Respiratory Tract Infections	6.0453	4	0.1958
Sanitation vs Diarrhoea	***7.2440***	***2***	***0.0267***
Water source vs Diarrhoea	2.1417	2	0.3427
Age of introduction to solids vs Diarrhoea	3.2804	2	0.1939
Family size vs TB contact	5.1178	2	0.0774
Age of testing vs child on HAART	2.6067	2	0.2724
Caregiver Education vs Number of children	***9.7312***	***4***	***0.0452***
Caregiver Education vs Birth order	***45.4784***	***4***	***0.0000***
Caregiver Education vs Birth spacing	***13.9137***	***4***	***0.0076***
Caregiver Education vs child on HAART	***7.2878***	***2***	***0.0261***
Caregiver Education vs immunization	4.5609	2	0.1022
Caregiver Education vs household income	8.4308	4	0.0770

APPENDIX 5-RECLASSIFICATION OF VARIABLES

As the sample size (88) was relatively small, analysis including all the levels in both dependent and independent variables would have led to most cells in the resulting contingency table having very low expected frequencies and in turn, giving inaccurate inference. Therefore dependant variables were collapsed to 2 level and independent variables were regrouped to 2 or 3 levels as shown below

WFH-	**1**-; normal	**2** - acute malnutrition/wasting (mod +severe)
HFA –	**1**- ; normal	**2**- stunting (mod +severe)
WFA-	**1**- ; normal	**2**- underweight (mod +severe)

Family size	**1** -<3,	**2**- 3to5,	**3**- >5
Number of adults	**1** - 1	**2**- 2	**3**- ≥ 3
Number of children	**1**- 1,	**2**- 2	**3**- ≥ 3
Water source	**1** Tap	**2**- other	
Toilet	**1**- flush	**2**- non-flush	

Age Group	**1**-<6 months;	**2** 6-<12 months;	**3**- 12-<18months
Birth order	**1**- 1-2 yrs	**2**- 3-5yrs	**3**- ≥ 5
Birth spacing	**1**- 1-2	**2**- 3-5	**3**- **≥5**
	4- N/A if first child or foster care		
Duration of Exclusive breastfeeding	**1**- <4 months	**2**- 4months	**3**- >4months
Current feeding	**1**- exclusive feeding (Breast+formular)		
	2- Mixed feeding (breast or formular + other feeds)		**3**- weaned
Age of introducing solids	**1**- ≤4 months	**2**- >4months	
Age at HIV diagnosis	**1**- ≤8 weeks	**2**- >8 to 12 weeks	**3**- > 12 weeks
CD4%	**1**- ≤25%	**2**- >25%	
Pre HAART clinical stage	**1**- I&II	**2**- III&IV	

HAART Regimen **1**- Non LPV/r regimen **2**- LPV/r based regimen

Frequency of illnesses **1**- None **2**- 1 to 2 episodes **3**- ≥3 episodes

Parents status- **1**) care by both parents

2- care by one parent (that is children with both parents alive but one parent supporting the child and those with one deceased parent)

3- others(both parents dead + others)

Primary caregiver **1**- Mother **2**- Other

Caregiver education **1**- none

2- Primary

3- Secondary +Tertiary

Number of people with regular income **1**- Nil **2**- 1 **3**- >1

Household income **1**- <500 **2**- 500-1499 **3**- ≥1500

Average number of meals **1**- 1 **2** - 2 **3**- 3

Food Sources **1**- Home production

2- purchased only

3- other (borrowed/food aid)

BMI care giver **1**- underweight (BMI<18.5)

2- normal

3- overweight/obese (BMI ≥ 25)

APPENDIX 6- WHO GROWTH CHARTS

Table 28: Length for Age Boys.

Length-for-age BOYS

Birth to 2 years (z-scores)

