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An Assessment of Outcomes of the Nutritional Supplementation Programme of Children at Prince Mshiyeni Memorial Hospital, Umlazi, KwaZulu Natal

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A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, in fulfilment of the requirements for the degree

of

Master of Science (Medicine) in the field of Community Paediatrics

Johannesburg 2015

Declaration

I, Neil Robert Stephen declare that this research report is my own work. It is being submitted for the degree of Master of Science (Medicine) in the field of Community Paediatrics. It has not been submitted before for any degree or examination at this or any other University.

_____

Signature

Date:_____day of _____(month) ____2015_____

To God, my Wife & Children,

Michelle Stephen

Grace &Thomas Stephen

Parents,

Rob & Dawn Stephen

And in memory of,

Bella Stroebel

Abstract

Aim:

Malnutrition, specifically undernutrition, contributes to a reduction in potential for childhood growth and development, and an increase in morbidity and mortality. This study seeks to investigate whether sufficient weight gain is achieved using the existing nutrition supplementation programme offered by the Dietetics Department at Prince Mshiyeni Memorial Hospital.

Methods:

A retrospective descriptive study with analytical components was undertaken. Data from children receiving nutritional supplementation was extracted from an existing database belonging to the Dietetics Department. Factors influencing weight for length/ height (WL/HZ) and BMI for age z-scores (BMIAZ), and the change in anthropometric indicators, social factors, food security, reported symptoms and nutrition risk score were analysed for significance.

Results:

All Anthropometric indicators, except length/height for age z-scores (L/HAZ), showed positive significant ($p<0.001$) change over the first month of being in the programme. Between baseline and month six, significant positive changes were found for weight for age z-score (WAZ) ($p<0.001$), WL/HZ ($p=0.004$), and BMIAZ ($p=0.028$). It is clear the programme had a significant influence on BMIAZ and WL/HZ over time, $p<0.001$ from baseline to month one, and $p<0.01$ for baseline to month six. There were no significant changes in social factors. Food gardens ($p=0.001$) and patients receiving supplements from the PEM scheme ($p=0.002$) increase significantly over the duration of 6 months. The nutrition risk score and most symptoms (except vomiting) presenting at baseline decreased significantly over time, but most significantly in the

first month ($p<0.002$). It is evident that tuberculosis (TB) significantly delayed patient outcomes of BMIAZ >-1z-score ($p=0.02$) and WL/HZ ($p=0.04$) within 6 months of nutritional treatment. There is also a positive effect ($p=0.04$) on WL/HZ outcome if the patient was already receiving supplements on the PEM scheme.

Conclusion:

The Prince Mshiyeni nutrition programme (PNP) targeted and had a positive effect on BMIAZ and WL/HZ outcomes of the malnourished children entered. There was a significant improvement in WAZ, WL/HZ, BMIAZ, and symptoms affecting nutrition over time. Food gardens and the number of patients accessing the PEM scheme increased significantly over the duration of the programme. The presence of TB hindered anthropometric outcomes significantly.

The PEM scheme should be strengthened at clinics by improving service delivery to encourage patients to use clinics. The clinics will benefit from hospital level dietitians supporting their nutrition services. The importance of nutrition and adherence to treatment must be emphasised in TB programmes specifically in children. Food gardens should be emphasised in nutrition programmes at all levels of care. Seeds could be issued along with patient education on food gardening. Access to child support grants must be improved. Further research is required on TB, TB treatment adherence, and the possible effect on nutrition status, why patients have not accessed the PEM scheme at clinics, why patients have not accessed CSG's from birth, and how food gardens could contribute significantly to food security.

The PNP programme has positively affected anthropometric outcomes of patients, and this study exposes, and provides possible solutions to the challenges presented.

Acknowledgements

I wish to thank my supervisors, Ms Wiedaad Slemming and Dr Moherndran Archary, whose enthusiasm, encouragement and professional input were crucial to the completion of this research project. Their dedication and hours of reviewing this document are much appreciated. Also to Prof Haroon Saloojee for being an inspiration, helping us believe we can change the face of Maternal & Child Health. Finally, thank you to the KZN Department of Health and the Dietetics Department at Prince Mshiyeni Hospital for granting the permission to conduct this research in their department.

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Abbreviations:

BMI	Body mass index
BMIAZ	Body mass index for age z-score
CSG	Child Support Grant
DOH	Department of Health
HAZ	Height for age z-score
HIV/AIDS	Human immunodeficiency virus infection / acquired immunodeficiency syndrome
IMAM	Integrated management of acute malnutrition
INP	Integrated Nutrition Programme
IQR	Interquartile range
KZN	KwaZulu Natal
LAZ	Length for age z-score
LFBMS	Lactose free breast milk substitute
LNS	Lipid based nutrient supplement
MAM	Moderate acute malnutrition
MCWH	Maternal, Child and Women's Health
MUAC	Mid upper arm circumference
NCHS	National Centre for Health Statistics
NCLF	Nutritionally complete lactose free supplement
NFCS	National Food Consumption Survey
NRS	Nutrition Risk Score
NRST	Nutrition risk screening tool
PEM	Protein energy malnutrition
PMMH	Prince Mshiyeni Memorial Hospital
PMTCT	Prevention of Mother to Child Transmission Clinic
PNP	Prince Mshiyeni Hospital Nutrition Programme
POPD	Paediatric Outpatient Department
RUTF	Ready to use therapeutic feed
SAM	Severe acute malnutrition
SANHANES	South African National health and Nutrition Examination Survey
TB	Tuberculosis
UNICEF	United Nations Children's Fund
WAZ	Weight for age z-score
WHO	World Health Organization

WHZ	Weight for height z-score
WL/HZ	Weight for length or height z-score
WLZ	Weight for length z-score

1. Background to the study

1.1 Introduction

Worldwide, undernutrition is a contributing cause in 30% of under-five childhood mortality.[1] All forms of undernutrition contribute globally toward child mortality, disease and disability with stunting, underweight and wasting affecting 26%, 16% and 5% of children less than five years of age respectively.[2] Stunting increases a child's risk of mortality up to four fold, and wasting increases the risk to nine fold.[2,3] Undernutrition during childhood also is associated with worse educational, income and productivity outcomes later in life.[2] Undernutrition in females may have intergenerational consequences which further perpetuate the cycle of malnutrition.[2]

The 2005 National Food Consumption Survey (NFCS) reported that of the children aged one to nine years in KwaZulu Natal (KZN), 15% are stunted, five percent are underweight and 1.3% is wasted.[4] Data from 2010 in KZN show that stunting is higher in rural areas (22% to 26%), and confirm the prevalence of underweight (2% to 6%) and wasting (1%).[5] Since 1994, in KZN, there has been a one percent decrease in stunting; a one percent increase in underweight; however the percentage of wasted children has remained static.[4] Information from 2010 showed that KZN had the highest reported rate of severe malnutrition in children less than five years of age in the country.[5,6] In South Africa, eThekwini has the highest metro district rate and Umkhanyakude has the highest rural district rate for severe malnutrition. Both of these districts are in the KZN province.[7]

The SANHANES 2012 reported that for South African children between the ages of zero to fourteen years, severe stunting was 3.8%, severe wasting 0.8%, and severe underweight 1.1%.[8] In KZN specifically, of the children zero to fourteen years old, the overall prevalence of stunting was below 14%, wasting was 2.4% for boys (no value for girls), severe wasting was 0.1% for boys, and

underweight for age figures were 3.4% for boys and 1.5% for girls which is lower than the previous NFCS figures, and confirms improvement in nutritional status over time.[8]

1.2 Determinants of Undernutrition

There are many factors contributing to undernutrition in children. These can be categorised as immediate determinants (inadequate dietary intake, disease), underlying determinants (Food security, feeding practices, household environment, and health service access) or basic determinants (socioeconomic factors, education, and political context).[2] Interventions should be aimed at addressing all levels of determinants affecting poor nutrition outcomes.

1.3 Nutrition Interventions

A Lancet series on nutrition states that Nutrition-specific interventions influence the immediate determinants of nutrition. These interventions are complemented by broader nutrition-sensitive interventions.[2,9]Nutrition specific interventions include breastfeeding, appropriate complementary feeding, prevention and treatment of micronutrient deficiencies and severe malnutrition, promotion of general healthy practices, good sanitation practices, access to clean safe drinking water, and the use of health services.[2,9]The Roadmap for Nutrition in South Africa 2013 to 2017, prioritises a package of interventions which are nutrition specific, categorised into behaviour change interventions (maintaining maternal health, exclusive breastfeeding promotion, improved complementary feeding, improved hygiene, and nutrition education), micronutrient and deworming programmes (micronutrients aimed at maternal health, vitamin A for children 6 to 59 months, food fortification, specific micronutrients for undernourished, HIV and TB patients), and therapeutic feeding (treatment of moderate and severe acute malnutrition).[10] These interventions have been integrated into current programmes and guidelines such as Prevention of Mother to Child Transmission, Integrated Management of Childhood Illness, Growth monitoring

and promotion, Food based dietary guidelines, and the WHO 10 Steps to the management of severe acute malnutrition.[10]

Nutrition-sensitive interventions are those that address underlying determinants of nutrition and development such food insecurity.[9] Examples of programmes attempting to address these determinants are social safety nets and agriculture including food gardens.[9] In the past decade little evidence of effectiveness has been found for home food gardens improving the nutritional status of children (mostly based on anthropometry), with the exception of the improvement of vitamin A status.[9] There is no effect of conditional or unconditional cash transfers on children's nutritional status.[9]

1.4 Access to Resources and Basic Services

Access to basic services contributes as an underlying determinant of malnutrition.[2] In KZN, a low proportion of the population had access to flush toilets in rural areas (<2%). Around half of the population in KZN rural areas had access to their own tap water (10% to 50%), and 25% to 39% used a communal or neighbours tap.[5,6] Greater than two-thirds of all households used wood as the primary source of energy for cooking.[5] Only six to eight percent of households in rural KZN reported cooking using electricity, and the same percentage reported using paraffin or gas.[5] Data from 2008 shows 11.5% of KZN having access to electricity, 24.4% with sewage and sanitation and 10.4% with solid waste management.[6]

A study in China presented good evidence that improving the quality of drinking water decreases disease in adults (11%), increases weight for height, and specifically increases height in children.[11] Based on the same data in a separate study, the proximity of drinking water was found to improve child health, but only in conjunction with maternal education.[12]

1.5 Socioeconomic Status

The employment rate in South Africa in 2009 was only 42.9% resulting in a large portion of the population dependant on social grants.[6] In 2010 KZN province had the highest number of beneficiaries from grants (unconditional cash transfer) which include, pension (old age), child support, disability, foster care, care dependency and grant in aid.[6] In KZN approximately 75% of rural households reported their main income as the Child Support Grant.[5] Less than 20% of households in rural KZN reported an income from employment[5], 27% to 35% reported an income from a pension, 11% to 19% sold vegetables to create income, and 4% to 10% had no cash income.[5] If a household was entitled to a grant but was not accessing one, the main reason was a lack of documentation.[5]

1.5.1 Cash Transfers and Nutrition

Unconditional cash transfers in Ecuador had no significant effect on HAZ[13], but a significant effect on language development for children who received the grant in rural areas during early childhood.[13] In Malawi cash transfers was effective in increasing food security and food diversity.[14] A meta-analysis of cash transfers and their effect on nutritional status found that although cash transfers had a positive effect, it was not statistically significant.[15]

Cash transfers are most effective when targeting the poorest and most vulnerable of the population such as young children.[15] They noted that providing supplements and cash needed to be in conjunction with good health care, sanitation and maternal education to be effective.[15] Unconditional cash transfers seem to be as effective as conditional cash transfers including health care participation.[15] Conditional transfers are more effective when related to health.[15]

In a South African study, receipt of a Child Support Grant (CSG) does not positively impact a child's HAZ.[16] However where mothers were educated above a grade 8 level and received a child support grant the results for HAZ improved significantly.[16]

1.6 Food Gardening

A food garden contributes to household food security which is an underlying cause of malnutrition.[2] In rural KZN 30% of the households obtained vegetables from their own gardens.[5] The proportion of households that reported to have enough food at all times is low in KZN rural areas (24% to 35%).[5] Studies have shown that in South Africa between 60-80% of total household income is spent on food in lower income households, and up to 90% of the food consumed is bought as opposed to being grown or farmed.[17] This high percentage applies to both urban and rural areas.[17] The presence of a food garden increases access to food and could play a protective role in the nutritional status of the children living in these households.