World Health Organization

Year: Month	Month	L	M	S	SD	Z-scores (length in cm)						
						-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
0: 0	0	1	49.8842	0.03795	1.8931	44.2	46.1	48.0	49.9	51.8	53.7	55.6
0: 1	1	1	54.7244	0.03557	1.9465	48.9	50.8	52.8	54.7	56.7	58.6	60.6
0: 2	2	1	58.4249	0.03424	2.0005	52.4	54.4	56.4	58.4	60.4	62.4	64.4
0: 3	3	1	61.4292	0.03328	2.0444	55.3	57.3	59.4	61.4	63.5	65.5	67.6
0: 4	4	1	63.8860	0.03257	2.0808	57.6	59.7	61.8	63.9	66.0	68.0	70.1
0: 5	5	1	65.9026	0.03204	2.1115	59.6	61.7	63.8	65.9	68.0	70.1	72.2
0: 6	6	1	67.6236	0.03165	2.1403	61.2	63.3	65.5	67.6	69.8	71.9	74.0
0: 7	7	1	69.1645	0.03139	2.1711	62.7	64.8	67.0	69.2	71.3	73.5	75.7
0: 8	8	1	70.5994	0.03124	2.2055	64.0	66.2	68.4	70.6	72.8	75.0	77.2
0: 9	9	1	71.9687	0.03117	2.2433	65.2	67.5	69.7	72.0	74.2	76.5	78.7
0:10	10	1	73.2812	0.03118	2.2849	66.4	68.7	71.0	73.3	75.6	77.9	80.1
0:11	11	1	74.5388	0.03125	2.3293	67.6	69.9	72.2	74.5	76.9	79.2	81.5
1: 0	12	1	75.7488	0.03137	2.3762	68.6	71.0	73.4	75.7	78.1	80.5	82.9
1: 1	13	1	76.9186	0.03154	2.4260	69.6	72.1	74.5	76.9	79.3	81.8	84.2
1: 2	14	1	78.0497	0.03174	2.4773	70.6	73.1	75.6	78.0	80.5	83.0	85.5
1: 3	15	1	79.1458	0.03197	2.5303	71.6	74.1	76.6	79.1	81.7	84.2	86.7
1: 4	16	1	80.2113	0.03222	2.5844	72.5	75.0	77.6	80.2	82.8	85.4	88.0
1: 5	17	1	81.2487	0.03250	2.6406	73.3	76.0	78.6	81.2	83.9	86.5	89.2
1: 6	18	1	82.2587	0.03279	2.6973	74.2	76.9	79.6	82.3	85.0	87.7	90.4
1: 7	19	1	83.2418	0.03310	2.7553	75.0	77.7	80.5	83.2	86.0	88.8	91.5
1: 8	20	1	84.1996	0.03342	2.8140	75.8	78.6	81.4	84.2	87.0	89.8	92.6
1: 9	21	1	85.1348	0.03376	2.8742	76.5	79.4	82.3	85.1	88.0	90.9	93.8
1:10	22	1	86.0477	0.03410	2.9342	77.2	80.2	83.1	86.0	89.0	91.9	94.9
1:11	23	1	86.9410	0.03445	2.9951	78.0	81.0	83.9	86.9	89.9	92.9	95.9
2: 0	24	1	87.8161	0.03479	3.0551	78.7	81.7	84.8	87.8	90.9	93.9	97.0

WHO Child Growth Standards

Table 29: Weight for age Boys.

Weight-for-age BOYS

Birth to 5 years (z-scores)

World Health Organization

Year: Month	Month	L	M	S	Z-scores (weight in kg)						
					-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
0: 0	0	0.3487	3.3464	0.14602	2.1	2.5	2.9	3.3	3.9	4.4	5.0
0: 1	1	0.2297	4.4709	0.13395	2.9	3.4	3.9	4.5	5.1	5.8	6.6
0: 2	2	0.1970	5.5675	0.12385	3.8	4.3	4.9	5.6	6.3	7.1	8.0
0: 3	3	0.1738	6.3762	0.11727	4.4	5.0	5.7	6.4	7.2	8.0	9.0
0: 4	4	0.1553	7.0023	0.11316	4.9	5.6	6.2	7.0	7.8	8.7	9.7
0: 5	5	0.1395	7.5105	0.11080	5.3	6.0	6.7	7.5	8.4	9.3	10.4
0: 6	6	0.1257	7.9340	0.10958	5.7	6.4	7.1	7.9	8.8	9.8	10.9
0: 7	7	0.1134	8.2970	0.10902	5.9	6.7	7.4	8.3	9.2	10.3	11.4
0: 8	8	0.1021	8.6151	0.10882	6.2	6.9	7.7	8.6	9.6	10.7	11.9
0: 9	9	0.0917	8.9014	0.10881	6.4	7.1	8.0	8.9	9.9	11.0	12.3
0:10	10	0.0820	9.1649	0.10891	6.6	7.4	8.2	9.2	10.2	11.4	12.7
0:11	11	0.0730	9.4122	0.10906	6.8	7.6	8.4	9.4	10.5	11.7	13.0
1: 0	12	0.0644	9.6479	0.10925	6.9	7.7	8.6	9.6	10.8	12.0	13.3
1: 1	13	0.0563	9.8749	0.10949	7.1	7.9	8.8	9.9	11.0	12.3	13.7
1: 2	14	0.0487	10.0953	0.10976	7.2	8.1	9.0	10.1	11.3	12.6	14.0
1: 3	15	0.0413	10.3108	0.11007	7.4	8.3	9.2	10.3	11.5	12.8	14.3
1: 4	16	0.0343	10.5228	0.11041	7.5	8.4	9.4	10.5	11.7	13.1	14.6
1: 5	17	0.0275	10.7319	0.11079	7.7	8.6	9.6	10.7	12.0	13.4	14.9
1: 6	18	0.0211	10.9385	0.11119	7.8	8.8	9.8	10.9	12.2	13.7	15.3
1: 7	19	0.0148	11.1430	0.11164	8.0	8.9	10.0	11.1	12.5	13.9	15.6
1: 8	20	0.0087	11.3462	0.11211	8.1	9.1	10.1	11.3	12.7	14.2	15.9
1: 9	21	0.0029	11.5486	0.11261	8.2	9.2	10.3	11.5	12.9	14.5	16.2
1:10	22	-0.0028	11.7504	0.11314	8.4	9.4	10.5	11.8	13.2	14.7	16.5
1:11	23	-0.0083	11.9514	0.11369	8.5	9.5	10.7	12.0	13.4	15.0	16.8
2: 0	24	-0.0137	12.1515	0.11426	8.6	9.7	10.8	12.2	13.6	15.3	17.1