1.7 Nutrition and Associated Health Problems

Disease is an immediate cause of malnutrition, and malnutrition perpetuates disease which is a vicious cycle. A study in South Africa compared 100 severely malnourished (marasmus, kwashiorkor, marasmic kwashiorkor) children to 200 better nourished (WAZ > -2sd) children.[18] The risk factors associated with severe malnutrition were suspicion of HIV in the family, poor weaning practices, parental death, being of male sex (gender), and higher birth order (being the third born child or higher).[18] Protective factors were a diverse food intake, and the receipt of a child support grant.[18] Area of residence, the age of the head of the household, maternal age, birth weight and the age of a child are also significant determinants of malnutrition.[19]

HIV positive children are at a higher risk for malnutrition and are specifically at a higher risk for stunting.[19] A variety of HIV associated health problems were reported in the rural areas of KZN, of which fever and no appetite were most frequent (>40%), followed by respiratory and skin infections (30% to 40%); diarrhoea was reported between 24% and 35% and lastly vomiting at 15% to 24%.[5] A study investigating nutrition and disease burden reported that 12.3% of mortality

was attributable to being underweight in children.[7] Protein-energy malnutrition and diarrhoeal disease contributed 44.7% and 29.6% respectively toward the total attributable burden.[7]

Efforts to improve nutritional status and reduce the occurrence of underweight children have a substantial impact on mortality.[7] In the eThekwini district of KZN, the quality of water available to children has improved[20], resulting in the incidence of diarrhoea decreasing from 243 in 2004 to 169 per 1000 in 2011.[20] The case fatality rate due to diarrhoea and dehydration has decreased from 6.7% (2008), to 4.0% (2009), and from 6.3% (2010), to 3.0% (2011).[20]Other strategies to improve the health of children include improving Vitamin A coverage which was 55.5% in 2011[20] and maintaining immunisation coverage for children less than 1 year above 95%.[20]

1.8 Nutrition Supplementation Programmes

Studies on food insecure populations, where complementary foods were provided to children six to twenty-four months of age, showed significant increases in HAZ and WAZ; the effect on stunting did not reach statistical significance.[21] Nutrition education as a part of the supplementation programme significantly, positively influenced WAZ, HAZ, and stunting in low income, food insecure populations.[21]

The World Health Organization (WHO) protocol for the treatment of severe acute malnutrition (SAM) and protocols for treating moderate acute malnutrition (MAM) have been successful in treatment and management of malnutrition.[22] The use of ready to use therapeutic feeds in SAM is 51% more successful than other standard treatment.[22]In separate studies where oedematous malnourished children were treated, first as inpatients and continued treatment as outpatients, it was found that the programmes were more successful when supplements were continued in the outpatient phase.[23]

In a study comparing recovery rates in HIV-infected and uninfected children in nutrition programmes, no significant difference were found between the two groups, although the risk for

mortality is higher in HIV positive children.[24] HIV-positive adult recipients of nutrition care and support programmes had an increased benefit if contextual factors such as socioeconomic status, dietary diversity, and household food security were taken into consideration as entry criteria to the nutrition care process.[25]

The selection of supplements used to treat patients in nutrition programmes play a role in the recovery of the patients in the programme. In supplement programmes aimed at treating moderate acute malnutrition lipid based nutrient supplement (LNS) significantly improved recovery when compared to blended foods. Both lipid based nutrient supplements and blended foods are effective in the treatment of MAM and SAM.[26,27] The blended food supplement consisted of a mixture of corn, soya, oil and sugar; the LNS are based on WHO formulation.[26] Another study indicated a corn blended supplement to be inferior to LNS in the treatment of MAM.[22]In severe acute malnutrition use of starter and catch-up formula are recommended and are effective as a part of treatment.[22,28] The 10 steps to managing malnutrition have decreased case fatality rates of severe malnutrition, despite criticism of the composition of the formulas used.[22,28,29]

1.9 The Nutrition Programme at Prince Mshiyeni Memorial Hospital

The Integrated Nutrition Programme (INP) of the National Department of Health (DOH) in South Africa falls under the Maternal, Child and Women's Health (MCWH) cluster. There are nine focus areas of the INP, one of which is disease specific nutrition support, treatment and counselling. Part of the goal of the disease specific nutrition support, treatment and counselling is to decrease morbidity and mortality rates associated with malnutrition, communicable and infectious diseases, and debilitating diseases.[30] The strategy proposed by KZN DOH for reaching these goals is in part through the implementation of nutrition guidelines and protocols, encouragement of appropriate feeding during illness and recovery, nutrition education and dietary modification, management of malnutrition, and implementation of the food based dietary

guidelines.[30]According to a 2014 national report evaluating nutrition interventions for children under the age of five years, KZN showed the highest level of commitment to improving nutritional status among 4 provinces investigated.[31] The role of the Dietetics Department at Prince Mshiyeni Memorial Hospital (PMMH) is to apply this strategy so as to work toward this common goal.

1.9.1 Umlazi

PMMH serves the greater Umlazi area in the southern eThekwini District of KZN. Umlazi consists of approximately 1.5 million residents, of which 38% are unemployed, 34% are younger than 15 years of age, and a reported 30% of the population have no household income. Of the housing, 12% is informal and 6.4% is traditional.[32] UNICEF's conceptual framework of the determinants of malnutrition needs to be taken into account as many of the children living in the catchment area of PMMH live in poverty and are exposed to negative underlying causes of malnutrition such as food insecurity, inadequate care, inadequate access to health services, and undesirable living conditions including a lack of electricity or water.[32]

1.9.2 Prince Mshiyeni Memorial Hospital & the Dietetics Department

PMMH is a 1200 bed district hospital that offers a variety of inpatient and outpatient services. The Dietetics Department at PMMH provides services to a variety of adult and paediatric patients. Children are referred from paediatric inpatient and outpatient departments or multidisciplinary departments/ clinics within the hospital, and primary health clinics surrounding PMMH. PMMH has six main paediatric wards including two general medical wards, a gastroenteritis ward, a surgical / burns combined ward, an orthopaedic ward and a neonatal nursery. Paediatric outpatient departments include the HIV/AIDS clinic, Paediatric Outpatient Department (POPD), and the Prevention of Mother to Child Transmission Clinic (PMTCT). The main components of the multidisciplinary team include social worker, physiotherapy, occupational therapy and speech

therapy. The children referred to the Dietetics Department at PMMH usually present with undernutrition and co-morbid conditions. Examples of common co-morbid conditions include, HIV/AIDS (including those receiving anti-retroviral treatment), respiratory infections and gastrointestinal infections. Children with cerebral palsy are also received as referrals. Health workers in all areas of the hospital or surrounding clinics identify children and refer them to the dietitian either by standard written referral, verbal or telephonic referral, or by using a written referral template developed by the dietitians at PMMH. A blank page is used to write the standard referral, whereas the template contains fields prompting specific information needed for referral, and is designed to take less time to write providing tick boxes and limited required information. This referral template is based on the KZN DOH Nutrition Risk Screening tool (NRST). The KZN DOH NRST (Appendix 1) was developed by dietitians, adapted from a screening tool for adults of unknown origin.[30]

1.9.3 Nutrition Risk Screening Tool

The NRST is a tool (Appendix 1) that was used by the lower level of health facilities, mostly clinics, to enter children into the protein energy malnutrition (PEM) scheme. This allowed clinics and other health care facilities without a dietitian to issue nutrition supplements to patients.[30] A NRST was used to refer children ages zero to fourteen years of age to the health care practitioner at the facility. The tool takes into account four areas of a child's health which affects nutritional status, namely, WAZ status, appetite, ability to eat and other problems (other problems refers to the presence of HIV/AIDS, tuberculosis or other infections). Each area has sub-categories which have been allocated a score. These scores are then added together and recorded as a Nutrition Risk Score (NRS). A higher NRS indicates a greater nutritional risk and places the patient at a higher priority for dietetic intervention, and will be referred to the dietitian for treatment. Using a nutrition supplementation protocol, the dietitian offers nutritional supplementation and counselling to correct and compensate for extra needs or deficiencies in the child's diet. A score

of zero to three indicated the child was not at risk, a score of four to five indicted the child was at risk for malnutrition, and a score of six or higher indicated the child was malnourished. This NRST had no previous history of validation. A score of four or higher, required nutrition supplementation with products from the PEM scheme. These products included enriched maize meal, lactose free energy drink, and ready to use therapeutic feed (RUTF).[30]

1.9.4 The Prince Mshiyeni Hospital Nutrition Programme

The aim of the programme is to improve the nutritional status by providing adequate nutrition counselling and supplementation to children who qualify. When an inpatient is referred to the dietitian, that patient is assessed and managed appropriately in the ward until discharge. Upon discharge the patient would visit the dietitian as an outpatient. All outpatients referred to the dietitian are assessed, receive appropriate dietary counselling and if necessary, nutrition supplements to take home. If the patient was offered nutrition supplements, they would be included into the Prince Mshiyeni Hospital Nutrition Programme (PNP).

As shown in figure 1, the conceptual framework refers to underlying social factors and access to resources. Children are assessed clinically and allocated a nutrition risk score, then referred on to the PEM Scheme and/or the nutrition supplementation programme. Exposures such as disease and symptoms affect nutrition outcomes. The important measures of outcomes from the programme and deciding factors for whether or not children are discharged from the programme are the anthropometric measures of WL/HZ and BMIAZ scores.

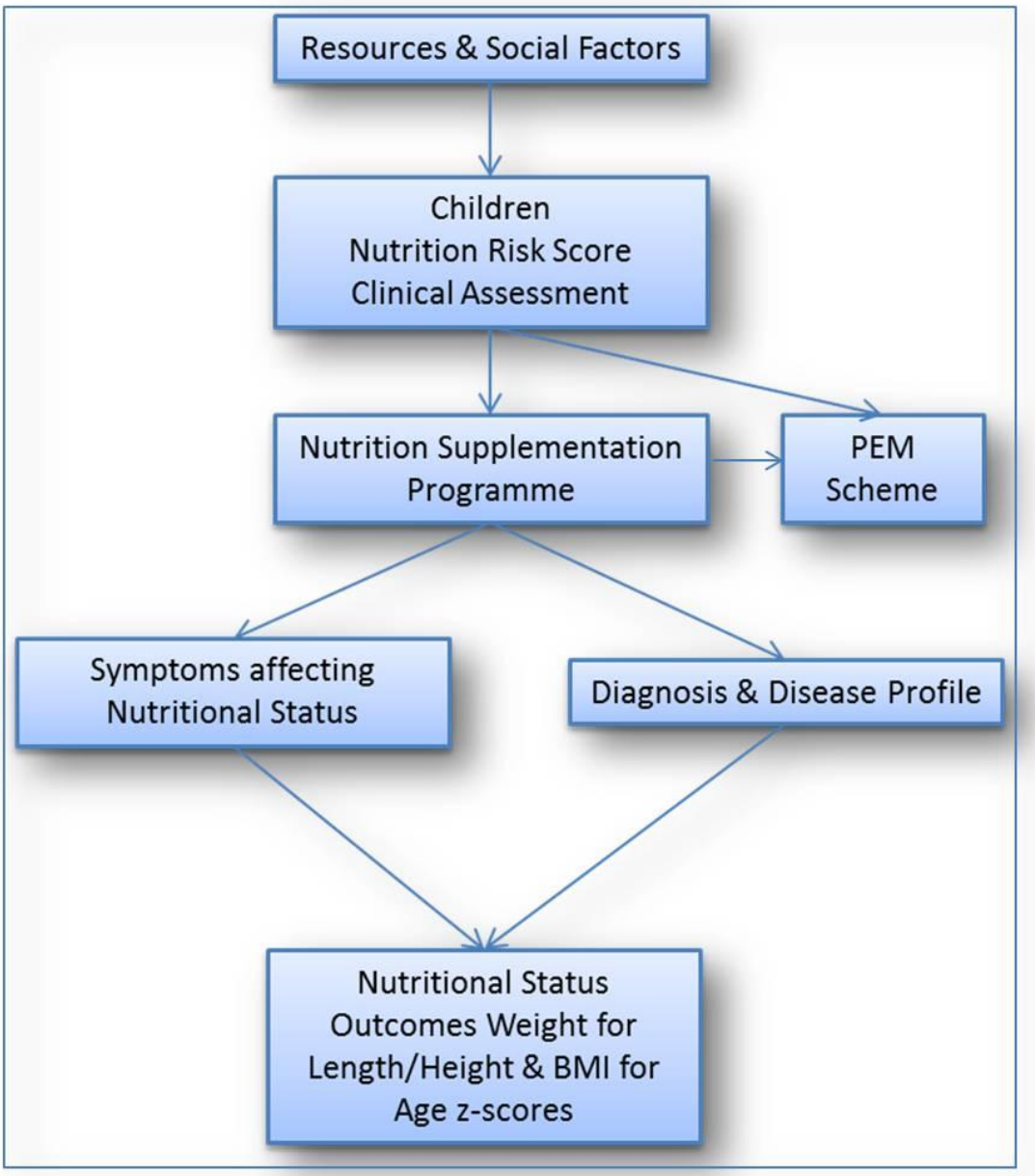


Figure 1: Conceptual Framework of the Nutrition Programme

In 2008, the dietitians at Prince Mshiyeni Memorial Hospital incorporated an adapted NRST into a referral tool for doctors and nursing sisters from the wards and outpatient departments. If any patient had a total nutrition risk score of higher than 8, the patients were referred to the dietitian. The reason the dietitians' increased the entry score is because they found that a patient with a lower score could be treated successfully on the PEM scheme alone. There were however patients referred with a lower score, and the dietitian would use their clinical judgement to assess

whether the patient should be counselled by the dietitian or referred for supplementation only from the PEM Scheme. Patients may have been entered into the PNP with a low NRS or normal anthropometrics as some patients had previously been an admitted to the ward (for example: gastroenteritis, HIV and/or TB) and the patient needed to be monitored as they may have been at risk for malnutrition. The dietitian would manage the patient as an inpatient if they were referred whilst in the hospital ward. Patients were only placed on the PNP if they were outpatients, as inpatients were treated with different protocols (relevant to an inpatient setting). Therefore upon discharge from the ward a patient would enter the PNP. Patients were accepted with the NRST adapted referral, or standard referral letter and were screened using the NRST by the dietitian when presenting with a referral letter. If the patient was already receiving supplements from the PEM scheme, the dietitian would record that information and the patient would still receive the full amount of supplements from the PNP.

The Department of Dietetics at PMMH had a database of children who had received nutritional supplementation and included information that was recorded for the nutrition risk score. The database was introduced in 2007 by the researcher. It captured relevant patient information including personal details, medication details, initial diagnosis, and at each visit information such as nutritional status, presence of a grant or employment, vegetable garden, nutrition supplement type and the duration of the consultation. When the patient returned for follow up, further information was accumulated. After each visit the information was entered into a database by an assigned dietitian.

An effort is made to meet the nutritional needs and improve the nutritional status of undernourished children by offering nutrition supplementation and education. Information on socio-economic status, access to water, and HIV status were collected as these factors all impact the nutritional status of the patient and could influence the outcome of the programme.

The WHO defines malnutrition by using the following four anthropometric z-score measures: weight-for-height (WHZ) or length (WLZ), and body mass index for age (BMIAZ) is used to indicate the severity of wasting or thinness; weight-for-age (WAZ) indicates severity of underweight for age; and the length or height-for-age (LAZ or HAZ) indicates the severity of stunting. The lower the z-score the more severe the malnutrition is. Length is used until the child reaches two years of age; thereafter the height is used for plotting purposes. An example of the WHO weight-for-height chart is included in Appendix 2.[33] The odds for mortality of a severely wasted child (weight for height <-3z) is almost nine times higher than that of a child of normal weight for height (>-1z).[3] The odds decrease to below three fold as the weight for height z-score increases to above negative three. The odds decrease further to below two fold at above -negative two z-score. There is a clear protective effect from improved nutritional status. WHO suggests that it is appropriate to discharge a child from care once they have reached a WL/HZ of greater than negative one z-score.[3]The PNP provides nutrition supplementation for approximately 6 months which should be sufficient time to achieve a safe weight for height of greater than negative one z-score. For the purpose of this study, the achievement of a weight for height z-score above negative one will be considered a good outcome or sufficient weight gain. Children and adolescents in the programme with a height of greater than 120cm cannot use weight for height z-score, therefore body mass index for age z-score of greater than negative one will also be considered as a good outcome from the programme for all ages.

This research project seeks to investigate whether sufficient weight gain (greater than negative one z-score WL/HZ or BMIAZ) is achieved using the existing nutrition supplementation programme at PMMH. Assessing the outcomes of this programme will provide information needed to make important decisions about the current programme and what needs to change to become more effective. Analysis of factors (determinants of malnutrition) that may affect weight gain will reveal challenges to the programme. A descriptive study will also reveal the strengths

and weaknesses of the programme which will add value to further planning for nutrition programmes around the country.

2. Methods

2.1 Aim of the Study

The aim of this study is to assess the outcomes of the nutritional supplementation programme at PMMH.

2.2 Objectives

1. To describe the baseline characteristics of the recipients of the nutrition supplementation programme at PMMH, in terms of age, demographics, anthropometry (including weight, height and mid upper arm circumference, head circumference), HIV status and other co-morbid disease conditions, nutritional symptoms (the presence of vomiting, diarrhoea, mouth sores, and appetite), socioeconomic characteristics (the presence of employment, a government grant, a food garden, and food supplementation received from their local clinic, access to water, and electricity), and nutrition risk score.

2. To describe the characteristics of the sample at the points of one month, three months and six months of the patient being on the programme, in terms of the number of patients at each point, the length of time (in months) remaining in the programme, the reasons for patients exiting the programme, the anthropometrics (WAZ, L/HAZ and WL/HZ, and MUAC) at each point, the change in co-morbid symptoms (nausea, vomiting, diarrhoea) at each point, the socioeconomic characteristics at each point (employment, government grant, vegetable garden, food supplementation received from local clinic), and the nutrition risk score at each point.

3. To determine the proportion of children receiving nutritional supplementation who achieved a final outcome of greater than negative one z-score using weight for height / length (WL/HZ) and body mass index for age (BMIAZ), using growth charts from the World Health Organization, during the nutrition supplementation programme.

4. To analyse factors which influence outcomes of greater than negative one z-score using the WHO weight for height / length and body mass index for age growth charts whilst the child is enrolled in the nutrition supplementation programme, by comparing them to the number of months attending, duration on supplements, HIV status, socioeconomic characteristics (employment, government grant, vegetable garden, food supplementation received from local clinic, access to water and electricity), nutritional symptoms, and the nutrition risk score.

2.3 Study Design

Retrospective descriptive study with analytical components.

2.4 Study Sample

All children referred to PMMH Department of Dietetics between January 2008 and July 2012 who received nutritional supplementation. Data from an existing database created by the PMMH Department of Dietetics, which included the researcher, was extracted.

2.5 Protocol for Issuing Nutrition Supplements

The protocol (Appendix 3) used for supplementing outpatients is broken down into ages, degree of malnutrition, and severity of diarrhoea. The age groups were zero to six months, six to twelve months, one to three years, four to six years, and seven to ten years. Mild, moderate and severe malnutrition categories are defined using the WAZ growth chart. Within each category for

malnutrition is an alternate supplement option for diarrhoea, where diarrhoea is defined as greater than three loose stools per day.

Once the child was categorised anthropometrically, nutritional supplements were issued accordingly. Appendix 3 contains a table detailing what was offered to the children. A 0 to 12 month old child with or without diarrhoea received a lactose free breast milk substitute (67kCal per 100ml) (LFBMS) as this was the only supplement available on the programme. A one to three year old child without diarrhoea received a nutritionally complete lactose free (NCLF) supplement. For mild, moderate and severe malnutrition the children received one cup (200ml per cup) (100kCal per 100ml), two cups or three cups of a NCLF supplement respectively. A second option for this regimen was offered to the patient of a ready to use therapeutic feed (RUTF) at a dose of three teaspoons to replace one cup of the NCLF supplement. The patient was given the choice. If these children had greater than three loose stools daily, they were issued a nutritionally complete semi-elemental supplement, at doses of one cup (100kCal per 100ml), two cups or three cups per day for mild, moderate and severe malnutrition respectively. Children between the ages of four and six were offered the same doses as the one to three year old children in similar categories.

All patients received counselling on appropriate nutrition, hygiene, growth monitoring, and food security (Food gardening). The patients were referred to the social worker, physiotherapist, occupational therapist, or back to the doctor when appropriate.

Outpatient records were recorded in a template developed by the dietetics department, which was filled out by the dietitian on each visit and kept in the dietetics department. All patient data was collected on a monthly basis and captured into a spread sheet.

The patients were followed up monthly. Weight was recorded monthly and height was recorded three monthly. Weight was taken on electronic scales which were calibrated when serviced. The height was taken using a height stick attached to the scale. Length was taken using length mats supplied by the department of health. As the children gained weight, the amount of supplements

decreased according to their progress. The patients were weaned off their dose on to a lower one until eventually the nutritional supplements were stopped and the child was monitored and eventually discharged. The recommended maximum time for a patient to be on the programme was six months. If a child recovered adequately by reaching its goal weight before six months they were discharged. If a child did not recover within 6 months they were reassessed for re-entry into the programme. To assess the weight for age status, the children greater than five years were plotted against the National Centre for Health Statistics (NCHS) growth charts or the National DOH Road to Health Chart (only if less than five years of age). The initial weight was taken on the first visit and is compared against the appropriate chart based on age and gender.

2.6 Inclusion criteria

All children enrolled in the nutrition supplementation programme during the period between January 2008 and July 2012.

2.7 Exclusion criteria

The study excluded patients who had only a baseline assessment (including only a baseline weight measurement) because the objectives required more than just the values from the initial visit for calculations. Patients with incomplete information such as age, diagnosis, gender etc. were also excluded.

2.8 Data Collection and Analysis

Data was extracted from an existing database using the data extraction tool (Appendix4). The z-scores for weight for age (WAZ), height for age (HAZ), length for age (LAZ), weight for length (WLZ), weight for height (WHZ), and body mass index for age (BMIAZ) were calculated using software - STAT GrowthCharts WHO lite (Austin Physician Productivity,LLC).

Microsoft Excel 2007 (Microsoft, Seattle, USA) was used for data capture and producing graphs and tables. IBM SPSS Statistics 21 (IBM Corp) was used to analyse data. Frequencies and proportions were used to describe data where appropriate. IQR and median were used where data was not normally distributed. Bivariate analyses were conducted as appropriate to explore associations between independent variables and each of the outcomes. Categorical data was analysed using a chi-squared test. Where appropriate, a p-value of <0.05 was used for significance testing.

2.9 Ethics

This study was approved by the Human Research Ethics Committee for Research in Human Subjects (Medical) at the University of the Witwatersrand (Appendix 5). Ethical approval was also granted by the Ethics Committee at Prince Mshiyeni Memorial Hospital and the KwaZulu Natal Department of Health (Appendix 6&7). Confidentiality of patient data was maintained as the patient identifiers were not entered onto the database.

3. Results

3.1 Baseline Characteristics

The PNP had a total of 537 patients data recorded, which were considered for inclusion in the study. Of these patients, six patients had no gender; seven had no date of birth, and 28 no baseline weight recorded; and 202 baseline visit (no follow up/ loss to follow up). Thus 294 patients met the inclusion criteria and were included in the analysis for this study. Approximately 47% of these patients (n=139) were female. The median age was 21 months (interquartile range [IQR] 13-51months), with a range of one to 202 months (Figure 2).

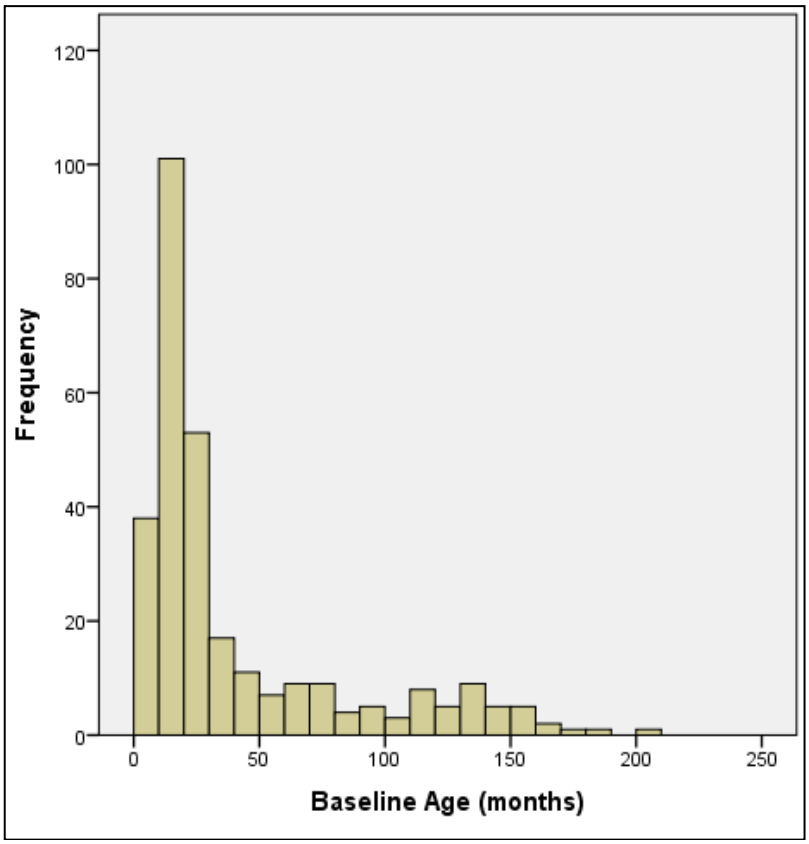


Figure 2: Distribution of Age

3.1.1 Anthropometry at Baseline

Of the children from the age of six months to 60 months, 22% had a mid-upper arm circumference of <11.5cm. More than half of the patients (137) were severely stunted (<-3z score L/HAZ). Just less than half (125) of the patients were severely underweight for age (<-3 z-score WAZ). Nearly two-thirds of the patients entered the programme at less than -1 z-score WL/HZ (129) & BMIAZ (147) (Table 1).

Table 1: Anthropometry at Baseline

Anthropometric Classification	L/HAZ Categories (N=246)	WAZ Categories (N=264)	WL/HZ Categories (N=214)	BMIAZ Categories (N=245)
	Frequency n (%)	Frequency n (%)	Frequency n (%)	Frequency n (%)
<-3z	137 (55.7)	45 (21)	125 (47.3)	56 (22.9)
-2z to -3z	56 (22.8)	42 (19.6)	67 (25.4)	38 (15.5)
-1z to -2z	33 (13.4)	42 (19.6)	49 (18.6)	53 (21.6)
0z to -1z	10 (4.1)	47 (22)	17 (6.40)	39 (15.9)
> 0z	10 (4)	38 (17.8)	6 (2.40)	59 (24)

3.1.2Referral Diagnosis & Symptoms at Baseline

Patients were diagnosed at the paediatric outpatient department or in the wards before seeing the dietitian. Over half of the patients were confirmed HIV positive, and of the HIV positive patients' majority were receiving antiretroviral therapy. The more common referral diagnoses and co-morbidities were tuberculosis, protein energy malnutrition (Table 2). The total number of patients with HIV and tuberculosis was 54. The proportion of patients with tuberculosis (n=71) who also presented with HIV (54) was 76%.

Table 2: Referral Diagnosis

Referral Diagnosis	Baseline	
	Total (N)	Frequency n(%)
HIV Negative or Unknown	294	121 (41.2)
HIV Positive	294	173 (58.8)
HIV Positive on Treatment	173	143 (82.7)
HIV Positive Treatment Naive	173	30 (17.3)
Tuberculosis	294	71 (24.1)
HIV Positive & Tuberculosis	294	54 (18.3)
Protein Energy Malnutrition	294	177 (60.2)
Gastroenteritis	294	17 (5.8)
Cerebral Palsy	294	22 (7.5)
Other - not stated	294	12 (4.1)
Biliary Atresia	294	1 (0.3)
Chronic Liver Disease	294	1 (0.3)
Down Syndrome	294	1 (0.3)
Epilepsy	294	1 (0.3)
Trisomy	294	1 (0.3)

The most common symptom reported at baseline was loss of appetite (40%)(Table 3).

Table 3: Symptoms Reported at Baseline

Reported Symptom	Baseline	
	Total (N)	Frequency n (%)
Diarrhoea	289	52 (18.0)
Vomiting	288	45 (15.6)
Mouth sores/thrush	288	55 (19.1)

Loss of Appetite	289	106 (36.9)

3.1.3 Social Factors, Available Resources at Baseline and Food Security

Many of the participants (64%) were in receipt of social assistance; the majority of whom were in receipt of a child support grant (59%) The majority of the patients had access to electricity (76%) and 44% had access to running water inside their houses. Twenty three percent of the patients reported having a vegetable garden at home, and 21% were receiving nutrition supplements from the PEM scheme (Table 4).

Table 4: Social Factors, Available Resources & Food Security at Baseline

Social Factors, Available Resources & Food Security	Baseline	
	Total (N)	**Frequency n (%)**
Any Cash Transfer (Total All)	294	189 (64.3)
Child Support Grant	294	172 (58.5)
Disability Grant	294	13 (4.4)
Foster Care	294	4 (1.4)
Pension	294	1 (0.3)
Working	284	49 (17.3)
Resources - Electricity	294	223 (75.9)
Resources - Paraffin	294	24 (8.2)
Resources - Gas	294	10 (3.4)
Resources - Water inside the house	293	130 (44.4)
Resources - River Water	293	17 (5.8)
Resources - Water Communal Pump	291	131 (45.0)
Vegetable garden	279	64 (22.9)
On the PEM Scheme	279	59 (21.1)

3.1.4 Nutrition Risk Score and Classification at Baseline

The median nutrition risk score was seven (IQR 5-9), and a range of zero to 15. The nutrition risk score at baseline after categorisation (Table 5) showed that out of 241 records, 13% patients were not at nutritional risk (score 0 to 3), and 87% patients entered with a score of four or greater. The proportion of children at risk for malnutrition was 16%, and 71% was malnourished.