WHO Child Growth Standards

Table 30: Length for Age Girls.

Length-for-age GIRLS

Birth to 2 years (z-scores)

World Health Organization

Year: Month	Month	L	M	S	SD	Z-scores (length in cm)						
						-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
0: 0	0	1	49.1477	0.03790	1.8627	43.6	45.4	47.3	49.1	51.0	52.9	54.7
0: 1	1	1	53.6872	0.03640	1.9542	47.8	49.8	51.7	53.7	55.6	57.6	59.5
0: 2	2	1	57.0673	0.03568	2.0362	51.0	53.0	55.0	57.1	59.1	61.1	63.2
0: 3	3	1	59.8029	0.03520	2.1051	53.5	55.6	57.7	59.8	61.9	64.0	66.1
0: 4	4	1	62.0899	0.03486	2.1645	55.6	57.8	59.9	62.1	64.3	66.4	68.6
0: 5	5	1	64.0301	0.03463	2.2174	57.4	59.6	61.8	64.0	66.2	68.5	70.7
0: 6	6	1	65.7311	0.03448	2.2664	58.9	61.2	63.5	65.7	68.0	70.3	72.5
0: 7	7	1	67.2873	0.03441	2.3154	60.3	62.7	65.0	67.3	69.6	71.9	74.2
0: 8	8	1	68.7498	0.03440	2.3650	61.7	64.0	66.4	68.7	71.1	73.5	75.8
0: 9	9	1	70.1435	0.03444	2.4157	62.9	65.3	67.7	70.1	72.6	75.0	77.4
0:10	10	1	71.4818	0.03452	2.4676	64.1	66.5	69.0	71.5	73.9	76.4	78.9
0:11	11	1	72.7710	0.03464	2.5208	65.2	67.7	70.3	72.8	75.3	77.8	80.3
1: 0	12	1	74.0150	0.03479	2.5750	66.3	68.9	71.4	74.0	76.6	79.2	81.7
1: 1	13	1	75.2176	0.03496	2.6296	67.3	70.0	72.6	75.2	77.8	80.5	83.1
1: 2	14	1	76.3817	0.03514	2.6841	68.3	71.0	73.7	76.4	79.1	81.7	84.4
1: 3	15	1	77.5099	0.03534	2.7392	69.3	72.0	74.8	77.5	80.2	83.0	85.7
1: 4	16	1	78.6055	0.03555	2.7944	70.2	73.0	75.8	78.6	81.4	84.2	87.0
1: 5	17	1	79.6710	0.03576	2.8490	71.1	74.0	76.8	79.7	82.5	85.4	88.2
1: 6	18	1	80.7079	0.03598	2.9039	72.0	74.9	77.8	80.7	83.6	86.5	89.4
1: 7	19	1	81.7182	0.03620	2.9582	72.8	75.8	78.8	81.7	84.7	87.6	90.6
1: 8	20	1	82.7036	0.03643	3.0129	73.7	76.7	79.7	82.7	85.7	88.7	91.7
1: 9	21	1	83.6654	0.03666	3.0672	74.5	77.5	80.6	83.7	86.7	89.8	92.9
1:10	22	1	84.6040	0.03688	3.1202	75.2	78.4	81.5	84.6	87.7	90.8	94.0
1:11	23	1	85.5202	0.03711	3.1737	76.0	79.2	82.3	85.5	88.7	91.9	95.0
2: 0	24	1	86.4153	0.03734	3.2267	76.7	80.0	83.2	86.4	89.6	92.9	96.1