Table 5: Nutrition Risk at Baseline

Nutrition Risk Classification	Baseline
	Frequency n (%)(N=241)
Not at Nutritional risk (0-3)	31 (12.9)
At Nutritional risk (4-5)	38 (15.8)
Malnourished (>5)	172 (71.4)

3.2 Characteristics at month 1, 3 & 6

3.2.1 Length of time in the programme and exit reasons

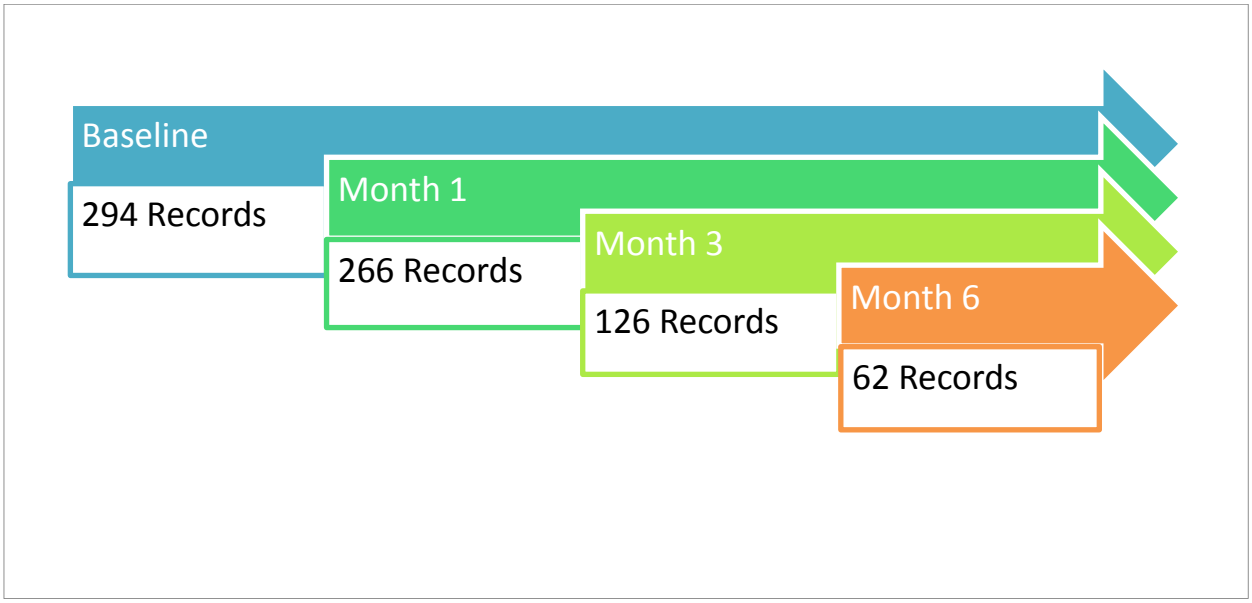


Figure 3: Records remaining at visits 1,3& 6

At month one, three and six, there remained 266, 126 and 62 records remaining respectively (Figure 3). Thirty two percent of the patients had exit dates recorded. The median days in the programme was 118 (IQR 64 – 191), range of 19 to 736 days (Figure 4).

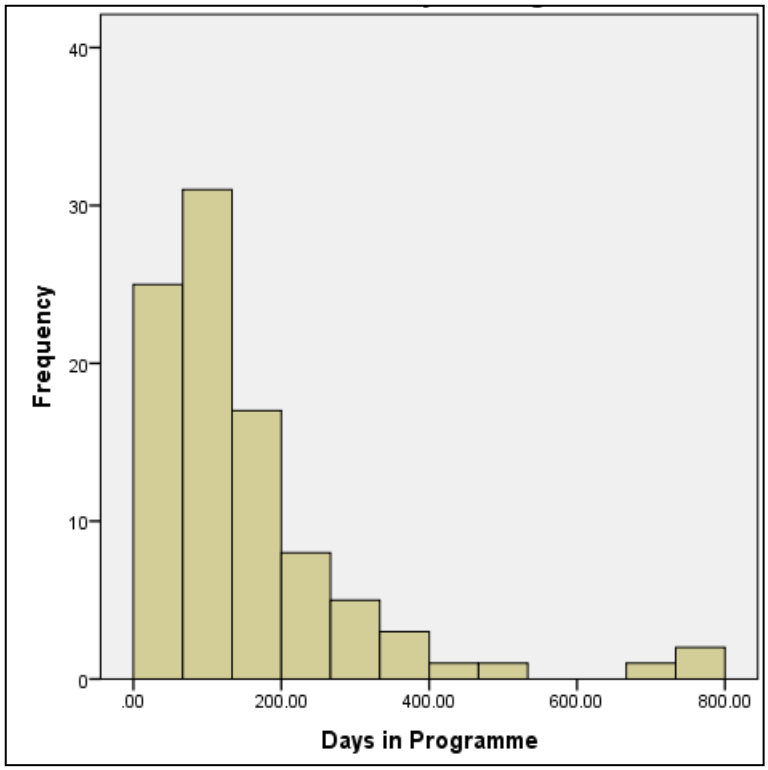


Figure 4: Period of Time in the Programme

Of the 294 patients, 87 had exit reasons. The main reasons for exiting the programme (Table 6) were that the patients reached their anthropometric goals 40%, or patients were well 52%. Four (5%) patients deceased, one (1%) was transferred to another hospital, and two (2%) were discharged for not responding to supplements (Table 6).

If a patient had reached anthropometric goals in context of the programme, it would mean that they had reached an appropriate WAZ or WL/HZ or BMIAZ. The term "Well" referred to the resolving of the symptoms they may have presented with on entry to the programme. An example of a "Well" patient would be a patient whose nutrition risk score was high because of weight loss, diarrhoea, loss of appetite and HIV infection, where the weight may have been

normal. Once the diarrhoea and loss of appetite resolves the NRS would have been low enough to discharge the patient form the programme. The circumstances for patients not responding to supplements are unknown to the researcher as there was no elaboration on the reasons for patients exiting the programme in the original database.

Table 6: Exit Reasons

Reasons for exiting the programme	Frequency n (%)(N=87)
Not responding to supplements	2 (2.3)
Reached Anthropometric goals	35 (40.2)
Death	4 (4.6)
Transfer	1 (1.1)
Well	45 (51.7)

3.2.2 Anthropometry at follow up visits

The proportion of L/HAZ <-3 (severe stunting) were, 53.5% at one month, 58.3% in the third month, and 51.7% in the sixth month. WAZ <-3 (severe underweight for age) were 36.9%, 29.5%, and 32.7%, in months one, three, and six respectively. WL/HZ<-3 (severe wasting) were, 13.2% at one month, six percent at three months and 4.3% at month six. The BMIAZ scores of less than negative three (severe thinness) at one month were, 17.2%, 4.8%, and 6.9% at months one, three, and six respectively (Table 7).

Table 7: Anthropometry at each Visit

Anthropometric Classification		Baseline	Month 1	Month 3	Month 6
		Frequency n (%)(N=246)	Frequency n (%)(N=129)	Frequency n (%)(N=84)	Frequency n (%)(N=29)
L/HAZ Categories	**<-3z**	137 (55.7)	69 (53.5)	49 (58.3)	15 (51.7)
	-2z to -3z	56 (22.8)	31 (24)	17 (20.2)	8 (27.6)
	-1z to -2z	33 (13.4)	14 (10.9)	12 (14.3)	3 (10.3)

	0z to -1z	10 (4.1)	11 (8.5)	4 (4.8)	2 (6.9)
	>0z	10 (4)	4 (3.2)	2 (2.4)	1 (3.4)
Anthropometric Classification		**Baseline**	**Month 1**	**Month 3**	**Month 6**
		Frequency n (%)(N=264)	Frequency n (%)(N=236)	Frequency n (%)(N=105)	Frequency n (%)(N=52)
WAZ Categories	**<-3z**	125 (47.3)	87 (36.9)	31 (29.5)	17 (32.7)
	-2z to -3z	67 (25.4)	62 (26.3)	25 (23.8)	12 (23.1)
	-1z to -2z	49 (18.6)	49 (20.8)	32 (30.5)	12 (23.1)
	0z to -1z	17 (6.4)	28 (11.9)	12 (11.4)	6 (11.5)
	>0z	6 (2.4)	10 (4.1)	5 (4.9)	5 (9.6)
Anthropometric Classification		**Baseline**	**Month 1**	**Month 3**	**Month 6**
		Frequency n (%)(N=214)	Frequency n (%)(N=106)	Frequency n (%)(N=67)	Frequency n (%)(N=23)
WL/HZ Categories	**<-3z**	45 (21)	14 (13.2)	4 (6)	1 (4.3)
	-2z to -3z	42 (19.6)	13 (12.3)	4 (6)	2 (8.7)
	-1z to -2z	42 (19.6)	19 (17.9)	10 (14.9)	4 (17.4)
	0z to -1z	47 (22)	29 (27.4)	18 (26.9)	5 (21.7)
	>0z	38 (17.8)	31 (29.2)	31 (46.2)	11 (47.7)
Anthropometric Classification		**Baseline**	**Month 1**	**Month 3**	**Month 6**
		Frequency n (%)(N=245)	Frequency n (%)(N=128)	Frequency n (%)(N=84)	Frequency n (%)(N=29)
BMIAZ Categories	**<-3z**	56 (22.9)	22 (17.2)	4 (4.8)	2 (6.9)
	-2z to -3z	38 (15.5)	17 (13.3)	11 (13.1)	3 (10.3)
	-1z to -2z	53 (21.6)	26 (20.3)	10 (11.9)	7 (24.1)
	0z to -1z	39 (15.9)	26 (20.3)	25 (29.8)	7 (24.1)
	>0z	59 (24)	37 (29)	34 (40.5)	10 (34.4)

The proportion of children between the age of six months and five years who had a MUAC of <11.5cm (Table 8), was 20%, 10% and 20% respectively at months one, three, and six.

Table 8: MUAC Recorded at each Visit

	Baseline	Month 1	Month 3	Month 6
MUAC (Children 6 to 60 months)	**Frequency n (%)(N=98)**	**Frequency n (%)(N=35)**	**Frequency n (%)(N=21)**	**Frequency n (%)(N=5)**
<11.5cm	22 (22.4)	7 (20.0)	2 (9.5)	1 (20.0)

When analysing the change in anthropometric indicators over time we find that there was a significant positive change for most indicators from baseline to month one. Scores and measurements for WAZ ($p<0.001$), WL/HZ ($p<0.001$), BMIAZ ($p<0.001$), and MUAC ($p<0.001$) showed significant changes from baseline to month one. The L/HAZ did not show significant changes throughout the programme. Month one to month three for the WAZ ($p<0.001$), WL/HZ ($p=0.003$), and BMIAZ ($p<0.001$), show significant positive changes. None of the measurement or z-score changes between month three and six were significant. The sample sizes for the tests at this time are also low (less than n=30), except for weight for age (n=31). When testing for changes between baseline and month six, significant positive changes were found for WAZ ($p<0.001$), WL/HZ ($p=0.004$), and BMIAZ ($p=0.028$). Although tests were significant for WL/HZ (n=19) and BMIAZ scores (n=26), it must be noted that the sample size for those two categories were less than n=30 which may influence the statistical power of the outcomes (Table9).

Table 9: Change in Anthropometric Measures over Time

Anthropometric Measure	Baseline to Month 1 p-value(n)	Month 1 to Month 3 p-value(n)	Month 3 to Month 6 p-value(n)	Baseline to Month 6 p-value(n)
Height/Length-for-age z-score [a]	0.690 (107)	0.982 (39)	0.824 (12)	0.594 (26)

Weight-for-age z-score [a]	**<0.001 (235)**	**<0.001 (82)**	0.164 (31)	**<0.001 (51)**
Weight-for-Height/Length z-score [a]	**<0.001 (83)**	**0.003 (28)**	0.069 (8)	**0.004 (19)**
BMI-for-Age z-score [a]	**<0.001 (105)**	**<0.001 (39)**	0.239 (12)	**0.028 (26)**
Mid Upper Arm Circumference (cm) [a]	**<0.001 (37)**	0.154 (12)	0.715 (4)	0.893 (5)
[a] *Related Samples Wilcoxon Signed Rank Test*				

3.2.2.1 Outcomes of >-1 z-score for BMIAZ & WL/HZ

At one month 56% of the patients presented with a WL/HZ >= -1, at three months 73.1%, and at 6 months 69.6%. Half had a BMIAZ of negative one by the first month, 70.2% in the third, and 58.6% in the sixth month (Table 10). The WL/HZ and BMIAZ outcomes where analysed for each patient to determine if their outcome was equal to or greater than negative one z-score, at any point during the programme. Table 11 represents all of the children who achieved a score of >=-1 for BMIAZ and WL/HZ at any visit. Overall, 63% of the patients had an outcome of BMIAZ and WL/HZ >-1, within the period of six months (Table 11).

Table 10: Outcomes of WL/HZ & BMIAZ at Follow up Visits

	Month 1		**Month 3**		**Month 6**	
	Total (N)	**Frequency n (%)**	**Total (N)**	**Frequency n (%)**	**Total (N)**	**Frequency n (%)**
WL/HZ of -1z-score Achieved	106	60 (56.6)	67	49 (73.1)	23	16 (69.6)
BMIAZ of -1z-score Achieved	128	63 (49.2)	84	59 (70.2)	29	17 (58.6)

Table 11: Overall Outcomes for WL/HZ and BMIAZ

Patients who presented with a WL/HZ or BMIAZ >-1 at any point after baseline	**Total (N)**	**Frequency n (%)**

WL/HZ Outcome Overall	156	98 (62.8)
BMIAZ Outcome Overall	184	116 (63.0)

When analysing the total number of children who reached a BMIAZ or WL/HZ of >=-1 from baseline to month one, it was found that only WL/HZ (p=0.007) changed significantly. From month one to month three only BMIAZ (p=0.002) changed significantly. For month three to six, and baseline to six months, neither WL/HZ nor BMIAZ showed significance.

At baseline it was evident that children were entered into the programme with a score of greater than negative one for BMIAZ and WL/HZ. Further analysis was then done whereby these entries were excluded. After exclusion of the baseline scores greater than or equal to negative one, it was found that both BMIAZ (p<0.001) and WL/HZ (p<0.001) showed significant change from baseline to month one, and from baseline to month six (WL/HZ p=0.008, BMIAZ p=0.004). From month one to month three a significance was only noted for BMIAZ (p=0.002), and month three to six showed no significant change for BMIAZ or WL/HZ. It must be noted that the samples tested after baseline to one month had sample sizes of smaller than n=30, which could decrease the statistical power of the test (Table 12).

Table 12: Change in WL/HZ >=-1, and BMIAZ >=-1 scores over Time

Anthropometric Measure	Baseline to Month 1 p-value(n)	Month 1 to Month 3 p-value(n)	Month 3 to Month 6 p-value(n)	Baseline to Month 6 p-value(n)
Total BMIAZ >=-1 [b]	0.064 (105)	**0.002 (39)**	1.000 (12)	0.077 (26)
Total WL/HZ >=-1 [b]	**0.007 (83)**	0.250 (28)	0.500 (8)	0.109 (19)
BMIAZ >= -1 one excluding Base >-1 [b]	**<0.001 (66)**	**0.002 (20)**	1.000 (9)	**0.004 (13)**
WHLZ >= -1 one excluding Base >-1 [b]	**<0.001 (51)**	0.500 (11)	0.500 (4)	**0.008 (12)**

[b] *Related -Samples McNemar Test*

3.2.3 Reported Symptoms at follow-up visits

The proportion of patients experiencing diarrhoea was highest at month six (14%). Vomiting was highest at one month 11%. Diarrhoea and vomiting decreased in the third month but increased in the sixth. The incidence of mouth sores and loss of appetite decreased from month one to six. The proportion of patients with a loss of appetite decreased from 21% at month one, to 12% at month six (Table 13).

Table 13: Reported Symptoms at each Follow up Visit

Reported Symptom	Month 1		Month 3		Month 6	
	Total (N)	Frequency n (%)	Total (N)	Frequency n (%)	Total (N)	Frequency n (%)
Diarrhoea	259	23 (8.9)	121	5 (4.1)	58	8 (13.8)
Vomiting	258	27 (10.5)	121	6 (5.0)	58	5 (8.6)
Mouth sores	259	20 (7.7)	121	8 (6.6)	58	2 (3.4)
Loss of Appetite	259	55 (21.2)	121	20 (16.5)	58	7 (12.1)

Diarrhoea (p=0.001), mouth sores (p<0.001) and loss of appetite (p**<0.001**) decreased significantly from baseline to visit one. Loss of appetite changed significantly from baseline to month six (p=0.001). There was no significant from change month one to three, three to six or baseline to six months for other symptoms (Table 14).

Table 14: Change in Symptoms over Time

	Baseline to Month 1 p-value(n)	Month 1 to Month 3 p-value(n)	Month 3 to Month 6 p-value(n)	Baseline to Month 6 p-value(n)
Symptom – Diarrhoea [b]	**0.001 (255)**	0.227 (97)	0.375 (34)	1.000 (57)
Symptom - Vomiting [b]	0.127 (253)	1.000 (97)	1.000 (34)	1.000 (57)
Symptom - Mouth sores [b]	**<0.001 (254)**	0.688 (97)	1.000 (34)	0.210 (57)

Symptom - Loss of Appetite [b]	**<0.001 (253)**	0.441 (96)	1.000 (34)	**0.001 (57)**
[b] *Related -Samples McNemar Test*				

3.2.4 Social Factors and Food Security at follow-up visits

Seventeen percent of the patient's caregivers were employed at one month, and remained at 16% in the sixth month. The proportion of patients receiving care dependency grants increased from the first to the sixth month. Patients receiving a child support grant remained at 60% throughout the study. None of the caregivers reported receiving a pension in months one, three or six. Less than five percent of the patients received a Foster care grant throughout the six months analysed. The proportion of patients, or patient's caregivers receiving any type of cash transfer remained above 65% from the first to the sixth month. Thirty two percent of the patients reported having a vegetable garden at one month which doubled to 61% in the sixth month. Patients were receiving supplements from the PEM scheme increased by 10% from the first to the sixth month (Table 15).

Table 15: Social Factors and Food Security at each follow up visit

Social and Food Security	Month 1		Month 3		Month 6	
	Total (N)	Frequency n (%)	Total (N)	Frequency n (%)	Total (N)	Frequency n (%)
Any Cash Transfer (Total All)	266	176 (66.2)	126	91 (72.2)	62	44 (71.0)
Child Support Grant	266	159 (59.8)	126	78 (61.9)	62	38 (61.3)
Disability Grant	266	11 (4.1)	126	8 (6.3)	62	5 (8.1)
Foster Care	266	6 (2.3)	126	5 (4.0)	62	1 (1.6)
Pension	0	0	0	0	0	0
Working	253	42 (16.6)	119	15 (12.6)	55	9 (16.4)
Vegetable garden	252	80 (31.7)	120	39 (32.5)	56	34 (60.7)
On the PEM Scheme	250	66 (26.4)	118	32 (27.1)	56	21 (37.5)

None of the social factors changed significantly over time. Vegetable gardens increased significantly from baseline to month one (p<0.001), and from baseline to month six (p=0.001). Patients on the PEM scheme showed a significant increase from baseline to month six (p=0.002) (Table 16).

Table 16: Change in Social Factors and Food Security over Time

	Baseline to Month 1 p-value(n)	Month 1 to Month 3 p-value(n)	Month 3 to Month 6 p-value(n)	Baseline to Month 6 p-value(n)
Social - Working [b]	1.000 (246)	0.453 (92)	1.000 (32)	0.754 (54)
Social - Disability Grant [b]	0.688 (266)	1.000 (103)	0.375 (39)	0.688 (62)
Social - Child Support Grant [b]	0.855 (266)	1.000 (103)	1.000 (39)	0.640 (62)
Social - Pension [b]	1.000(266)	-	-	1.000 (62)
Social - Foster Care [b]	0.500 (266)	0.500 (103)	1.000 (39)	1.000 (62)
Social - Any Cash Transfer [b]	0.850 (266)	0.581 (103)	0.754 (39)	0.263 (62)
Vegetable Garden [b]	**<0.001 (241)**	0.238 (93)	0.057 (32)	**0.001 (55)**
Patient on PEM Scheme [b]	0.130 (237)	0.344 (91)	0.125 (31)	**0.002 (55)**

[b] *Related -Samples McNemar Test*

3.2.5 Nutrition Risk Score at follow-up visits

The proportion of nutrition risk scores above three (combining patients at a risk of malnutrition and those that are malnourished) at one, three and six months (Table 17) were 76%, 70%, and 71% respectively.

Table 17: Nutrition Risk Category at each Visit

Nutrition Risk Classification	Baseline (N=241)	Month 1 (N=190)	Month 3 (N=94)	Month 6 (N=44)
	Frequency n (%)	Frequency n (%)	Frequency n (%)	Frequency n (%)
Not at Nutritional risk (0-3)	31 (12.9)	45 (23.7)	28 (29.8)	13 (29.5)
At Nutritional risk (4-5)	38 (15.8)	40 (21.1)	14 (14.9)	11 (25.0)

Malnourished (>5)	172 (71.4)	105 (55.3)	52 (55.3)	20 (45.5)

Analysis of nutrition risk score over time (Table 18) shows significance from baseline to one month (p<0.001), one month to three months (p=0.024), and baseline to six months (p=0.001).

Table 18: Change in Nutrition Risk Score over Time

Nutrition Risk Score	Baseline to Month 1 p-value(n)	Month 1 to Month 3 p-value(n)	Month 3 to Month 6 p-value(n)	Baseline to Month 6 p-value(n)
Nutrition Risk Score [a]	**<0.001 (171)**	**0.024 (62)**	0.173 (23)	**0.001 (42)**

[a] *Related Samples Wilcoxon Signed Rank Test*

3.3 Factors influencing the outcome of <-1 z-score for WL/HZ & BMIAZ

Factors which may affect an outcome of the z-scores for BMIAZ or WL/HZ were cross tabulated to find the strength of these relationships. Significance was measured using a p-value of <0.05.

The relationship between BMIAZ (p=0.02) and WL/HZ (p=0.04) outcomes and tuberculosis at baseline are statistically significant. All other referral diagnosis did not affect the outcomes significantly (Table 19). The presence of tuberculosis decreased the outcome of >-1z-score for both BMIAZ and WL/HZ. Further analysis found that co-morbidity of HIV and tuberculosis had no significant affect on outcomes.

Table 19: Influence of Referral Diagnosis on BMIAZ and WL/HZ outcome of >-1 z-score

Referral Diagnosis	Total (N)	Did not Achieve -1z		Achieved -1z		p-value
		n	(%)	n	(%)	
Tuberculosis * BMIAZ Outcome [a]	52	26	(50%)	26	(50%)	**0.02**
Tuberculosis * WL/HZ Outcome [a]	39	20	(51%)	19	(49%)	**0.04**

HIV Positive on treatment * WL/HZ Outcome [a]	85	28	(33%)	57	(67%)	0.25
HIV Positive on treatment* BMIAZ Outcome [a]	107	40	(37%)	67	(63%)	0.33
HIV Positive* BMIAZ Outcome [a]	123	48	(39%)	75	(61%)	0.41
HIV & TB * BMIAZ Outcome [a]	38	22	(58%)	16	(32%)	0.46
HIV Positive * WL/HZ Outcome [a]	97	34	(35%)	63	(65%)	0.48
Cerebral Palsy * WL/HZ Outcome [a]	13	6	(46%)	7	(54%)	0.48
Gastroenteritis * BMIAZ Outcome [a]	11	3	(27%)	8	(73%)	0.49
Gastroenteritis * WL/HZ Outcome [a]	11	5	(45%)	6	(55%)	0.56
Protein Energy Malnutrition * BMIAZ Outcome [a]	105	37	(35%)	68	(65%)	0.58
HIV & TB * BMIAZ Outcome [a]	31	19	(61%)	12	(39%)	0.84
Cerebral Palsy * BMIAZ Outcome [a]	13	5	(38%)	8	(62%)	0.91
Protein Energy Malnutrition * WL/HZ Outcome [a]	92	34	(37%)	58	(63%)	0.94
[a] = *Chi-Square test*						

The symptoms that influence nutrition were not statistically significant (Table 20).

Table 20: Influence of Symptoms on BMIAZ and WL/HZ outcome of >-1 z-score

Symptoms	**Total (N)**	**Did not Achieve -1z**	**Achieved -1z**	**p-value**
		n (%)	**n (%)**	
Loss of Appetite * BMIAZ Outcome [a]	69	30 (43%)	39 (57%)	0.15
Mouth sores/thrush * WL/HZ Outcome [a]	29	14 (48%)	15 (52%)	0.16
Loss of Appetite * WL/HZ Outcome [a]	57	24 (42%)	33 (58%)	0.32
Mouth sores/thrush * BMIAZ Outcome [a]	38	16 (42%)	22 (58%)	0.45
Vomiting * BMIAZ Outcome [a]	32	13 (41%)	19 (59%)	0.62
Diarrhoea * BMIAZ Outcome [a]	31	12 (39%)	19 (61%)	0.81
Diarrhoea * WL/HZ Outcome [a]	28	10 (36%)	18 (64%)	0.87

Vomiting * WL/HZ Outcome [a]	29	11 (38%)	18 (62%)	0.91

[a] = *Chi-Square test*

The resources available to the patients were not statistically significant (Table 21).

Table 21: Influence of Resources on BMIAZ and WL/HZ outcome of >-1 z-score

Resources	**Total(N)**	**Did not Achieve -1z**	**Achieved -1z**	**p-value**
		n (%)	**n (%)**	
Gas * BMIAZ Outcome [a]	4	0 (0%)	4 (100%)	0.12
Gas * WL/HZ Outcome [a]	3	0 (0%)	3 (100%)	0.18
Water inside the house * BMIAZ Outcome [a]	79	26 (33%)	53 (67%)	0.37
Water Communal Pump * BMIAZ Outcome [a]	87	35 (40%)	52 (60%)	0.44
River Water * BMIAZ Outcome [a]	8	2 (25%)	6 (75%)	0.47
Paraffin * WL/HZ Outcome [a]	14	4 (29%)	10 (71%)	0.48
Water inside the house * WL/HZ Outcome [a]	67	23 (34%)	44 (66%)	0.52
River Water * WL/HZ Outcome [a]	7	3 (43%)	4 (57%)	0.75
Water Communal Pump * WL/HZ Outcome [a]	72	28 (39%)	44 (61%)	0.77
Electricity * WL/HZ Outcome [a]	117	43 (37%)	74 (63%)	0.85
Paraffin * BMIAZ Outcome [a]	14	5 (36%)	9 (64%)	0.92
Electricity * BMIAZ Outcome [a]	141	52 (37%)	89 (63%)	0.97

[a] = *Chi-Square test*

A child support grant, although not significant, had a trend toward being protective (p=0.06) for the outcome of BMIAZ (Table 22).

Table 22: Influence of Cash Transfer on BMIAZ and WL/HZ outcome of >-1 z-score

Social	Total (N)	Did not Achieve -1z		Achieved -1z		p-value
		n	(%)	n	(%)	
Child Support Grant * BMIAZ Outcome [a]	116	37	(32%)	79	(68%)	0.06
Foster Care * BMIAZ Outcome [a]	4	3	(75%)	1	(25%)	0.11
Working * BMIAZ Outcome [a]	30	14	(47%)	16	(53%)	0.22
Care dependency grant * BMIAZ Outcome [a]	9	5	(56%)	4	(44%)	0.24
Care dependency grant * WL/HZ Outcome [a]	9	5	(56%)	4	(44%)	0.24
Working * WL/HZ Outcome [a]	27	12	(44%)	15	(56%)	0.37
Any Cash Transfer * BMIAZ Outcome [a]	129	45	(35%)	84	(65%)	0.37
Foster Care * WL/HZ Outcome [a]	1	0	(0%)	1	(100%)	0.44
Any Cash Transfer * WL/HZ Outcome [a]	110	42	(38%)	68	(62%)	0.69
Child Support Grant * WL/HZ Outcome [a]	100	37	(37%)	63	(63%)	0.95
Pension * BMIAZ Outcome [a]	0	0	(0%)	0	(0%)	N/A
Pension * WL/HZ Outcome [a]	0	0	(0%)	0	(0%)	N/A

[a] *= Chi-Square test*

There is a significant effect (p=0.04) on WL/HZ outcome if the patient was already receiving supplements on the PEM scheme (Table 23). The same effect was not observed for BMIAZ outcomes and receiving supplements on the PEM Scheme. Vegetable gardens did not contribute toward the anthropometric outcomes of BMIAZ or WL/HZ (Table 23).

Table 23: Influence of Food Security on BMIAZ and WL/HZ outcome of >-1 z-score

Patient on the PEM Scheme	**Total(N)**	**Did not Achieve -1z**	**Achieved -1z**	**p-value**
		n (%)	**n (%)**	
Baseline Patient on PEM Scheme * WL/HZ Outcome [a]	32	7 (22%)	25 (78%)	**0.04**
Baseline Patient on PEM Scheme * BMIAZ Outcome [a]	43	18 (42%)	25 (58%)	0.51
Vegetable Garden	**Total(N)**	**Did not Achieve -1z**	**Achieved -1z**	**p-value**
		n (%)	**n (%)**	
Baseline Vegetable Garden * WL/HZ Outcome [a]	38	17 (45%)	21 (55%)	0.30
Baseline Vegetable Garden * BMIAZ Outcome [a]	43	16 (37%)	27 (63%)	0.98
[a] = *Chi-Square test*				

4. Discussion

4.1 Main Findings

4.1.1 Length of time in the programme

Of the patients included in the study, the majority (94%) returned at month one follow up. For inclusion into the study, the patient had to have a baseline visit with the correct information recorded and one other visit (not necessarily month one). If it was planned that the patient would return later than one month (for example a two month follow up visit), the dietitian would ensure that the patient was given sufficient nutrition supplements to last until the next visit.