WHO Child Growth Standards

Table 31: Weight for Age Girls

Weight-for-age GIRLS

Birth to 5 years (z-scores)

World Health Organization

Year: Month	Month	L	M	S	Z-scores (weight in kg)						
					-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
0: 0	0	0.3809	3.2322	0.14171	2.0	2.4	2.8	3.2	3.7	4.2	4.8
0: 1	1	0.1714	4.1873	0.13724	2.7	3.2	3.6	4.2	4.8	5.5	6.2
0: 2	2	0.0962	5.1282	0.13000	3.4	3.9	4.5	5.1	5.8	6.6	7.5
0: 3	3	0.0402	5.8458	0.12619	4.0	4.5	5.2	5.8	6.6	7.5	8.5
0: 4	4	-0.0050	6.4237	0.12402	4.4	5.0	5.7	6.4	7.3	8.2	9.3
0: 5	5	-0.0430	6.8985	0.12274	4.8	5.4	6.1	6.9	7.8	8.8	10.0
0: 6	6	-0.0756	7.2970	0.12204	5.1	5.7	6.5	7.3	8.2	9.3	10.6
0: 7	7	-0.1039	7.6422	0.12178	5.3	6.0	6.8	7.6	8.6	9.8	11.1
0: 8	8	-0.1288	7.9487	0.12181	5.6	6.3	7.0	7.9	9.0	10.2	11.6
0: 9	9	-0.1507	8.2254	0.12199	5.8	6.5	7.3	8.2	9.3	10.5	12.0
0:10	10	-0.1700	8.4800	0.12223	5.9	6.7	7.5	8.5	9.6	10.9	12.4
0:11	11	-0.1872	8.7192	0.12247	6.1	6.9	7.7	8.7	9.9	11.2	12.8
1: 0	12	-0.2024	8.9481	0.12268	6.3	7.0	7.9	8.9	10.1	11.5	13.1
1: 1	13	-0.2158	9.1699	0.12283	6.4	7.2	8.1	9.2	10.4	11.8	13.5
1: 2	14	-0.2278	9.3870	0.12294	6.6	7.4	8.3	9.4	10.6	12.1	13.8
1: 3	15	-0.2384	9.6008	0.12299	6.7	7.6	8.5	9.6	10.9	12.4	14.1
1: 4	16	-0.2478	9.8124	0.12303	6.9	7.7	8.7	9.8	11.1	12.6	14.5
1: 5	17	-0.2562	10.0226	0.12306	7.0	7.9	8.9	10.0	11.4	12.9	14.8
1: 6	18	-0.2637	10.2315	0.12309	7.2	8.1	9.1	10.2	11.6	13.2	15.1
1: 7	19	-0.2703	10.4393	0.12315	7.3	8.2	9.2	10.4	11.8	13.5	15.4
1: 8	20	-0.2762	10.6464	0.12323	7.5	8.4	9.4	10.6	12.1	13.7	15.7
1: 9	21	-0.2815	10.8534	0.12335	7.6	8.6	9.6	10.9	12.3	14.0	16.0
1:10	22	-0.2862	11.0608	0.12350	7.8	8.7	9.8	11.1	12.5	14.3	16.4
1:11	23	-0.2903	11.2688	0.12369	7.9	8.9	10.0	11.3	12.8	14.6	16.7
2: 0	24	-0.2941	11.4775	0.12390	8.1	9.0	10.2	11.5	13.0	14.8	17.0