When a patient was discharged from the programme it was recorded in the database. Exit reasons existed for only one third of patients on the database; two thirds of the patients were lost to follow up. It is concerning that the majority of the patients entered did not return without a reason recorded. The possible reasons for loss to follow-up are that the mortality rate was higher than the recorded (1.4%), or that caregivers could not afford to return, or caregivers may not have understood the importance of the nutrition supplements, or the patients did not tolerate the supplements and therefore did not return for more. Of the patients with exit reasons recorded, almost all were exited as "well" or "reached anthropometric goals", which may indicate that these patients and caregivers understood the importance of the programme and reaped the benefits. Evaluation of a similar nutrition supplementation programme found that although caregivers were satisfied with receiving supplements, they were given little education on how to help their children gain weight, and some were ill-treated by the health professionals which may have affected compliance.[34] Patients enrolled in the PNP were counselled fully, in their own language (with the use of interpreters), and treated with dignity to attempt to improve compliance. Two patients were discharged for not responding to supplements, the reasons for not responding is unknown as only the database of patients were accessed and not individual patient records.

4.1.2 Referral Diagnosis & Symptoms

As expected, because the programme is an intervention for malnutrition, the most common referral diagnosis was PEM. More than half of the patients were HIV positive and majority of them were on ARV treatment. HIV infection is known to affect nutrition and it is likely that it contributed toward the high prevalence of stunting.[10,19] The diagnosis of TB was present in a quarter of the patients referred that were included into the PNP. We expect the proportion of patients with TB to be higher than other referral diagnoses as malnutrition and HIV increase the risk for developing TB, and TB is a disease which is an immediate cause of malnutrition.[35] Three quarters of the children with TB were HIV positive. The referral diagnosis of Gastroenteritis was

relatively low in comparison to previous studies conducted in rural areas and a local burden of disease study.[3,7]

The dietitian would ask the patient what symptoms were present whilst counselling at every visit. The list of symptoms chosen for reporting all had an effect on the nutrition outcome. The symptom reported most frequently was loss of appetite which is at a similar proportion to what is found in the literature.[5] The report of diarrhoea and vomiting was greater than three times that of gastroenteritis which may have been a result of using the primary diagnosis on the referral letter to the dietitian. The proportion of patients presenting with diarrhoea was slightly lower, and vomiting was the similar to the proportions found in more rural areas.[5] We expect the rate to be higher because of the high proportions of malnutrition and HIV infection which both increase this risk of diarrhoea.[36] Mouth sores or oral thrush were reported in a fifth of the patients and is expected in a sample where HIV prevalence is high.[37] Upon analysis, symptoms of diarrhoea ($p=0.001$), mouth sores ($p<0.001$) and loss of appetite ($p<0.001$) show significant change from baseline to month one (Table 14). Symptoms are also expected to resolve in less than a month as the patients have been previously treated for underlying problems before being referred to the dietitian. The decrease in diarrhoea was expected as the protocol used by the dietitian included a category specific to this symptom and the supplements chosen for these categories were suitable to use in diarrhoea. Vomiting did not decrease significantly at any point, but there was a decrease in the number of patients reporting the symptom of vomiting over time. Only loss of appetite appeared to be significant over the duration of the entire programme (baseline to six months $p=0.001$) (Table14). It is possible that loss of appetite was a more subjective measure reported by the patient that could vary depending on the patient's perception of the amount of food that they should be eating.

The symptoms reported at each visit generally decreased except for diarrhoea which increased in numbers and proportion in month six. We expect to see a decrease in all symptoms with an

overall increase in nutritional status.[35] We could postulate that because these patients are still in the programme at six months they are still at a higher risk and more prone to recurrent infections such as diarrhoea, which in turn perpetuates the malnutrition.[38]

4.1.3 Social Factors and Available Resources

The proportion of employed caregivers of these children was very low and a high proportion of patients and their families relied on some form of cash transfer as their sole source of income. These proportions reflect the high rate of unemployment and the proportion of households without any income in the Umlazi area.[32] Half of the patients received a child support grant, which is a concern as most of the children in the study sample were eligible for the grant. A higher uptake of the child support grant is expected in poorer settings.[16] It is lower than rural KZN estimates where up to 75% of eligible children/ families are receiving their child support grants.[5] The main reason for not receiving a child support grant in other studies was a lack of documentation, which could apply here.[5] The lack of access to a child support grant could have contributed to the high rate of stunted and underweight patients observed in this study.[16] It is unfortunate to see that the proportion of care dependency grants was not higher as almost double that number of patients entered the programme with the diagnosis of cerebral palsy. A comment that must be made about the number of pensions, and foster care grants is that there was only one space on the form to fill in what the main source of income was for a child, so if the child had a child support grant, the other forms of income would not be recorded. A separate space was allocated for whether or not the patient was employed so that data would be more accurate.

Access to electricity was available to a high proportion of the patients (75%). This is much higher than surrounding rural areas in the same province.[5,6] We might assume electricity to be available to a high proportion of the population as a 2008 report mentioned that 80% of Umlazi contained

formal houses.[32] Less than half of the patients had access to running water inside their houses, and half of the patients collected water from a communal tap which is around ten percent higher than rural estimates.[5,6] Basic services influence nutrition negatively when access is low.[2] The proximity and lack of access to clean water could be a factor contributing to the high proportion of stunting and wasting in this group of patients.[2,11,12]

As the months progressed there was an increase in the proportion of cash transfers of any kind received by the patients. We would expect to see an increase in the number of children receiving child support grants overtime as the dietitian, and other health workers, routinely referred all children to the department of social work within the hospital to initiate or investigate the status of the patients grant. The average amount of time that a patient would wait for a child support grant was 3 months, and because they may have been discharged at month four or five, and this study only takes into account month three and six, there may be patients who did receive a child support grant who are not recorded. Unfortunately due to a lack of enabling documentation, such as birth certificates or identification documents, the process may have taken longer than 6 months which is also not recorded in this study.[5] Analysis of the change in any social factor was not significant. Perhaps a longer time frame would show an increase in cash transfer uptake.

The proportion of patients who had a vegetable garden was lower than rural estimates.[5] The low number of food gardens could have been due to limited space, or where the patient may have been living in a more urban setting with no garden. The patients may not have had the knowledge or resources to plant and sustain a garden. Analysis of the social factors and food security over time shows a significant increase in vegetable gardens from baseline to month one ($p<0.001$), and baseline to month six ($p=0.001$). This positive finding confirms that home gardening education and provision of seeds was an effective part of the programme. The food

gardens are an important contribution to food security and could play a minor role in contributing toward positive anthropometric outcomes.

It is encouraging to see that the number of food gardens increased in number and proportion from baseline to month one and the proportion continued to increase up until month six. The patients were provided with seeds and educated on the basics of food gardening. The increasing proportion of patients who reported having a food garden is a reflection that issuing the seeds to the patients could in fact improve food security. Unfortunately the dietitians working in the programme did not quantify the output or diversity of produce from these gardens.

A small proportion of the patients in the study were previously on the PEM Scheme from lower levels of care (clinics) before they entered the program. This may be due to patients bypassing the clinics (primary health care) where they live because of poor service delivery.[38] The proportion of patients receiving supplementation from the PEM Scheme slowly increased as the months progressed. A positive finding from analysis of baseline to six months is that there is a significant increase in the number of children on the PEM scheme (p=0.002). The dietitians would refer all patients to the PEM Scheme at the baseline visit. We would again expect a far greater proportion of patients on the PEM Scheme because the same nutrition risk screening tool was used as the dietitians were using to enter patients into their nutrition supplementation programme.[30]

4.1.4 Nutrition Risk Score

As expected, most patients had a nutrition risk score greater than three, as they had to meet the entry criteria to enter the programme. The median nutrition risk score of seven and IQR of five to nine reflect the high frequency of malnutrition and possibly the combination of a loss of appetite and HIV infection. These scores further substantiate the need for the patients to be in the programme. There were patients with a nutrition risk score less than three which again indicates

the need to adjust the entry criteria into the programme. The entry criteria could possibly include a score assigned to social circumstances.

Upon follow up, the proportion of patients with a NRS less than three was high because these were the patients who are still malnourished or at a risk for malnutrition. The proportion of patients with a score of less than three increased slowly during the six months which could have been the result of the patient remaining in the programme for social or monitoring reasons. Another explanation could have been that the WAZ had not increased sufficiently for discharge but the patient did not score high for any of the other criteria. This could be the result of the patient reaching their WL/HZ or BMIAZ goal of negative one z-score whilst being severely stunted. This scenario would result in a decreased risk for co-morbidity and mortality.[3]

When analysing the change in nutrition score over time it was observed that, from baseline to month one ($p<0.001$), month one to month three ($p=0.024$), and baseline to month six ($p=0.001$), a significant decrease was observed for the Nutrition Risk Score (Table18). The score is expected to decrease over time as we expect the patient's condition to improve whilst in the programme. This does not validate the Nutrition Risk Screening Tool but does show sensitivity to the outcomes of the programme. As anthropometric indicators improve, and reported symptoms decrease, so the NRS decreases. This is encouraging information should the department of health continue to use the tool in nutrition programming.

4.1.5 Anthropometry

This study found that more than 70% of the patients entered into the programme were moderately to severely stunted and underweight for age, and over 60% of the patients entered the programme with a z-score of less than negative one for WL/HZ and BMIAZ. This was expected as the programme uses anthropometric criteria (WAZ and/or recent weight loss) for entry to the programme, and indicates that the correct type of patient was entered into the programme. WAZ

was a part of the entry criteria and exit criteria of this programme. At the time, WAZ was the only measurement that was assessed for patients on a regular basis, and was the only growth chart that was available in the patient's clinic card or "Road to Health Chart". A challenge with using only WAZ is that when a child is stunted they may have a normal WHZ but a low WAZ. This is evident as there were more children entered into the programme with a WAZ <-1 than a BMIAZ or WL/HZ <-1.

MUAC confirms the presence of severe malnutrition (MUAC < 11.5cm) at the same rate as WL/HZ and BMIAZ <-3. There were few patients which were either overweight or of a normal anthropometric status which indicates that the entry criteria may need adjustment. These patients often had social challenges (caregiver had no employment or social grants or access to food) which required nutrition supplementation, or they were patients who achieved a high nutrition risk score without being malnourished. These patients may have been at a high risk for malnutrition and therefore were supplemented to prevent malnutrition. In addition, patients may have had normal anthropometric measures, and a low NRS, but could have been referred from the ward to the dietitian on discharge for further monitoring as they may be at risk for malnutrition.

The proportion of severely stunted children remained at around half for the duration of this study. Upon analysis, there was no significant change in HAZ scores during the programme. Extra nutrition was provided to the patients but, stunting takes proportionally more time to correct than weight depending on the age of the patient. Once the patient had reached their goal weight, which changes more rapidly than height, they could have been discharged before the patient had achieved an ideal height. The products that were offered to the patients may have lacked sufficient nutrients to promote a gain in height.[39] It has been suggested that the products used to promote weight gain should contain sufficient nutrient's to promote height gain as well.[39]

Contributing factors present at baseline also take time to change which perpetuates the process of stunting.

From baseline to month six there is a definite decrease of proportion and number of cases in underweight categories, in all WAZ categories, which stabilizes from month one to six (Table 7). This would suggest that the patients are gaining weight. This is confirmed by analysis of the WAZ scores over time. The change in WAZ from baseline to month one ($p<0.001$), month one to three ($p<0.001$), and baseline to month 6 ($p<0.001$) (Table 9). We could assume that the caloric deficit that existed in the patient's diet was being met. From month one to six, half of the patients remained below -2z scores. The proportion of patients below -2z-scores is expected as time in the programme increases as those are the patients who have not yet reached their anthropometric goals and hence were not discharged.

The proportion of children with a WL/HZ and BMIAZ of less than -2 z-scores decreased, and the proportion of children with a z-score of greater than negative two slowly increased. Similarly the number of children with a MUAC of <11.5cm decreased as the months progressed. Over time WL/HZ ($p<0.001$), BMIAZ ($p<0.001$), and MUAC all showed significant changes from baseline to month one. WL/HZ ($p=0.003$), and BMIAZ ($p<0.001$), showed a significant increase in scores from month one to month three (Table 9). Over the duration of six months in the programme (baseline to month six), significant positive increases were noted for WL/HZ ($p=0.004$), and BMIAZ ($p=0.028$). When analysing patients who achieved a BMIAZ and WL/HZ of greater than or equal to negative one, it was observed that BMIAZ ($n=39$) significantly increased ($p=0.002$) from visit one to three, and WL/HZ ($n=51$; $p=0.007$) from baseline to month one (Table 12). The patients who were entered into the programme above negative one z-score may have distorted the interpretation of outcomes for the programme. For this reason, further analysis, using the same test was done where the patients who were entered into the programme at baseline, above negative one z-scores for BMIAZ and WL/HZ were excluded. After exclusion there is a significant

increase for BMIAZ from baseline to month one ($p<0.001$), month one to three ($p=0.002$), and baseline to month six ($p=0.004$). After exclusion WL/HZ shows significant increase from baseline to month one ($p<0.001$), and baseline to month six ($p=0.008$) (Table 12). This is the effect that the programme seeks to achieve. It suggests that the overall effect of the programme is positive as patients are gaining weight and achieving discharge criteria.

The proportion of patients that were still in the programme that had a BMIAZ or WL/HZ of >-1 was higher than the proportion of WAZ z-scores, which was probably due to the high rate of stunting. When using only WAZ as part of an exit criteria (in place of WL/HZ or BMIAZ), the challenge is that if the patient is severely stunted they will have to gain weight beyond the WLHZ or BMIAZ exit criteria (in this case -1z-score) which has cost implications for the programme and may result in an overweight child. There is an advantage to using BMIAZ or WL/HZ as it incorporates the use of length and height which would avoid the over supplementation in stunted children. The ultimate reason for supplementation is to decrease the patients risk for mortality which is decreased as their WL/HZ increases to above negative one z-score.[3] We can assume similar positive outcomes for a BMIAZ of >-1.

For all anthropometric indicators, providing nutrition supplementation is more effective if other contributing factors such as socioeconomic, co-morbid conditions, access to clean safe water and use of clean fuels for cooking are dealt with. The dietitian can educate and refer the patient for help; however this is limited by the efficiency of the health and social system.

The proportion of patients with a z-score of <-1 decreased for both BMIAZ and WL/HZ, which was an expected outcome of the patients in this programme. Unfortunately the number of patients who had a height or length taken was low which affects the calculation of these z-scores. It would have been ideal to have a weight and height or length at every visit. It must be taken into consideration that height and length was not as important at the time that the programme was running as the discharge criteria of the programme used WAZ percentiles. At month six there is a

slight decline in the proportion of children presenting with a z-score of greater than negative one. An assumption could be made that by this stage the children had met the discharge criteria and were no longer in the programme, leaving the patients who still needed intervention in the programme.

The proportion of patients who presented with a z-score of greater than negative one for BMIAZ and WL/HZ at any time after baseline was similar which is expected as similar inputs are used for both. BMIAZ includes a greater age range of patients so we can assume that outcomes are similar for the entire sample. The number of patients that did not achieve greater than negative one z-score for BMIAZ and WL/HZ was higher than the number of patients remaining in the programme at month six. We must again take into consideration that the height and length was not always taken which could have reduced the number of BMIAZ and WL/HZ that could have been calculated, which would have contributed to the decline in numbers. The nutrition risk score shows that high proportions of patients were at a risk and were malnourished throughout the programme. If we consider the inputs to the nutrition risk score (disease, symptoms, anthropometry, ability to eat), we could assume that factors (other than anthropometry) were contributing to the remaining patients who did not reach a z-score of greater than negative one. Further analysis of the data was done to investigate if any of the factors recorded contributed significantly to outcomes of BMIAZ and WL/LZ. An important point to mention is that although patients did not reach an ideal z-score of greater than negative one, the number and proportion of children below a z-score of negative two decreased drastically which decreases the risk of mortality significantly.[3]

4.1.6Factors influencing the outcome of >-1 z-score for WL/HZ and BMIAZ

Tuberculosis had a significant negative effect on the desired outcome of greater than negative one z-score for both WL/HZ and BMIAZ. Tuberculosis is expected to delay the rate of recovery, decrease the chance of patients reaching anthropometric goals, and increase mortality.[35,40,41]

Provision of high energy supplements have been shown to have a moderate effect on weight gain, but interestingly the increase in weight did not improve TB treatment outcomes.[35] The fact that the weight gain is not necessarily associated with positive treatment outcomes could imply that long term recovery of the patient is more reliant on the effectiveness of the drug treatment as opposed to the nutrition therapy.

As expected, HIV infection did not significantly affect outcomes of BMIAZ and WL/HZ.[24] The results are similar to a Nigerian study where RUTF was used and there was no significant difference in weight gain between HIV positive and negative malnourished children, but saw both groups benefit.[41] HIV and TB both play a role in the children developing malnutrition, but only TB seems to hinder the nutrition rehabilitation of the children in this study. When analysis was done for TB and HIV co-infection, it did not affect the outcomes of BMIAZ or WL/HZ significantly, which is in conflict with evidence stating that HIV and TB co-infection should hinder recovery.[40]

The symptoms experienced by patients did not significantly affect outcomes for BMIAZ and WL/HZ. This could be because the symptoms were kept under control or did not last for long enough to affect the final outcome of the patient. The patients were counselled by the dietitians specifically on how to cope with the symptoms that were enquired about. The patients were given clear instructions and literature in the form of a pamphlet in their own language to take home. We could assume that the education the patients received decreased the negative effect of the symptoms on nutrition outcomes.

The resources the patients reported having did not significantly improve the patient's outcomes for BMIAZ and WL/HZ. It would be expected that the increased access to resources such as electricity and water would play a role in the recovery of these children, but is clear that we cannot isolate a resource such as electricity and expect a significant outcome.[11,12] The presence of an unconditional cash transfer or employment did not significantly improve BMIAZ or WL/HZ outcomes. A child support grant had the most positive (but not significant) influence on BMIAZ

but not WL/HZ. In South Africa, an impact study on the child support grant reported a positive effect on the outcome of stunting if the mother had an education of grade 8 or above and the grant was received in the first two years of life; no changes in BMIAZ and WL/HZ were mentioned.[16] Unfortunately the level of the mothers education, and the age at which the children started receiving the child support grants in this study, are unknown.

If the patient was receiving nutritional supplements from the PEM Scheme at baseline it had a significant effect (p=0.04) on a WL/HZ outcome of greater than negative one z-score. This outcome is expected as the patients would have had access to nutrition supplements and counselling before they reached the dietitian. These patients would have continued on the PEM scheme and received supplements from the dietitian. The better outcome could be attributed to the increased total of energy and nutrients received by the patients. In most cases, the amount of nutrition supplements offered to patients does not cover 100% of the patients' needs as the aim is to supplement their current diet. It is possible that the patient's dietary intake lacks the quantity; quality and diversity to achieve a positive result with supplementation from the dietitians' supplements alone. The significant effect of the PEM Scheme could indicate that the amount of nutritional supplements issued to the patients is insufficient to achieve a WL/HZ of greater than negative one, and that the PEM Scheme covers the deficit. Another factor to take into consideration is the family may have shared the supplements given to the patient. If the family members were sharing the supplements the patient would have benefited from the extra supplementation supplied by the PEM Scheme.

The same effect was not present for BMIAZ, which could imply that younger children (who fit in to the WLZ or WHZ categories) benefitted more from the PEM scheme than the older children. The number of children who achieved a z-score of >-1 for WL/HZ and BMIAZ was the same, but the number of children who did not achieve the score was higher in the BMIAZ category. The amount of supplementation given to older children may need to be reassessed and possibly increased.

The increase in the proportion of patients that had a food garden could have been attributed to the dietitians educating the patients and issuing a variety of seeds to the patients, but food gardens did not significantly affect the outcomes for WL/HZ or BMIAZ which reflects current literature.[9]

4.2 Study Limitations

Due to the programmatic nature of the intervention a high loss to follow up was expected. Patients who did not return for follow up were not contacted due to resource constraints. Different weighing scales were used which may cause a slight deviation in actual change in weight upon follow up. The scales were not calibrated regularly, and were only maintained as needed which would also affect the weight values collected from the patients. Standardised, plastic KZN Department of Health, length mats were used to measure the length of children. These length mats were in good condition but could be stretched from frequent use which may have given an incorrect reading. Height sticks, attached to the scales were used to measure the height of the older children. Unfortunately the height sticks were also not regularly calibrated, and only maintained as needed.

The nutrition risk screening tool was not validated and therefore may have incorrectly classified a patient. A patient may have been normal weight or over weight, but because of the symptoms and disease of the patient, they would have received a very high nutrition risk score, which could have overestimated the patient's needs. There were patients who were included into the programme at the clinicians' (referred by doctors to the dietitian for inclusion to the programme) discretion, with a nutrition risk score which was lower than the entry criteria of the programme. These patients may have been inpatients or outpatients who had recently recovered from illness and needed monitoring as they were at a risk for malnutrition. Supplements were issued to children who were not covered by the supplement issue protocol. Patient adherence to

nutritional supplements was not measured. There were times where the products on the protocol were not available and had to be substituted with an appropriate equivalent.

Information could have been incorrectly collected initially and could have been entered into the database incorrectly. The supplementation programme's record sheet only had one space to record the type of social grant being received; therefore child support grants or care dependency grants received by the child would have been favoured over pensions or other social grants received by the care giver. Only the CSG and CDG reflect the true number present and were interpreted appropriately.

WAZ, which was used for the nutrition risk screening tool, is dependent on accurate age data being available which may have been incorrectly reported by the caregiver as formal identification is not always available. Unfortunately the number of patients who had a height or length taken was low which affects the calculation of these z-scores. It would have been ideal to have a MUAC, weight and height or length at every visit. It must be taken into consideration that height and length were not considered as important at the time that the programme was running because the discharge criteria of the programme used weight for age percentiles or z-scores. MUAC was also not a priority measurement for the programme and was not measured and recorded frequently.

Loss to follow up and a lack of MUAC height and length measurements decreased sample sizes for statistical analysis. Where sample sizes were too small ($n<30$), caution was taken when interpreting the significance of results.

5. Recommendations

5.1. Recommendations for Nutrition Practice / Programmes

This study provides valuable information that can be applied to nutrition programmes of a similar nature. The nutrition risk score used to enter patients into the programme was identifying the correct/target patients who would benefit from nutrition supplementation. The majority of referrals for the PNP were for the diagnosis "PEM" which was based on clinical features and a low WAZ which may have included a broader range of patients who were not less than -1 WL/HZ or BMIAZ. Height, length and MUAC, which are essential to the classification of these patients was poorly recorded in this group of patients. At the time that the patients were being assessed these measurements were less essential because WAZ was the main focus for monitoring and discharge. All anthropometric measures should be used in nutrition programming but WL/HZ, BMIAZ and MUAC should be used specifically to measure outcomes.

The KwaZulu Natal Department of Health has since revised the nutrition supplementation programme (the programme is now named the integrated management of acute malnutrition (IMAM)) which now emphasises WLHZ, BMIAZ and MUAC which are more specific to wasting as opposed to underweight for age.[43] They have also removed the nutrition risk score which eliminates the consideration of nutritional symptoms and diagnosis. Aspects of the nutrition risk score have been added to categorise patients. The revision has made it easier to assess patients as health care workers no longer need to add up complicated scores which may lead to better access and coverage of malnourished patients.

There was a high loss to follow up from the programme where less than a third of the patients included in the study had exit records. A follow up system should be considered to complete the monitoring process for better ongoing evaluation of the nutrition supplementation programme, especially for particularly vulnerable groups/ children.

Future programmes need to include collection of specific data with a focus on anthropometric measurement, disease condition and whether the patient is receiving treatment (especially in the case of TB). The monitoring of patient symptoms will play a role in nutrition (supplementation) treatment and must be taken into consideration (for example diarrhoea). Perhaps the NRST could be refined and re-implemented as it is sensitive to the nutritional status of the patient. Food gardens must be advocated and where possible, education can be done and seeds issued, to increase food security. This can be done at all levels of care providing nutrition services of this nature. The process of receiving a child support grant should be reviewed (in terms of time frames and access) and made clear to referring practitioners to assist patients accessing the grant in a shorter time frame. Perhaps CSG's should be processed at the hospitals to decrease the delays in the process. This would decrease the amount of time and money spent by the patient travelling to different government departments, and increases the communication between health professionals and the social department dealing with CSG's. Patients contact details should be recorded on the initial visit, and depending on resources, the more important cases can be contacted upon default and then defaulting reasons should also be recorded. The data can then be used to investigate the high rate of loss to follow up. Integration into other programmes, such as TB or HIV, would increase the availability of resources as they already have patient tracking systems in place.

It will be of benefit to focus on the prevention and treatment of malnutrition at lower levels of care to ensure that patients are identified and are receiving the correct care supplementation to improve patient outcomes. KZN DOH has recently taken appropriate steps to improve the nutrition programme at lower levels of care by training and employing nutrition advisors and community health workers whose primary role is to educate, screen and supplement patients at a clinic level with a specific focus on paediatric patients.[31] This and an increased focus on the dietitians supporting their feeder clinics should yield improved care for malnourished patients.

A nutrition programme or nutrition specific intervention, such as this one, can only impact children who are identified to be malnourished. Once the children have met the required goals for discharge, they return to the same circumstances that could have contributed to their malnutrition. It is vital to address the underlying needs of the patient to ensure the cycle is not repeated. A focus on improving nutrition sensitive interventions food security, socioeconomic status, and basic resources (water and electricity), needs to be prioritised to achieve this. Other structures do exist within government that are addressing these needs, but integration of nutrition with these structures is essential to achieving desirable anthropometric outcomes, in essence decreasing and preventing malnutrition.

5.2 Recommendations for Future Research

Research is required through the continuum of care, from the community, to primary health care, to a hospital level, to cover the broad spectrum of factors affecting the nutrition outcomes of patients. Nutrition sensitive and specific factors should be assessed both individually and as a whole.

Further prospective studies should be done (as opposed to this retrospective study) to monitor and evaluate a nutrition programme. A larger sample size would be recommended as it would increase the power of the study and thus the significance of the findings. This study only included baseline, month one, three and six, whereas future studies could include every month to obtain a clearer picture of the sample. Perhaps studies could include multiple sites to increase the sample size and allow for multivariate analysis of factors contributing to patient outcomes. In future research projects, there should be a focus on recording accurately all relevant anthropometric data at every visit. It will be useful to include whether or not the patient is receiving treatment for TB. The evidence for TB and Nutrition Programmes is lacking. Many studies focus on the supplementation of specific micronutrients but few include macronutrient supplementation. A focus on nutrition outcomes for TB patients in nutrition programmes would add great value to the

current body of evidence. Prospective studies investigating the relationship between HIV, TB and nutrition, focusing on the amount of nutrition supplementation needed, and whether co-infection of HIV and TB influences outcomes significantly are required to adjust the volume of supplements needed to achieve positive anthropometric outcomes. Another important questioned raised is how improved adherence to TB treatment improves nutrition outcomes. It is important to improve the quality of the data and monitoring systems, such as including a follow-up protocol to account for patients who do not return. Future qualitative and quantitative studies could provide insight to unanswered questions such as, why patients did not access nutrition supplementation at a clinic level (PEM scheme), why patients were lost to follow up, if patients tolerated the nutrition supplements, if the supplements issued were acceptable to the patients, why patients had not accessed CSG's from birth, and if food gardens contributed significantly to food security.

Programmatic research on the current PEM scheme would provide a deeper understanding of the current strengths and weaknesses. Methods similar to this study could easily be adapted for analysis. Food garden research would provide insight to whether or not the intervention can provide dietary diversity, extra energy, micronutrients and increase food security. Cash transfer models should be further explored in South Africa. Aspects of our current child support grant must be investigated, especially at an operational level, to improve access and decrease time frames. The effect of the child support grant on food security and nutritional status is an important study to consider. This study focused on the outcomes of the entire programme, and perhaps future research could investigate specific aspects such as the quantity of nutrition supplements provided and the effect of nutrition counselling on the patients outcomes in a programme setting.