WHO Child Growth Standards

Table 32: Weight for Height reference Table

Weight-for-Height Reference Table

Boys' weight (kg)				Length[a](cm)		Girls' weight (kg)				
-4 SD[b] (60%)	-3 SD (70%)	-2 SD (80%)	-1 SD (90%)	Median		Median	-1SD (90%)	-2SD (80%)	-3 SD (70%)	-4 SD (60%)
1.8	2.1	2.5	2.8	3.1	**49**	3.3	2.9	2.6	2.2	1.8
1.8	2.2	2.5	2.9	3.3	**50**	3.4	3.0	2.6	2.3	1.9
1.8	2.2	2.6	3.1	3.5	**51**	3.5	3.1	2.7	2.3	1.9
1.9	2.3	2.8	3.2	3.7	**52**	3.7	3.3	2.8	2.4	2.0
1.9	2.4	2.9	3.4	3.9	**53**	3.9	3.4	3.0	2.5	2.1
2.0	2.6	3.1	3.6	4.1	**54**	4.1	3.6	3.1	2.7	2.2
2.2	2.7	3.3	3.8	4.3	**55**	4.3	3.8	3.3	2.8	2.3
2.3	2.9	3.5	4.0	4.6	**56**	4.5	4.0	3.5	3.0	2.4
2.5	3.1	3.7	4.3	4.8	**57**	4.8	4.2	3.7	3.1	2.6
2.7	3.3	3.9	4.5	5.1	**58**	5.0	4.4	3.9	3.3	2.7
2.9	3.5	4.1	4.8	5.4	**59**	5.3	4.7	4.1	3.5	2.9
3.1	3.7	4.4	5.0	5.7	**60**	5.5	4.9	4.3	3.7	3.1
3.3	4.0	4.6	5.3	5.9	**61**	5.8	5.2	4.6	3.9	3.3
3.5	4.2	4.9	5.6	6.2	**62**	6.1	5.4	4.8	4.1	3.5
3.8	4.5	5.2	5.8	6.5	**63**	6.4	5.7	5.0	4.4	3.7
4.0	4.7	5.4	6.1	6.8	**64**	6.7	6.0	5.3	4.6	3.9
4.3	5.0	5.7	6.4	7.1	**65**	7.0	6.3	5.5	4.8	4.1
4.5	5.3	6.0	6.7	7.4	**66**	7.3	6.5	5.8	5.1	4.3
4.8	5.5	6.2	7.0	7.7	**67**	7.5	6.8	6.0	5.3	4.5
5.1	5.8	6.5	7.3	8.0	**68**	7.8	7.1	6.3	5.5	4.8
5.3	6.0	6.8	7.5	8.3	69	8.1	7.3	6.5	5.8	5.0
5.5	6.3	7.0	7.8	8.5	**70**	8.4	7.6	6.8	6.0	5.2
5.8	6.5	7.3	8.1	8.8	**71**	8.6	7.8	7.0	6.2	5.4
6.0	6.8	7.5	8.3	9.1	**72**	8.9	8.1	7.2	6.4	5.6
6.2	7.0	7.8	8.6	9.3	**73**	9.1	8.3	7.5	6.6	5.8
6.4	7.2	8.0	8.8	9.6	**74**	9.4	8.5	7.7	6.8	6.0
6.6	7.4	8.2	9.0	9.8	**75**	9.6	8.7	7.9	7.0	6.2
6.8	7.6	8.4	9.2	10.0	**76**	9.8	8.9	8.1	7.2	6.4
7.0	7.8	8.6	9.4	10.3	**77**	10.0	9.1	8.3	7.4	6.6
7.1	8.0	8.8	9.7	10.5	**78**	10.2	9.3	8.5	7.6	6.7
7.3	8.2	9.0	9.9	10.7	**79**	10.4	9.5	8.7	7.8	6.9
7.5	8.3	9.2	10.1	10.9	**80**	10.6	9.7	8.8	8.0	7.1
7.6	8.5	9.4	10.2	11.1	**81**	10.8	9.9	9.0	8.1	7.2
7.8	8.7	9.6	10.4	11.3	**82**	11.0	10.1	9.2	8.3	7.4
7.9	8.8	9.7	10.6	11.5	**83**	11.2	10.3	9.4	8.5	7.6
8.1	9.0	9.9	10.8	11.7	**84**	11.4	10.5	9.6	8.7	7.7
7.8	8.9	9.9	11.0	12.1	**85**	11.8	10.8	9.7	8.6	7.6
7.9	9.0	10.1	11.2	12.3	**86**	12.0	11.0	9.9	8.8	7.7
8.1	9.2	10.3	11.5	12.6	**87**	12.3	11.2	10.1	9.0	7.9

[a] Length is measured for children below 85 cm. For children 85 cm or more, height is measured. Recumbent length is on average 0.5 cm greater than standing height; although the difference is of no importance to individual children, a correction may be made by subtracting 0.5 cm from all lengths above 84.9 cm if standing height cannot be measured.

[b] SD: standard deviation score (or Z-score). Although the interpretation of a fixed percent-of-median value varies across age and height, and although generally the two scales cannot be compared, the approximate percent-of-median values for −1 and −2 SD are 90% and 80% of median, respectively (*Borstein J et al. Issues in the assessment of nutritional status using anthropometry.* Bulletin of the World Health Organization, 1994, 72:273-283).