Conclusion

Overall the PNP had a positive effect on the nutritional status of patients. There was a clear improvement in patients WL/HZ and BMIAZ scores and decrease in the proportion of patients

with a z-score <-1 for those indicators. There was also a significant increase in WL/HZ and BMIAZ scores over time. Although more than half of the patients were HIV-positive and most of them were on ARV treatment, HIV did not show a significant effect on the nutritional outcome of the patients. A quarter of the patients in the programme were diagnosed with TB. TB had a significant negative effect on the WL/HZ and BMIAZ outcomes being achieved for these patients. Contrary to expectations, HIV and TB co-morbidity had no significant effect on outcomes of WL/HZ or BMIAZ. Perhaps a greater focus placed on commencing and adherence to TB medication could further improve nutrition outcomes. Interestingly, symptoms of diarrhoea, loss of appetite and mouth sores significantly decreased within the first month of the programme.

Access to resources such as water and electricity did not seem to influence the nutritional outcomes significantly. Only the child support grant had a positive influence on BMIAZ, nonetheless it was not significant. Upon analysis of the child support grant over time, there was no significant increase which could be attributed to the lengthy process and lack of documentation required to apply. A positive finding is that there was a significant increase in food gardens over the first month which indicates that patients were willing to plant the seeds issued to them. This could impact positively on food security and in turn impact anthropometric outcomes. Patients who received supplementation from the PEM scheme prior to inclusion in the nutrition supplementation programme had significantly improved outcomes for WL/HZ. It is encouraging to note that there was a significant increase of patients receiving supplements from the PEM scheme over time as dietitians' referred all patients on their first visit.

This study has shown that the model of the PNP programme positively affected anthropometric outcomes of patients enrolled in the programme, exposes real challenges in dietetic practice, and provides possible solutions to the challenges presented.

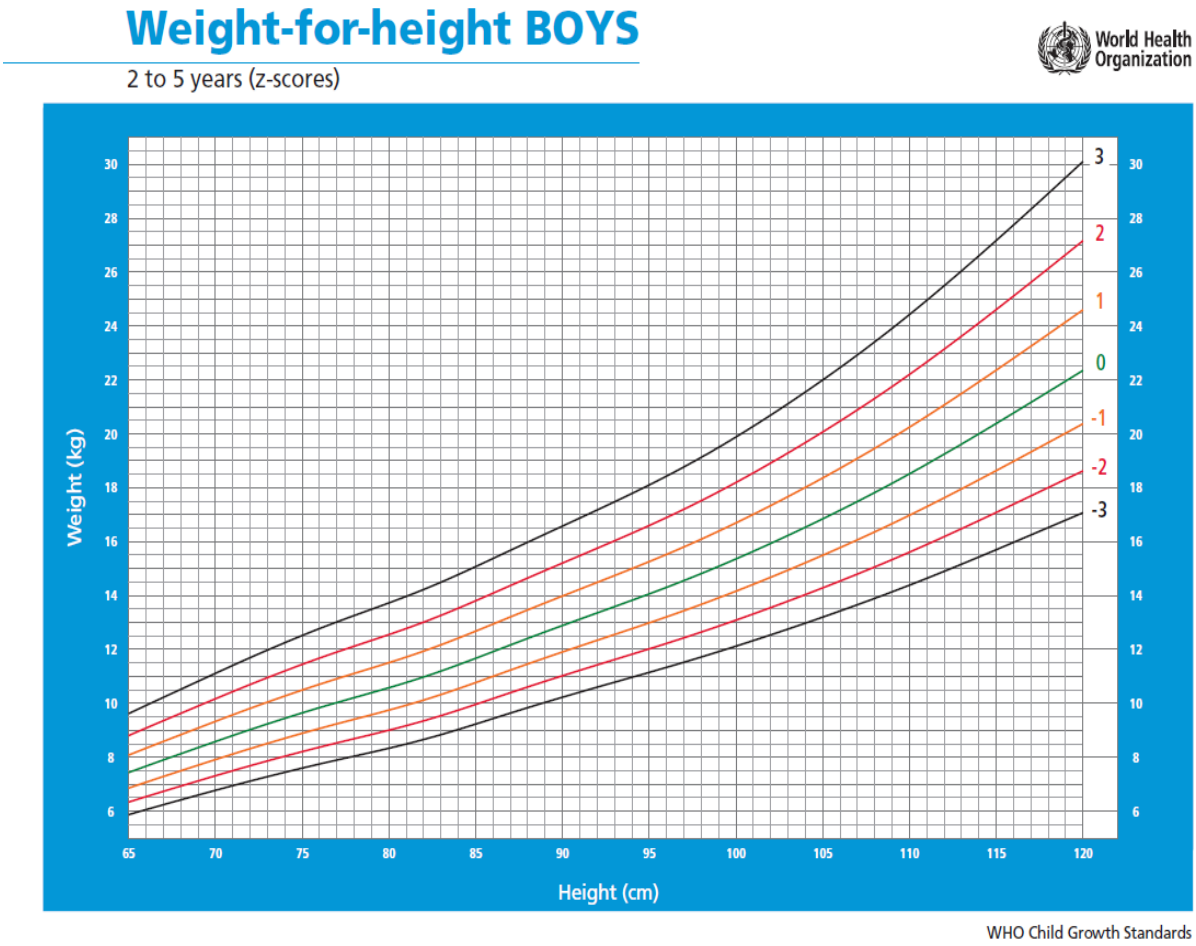
ANNEXURE B

Therapeutic Supplementation: Entry & Exit criteria Children: 0 – 14 years

Column 1 NUTRITION RISK SCORE	Column 2 ASSESSMENT	Column 3 EXIT CRITERIA
Is the child malnourished? **Present weight RTHC/ CDC chart** • Growing well 0 • Not growing well (flat growth/wt loss) 2 • Wt for age falls below -2 Z-score line 4 • Wt for age falls below -3 Z-score line 6 OR MUAC (6mo. – 60months) <115mm 4 MUAC (5 – 9 years) <129mm 4 • MUAC (10 – 14 years) <160mm 4 1. **Appetite** • Good (most of plate eaten) 0 • Poor (½ plate eaten) 2 • Unable to eat (no food eaten for last four meals) 3 2. **Ability to eat** • No problems 0 • Mild vomiting/diarrhoea 1 • Difficulty swallowing/chewing, e.g. mouth sores 2 • Need help with feeding 2 • Severe vomiting/diarrhoea 3 3. **Other Problems** • None 0 • TB/HIV/AIDS 2 • HIV/AIDS & other infections e.g. TB 3	If Score is –0-3 "Not currently at nutrition risk" Primary Intervention • Nutrition Education (if applicable) • Exclusive breastfeeding for 6 months and continued breastfeeding up to 2 years • Appropriate caring practices, in particular complementary feeding which addresses appropriate feeding practices in terms of energy intake, nutrient density of meals, and frequency of meals. • Consumption of micronutrient-rich foods • Safe food preparation & environmental hygiene issues. **4-5 Nutrition "At risk"** • **Start with Primary intervention** (as above) • Provide Therapeutic Supplements • Monitor weight monthly If score >6 "Malnourished" • Therapeutic Supplementation • Reassess monthly	**The Nutrition Risk Score in column 1 should be repeated at each visit.** • Persons will no longer require Therapeutic supplementation if: If Score <4 • Reassess score monthly/ assess at every visit **If Score >4 with:** • No improvement in nutrition score for >6 months • Or if the client is re-scored as <4 N.B. When patient is exiting the programme it is very important to follow-up with Primary Interventions & Monthly monitoring [Column 2].
GO TO COLUMN 2 →	GO TO COLUMN 3 →	

NB TO GET A NUTRITION RISK SCORE, POINTS FOR EACH QUESTION IN COLUMN 1 NEEDS TO BE ADDED!

Appendix 2: Example of WHO Growth Chart



WHO Child Growth Standards

Appendix 3: Paediatric Feeding Protocol for PMMH

PMMH INFANT/PAEDIATRIC TTO PROTOCOL		
AGE: 0 to 6 months		
Body weight < 3rd percentile	Mild Diarrhoea (with lactose malabsorption)	**200ml Soya based Breast Milk Substitute/ kg ABW/ day**
	Moderate Diarrhoea (with lactose-sucrose malabsorption)	**200ml Lactose & Sucrose Free Breast Milk Substitute / kg ABW/ day**
	Severe Diarrhoea (> 3 loose watery stools)	**200ml Semi Elemental Breast Milk Substitute / kg ABW/ day**
Body weight > 3rd but < 25th percentile	Mild Diarrhoea (with lactose malabsorption)	**180ml Soya based Breast Milk Substitute / kg ABW/ day**
	Moderate Diarrhoea (with lactose-sucrose malabsorption)	**180ml Lactose & Sucrose Free Breast Milk Substitute / kg ABW/ day**
	Severe Diarrhoea (> 3 watery stools)	**200ml Semi Elemental Breast Milk Substitute / kg ABW/ day**
Body weight > 25th but < 50th percentile	Mild Diarrhoea (with lactose malabsorption)	**150ml Soya based Breast Milk Substitute / kg ABW/ day**
	Moderate Diarrhoea (with lactose-sucrose malabsorption)	**150ml Lactose & Sucrose Free Breast Milk Substitute / kg ABW/ day**
	Severe Diarrhoea (> 3 loose watery stools)	**180ml Semi Elemental Breast Milk Substitute / kg ABW/ day**
AGE: > 6 to 12 months		
Body weight < 3rd percentile	Mild Diarrhoea (with lactose malabsorption)	**200ml Soya based Breast Milk Substitute / kg ABW/ day + 1 tub Ready to use therapeutic feed (1-2tsps/day)**

	Moderate Diarrhoea (with lactose-sucrose malabsorption)	**200ml Lactose & Sucrose Free Breast Milk Substitute / kg ABW/ day**
	Severe Diarrhoea (> 3 loose watery stools/ day)	**200ml Semi Elemental Breast Milk Substitute / kg ABW/ day**
Body weight > 3rd centile but < 25th percentile	Mild Diarrhoea (with lactose malabsorption)	**180ml Soya based Breast Milk Substitute / kg ABW/ day + 1 tub Ready to use therapeutic feed (1-2tsps/day)**
	Moderate Diarrhoea (with lactose-sucrose malabsorption)	**180ml Lactose & Sucrose Free Breast Milk Substitute / kg ABW/ day**
	Severe Diarrhoea (> 3 loose watery stools)	**200ml Semi Elemental Breast Milk Substitute / kg ABW/ day**
Body weight > 25th centile but < 50th centile	Mild Diarrhoea (with lactose malabsorption)	**150ml Soya based Breast Milk Substitute / kg ABW/ day + 1 tub Ready to use therapeutic feed (1-2tsps/day)**
	Moderate Diarrhoea (with lactose-sucrose malabsorption)	**150ml Lactose & Sucrose Free Breast Milk Substitute / kg ABW/ day**
	Severe Diarrhoea (> 3 loose watery stools)	**180ml Semi Elemental Breast Milk Substitute / kg ABW/ day**

PMMH PAEDIATRIC PROTOCOL (1 - 3yrs)		
Classification	Medical Condition	Monthly Issues
Severely malnourished	**Uncomplicated OR Mild to moderate diarrhoea (3 or less loose watery stools/day)**	12 cans Nutritionally complete lactose free supplement (3 cups/day)
		OR8 cans Nutritionally complete lactose free supplement (2 cups/day) + 2 tubs Ready to use therapeutic feed (2-4 tsp/day)

	Severe Diarrhoea **(> 3 loose watery stools)**	12 cans Nutritionally complete Semi Elemental(3 cups/day)
Moderately malnourished	**Uncomplicated** **OR** **Mild to moderate diarrhoea** **(3 or less loose watery stools/day)**	8 cans Nutritionally complete lactose free supplement (2 cups/day)
		OR4 cans Nutritionally complete lactose free supplement (1 cup/day) + 2 tubs Ready to use therapeutic feed (2-4 tsp/day)
	Severe Diarrhoea **(> 3 loose watery stools)**	8 cans Nutritionally complete Semi Elemental (2 cups/day)
Mildly malnourished	**Uncomplicated** **OR** **Mild to moderate diarrhoea** **(3 or less loose watery stools/day)**	4 cans Nutritionally complete lactose free supplement (1 cup/day)
		OR2 tubs Ready to use therapeutic feed (2-4tsps/day)
	Severe Diarrhoea **(> 3 loose watery stools)**	4 cans Nutritionally complete Semi Elemental(1 cup/day)
PMMH PAEDIATRIC TTO PROTOCOL (4 - 6yrs)		
Classification	Medical Condition	Monthly Issues
Severely malnourished	**Uncomplicated** **OR** **Mild to moderate diarrhoea** **(3 or less loose watery stools/day)**	12 cans Nutritionally complete lactose free supplement (3 cups/day)
		OR 8 cans Nutritionally complete lactose free supplement (2 cups/day) + 2 tubs Ready to use therapeutic feed (2-4 tsp/day)
	Severe Diarrhoea(> 3 loose	12 cans Nutritionally complete Semi

	watery stools)	Elemental(3 cups/day)
Moderately malnourished	**Uncomplicated OR Mild to moderate diarrhoea (3 or less loose watery stools/day)**	8 cans Nutritionally complete lactose free supplement (2 cups/day)
		OR 4 cans Nutritionally complete lactose free supplement (1cup/day) + 2 tubs Ready to use therapeutic feed (2-4 tsp/day)
	Severe Diarrhoea (> 3 loose watery stools)	8 cans Nutritionally complete Semi Elemental(2 cups/day)
Mildly malnourished	**Uncomplicated OR Mild to moderate diarrhoea (3 or less loose watery stools/day)**	4 cans Nutritionally complete lactose free supplement (1 cup/day)
		OR 2 tubs Ready to use therapeutic feed (2-4tsps/day)
	Severe Diarrhoea (> 3 loose watery stools)	4 cans Nutritionally complete Semi Elemental(1 cup/day)
PMMH PAEDIATRIC TTO PROTOCOL (7 - 10yrs)		
Classification	**Medical Condition**	**Monthly Issues**
Severely malnourished	**Uncomplicated OR Mild to moderate diarrhoea (3 or less loose watery stools/day)**	16 cans Nutritionally complete lactose free supplement (4 cups/day)
		OR 12 cans Nutritionally complete lactose free supplement (3 cups/day) + 2 tubs Ready to use therapeutic feed (2-4 tsp/day)
	Severe Diarrhoea (> 3 loose watery stools)	16 cans Nutritionally complete Semi Elemental(4 cups/day)

Moderately malnourished	**Uncomplicated** **OR** **Mild to moderate diarrhoea** **(3 or less loose watery stools/day)**	12 cans Nutritionally complete lactose free supplement (3 cups/day)
		<u>OR</u> 8 cans Nutritionally complete lactose free supplement (2cups/day) + 2 tubs Ready to use therapeutic feed (2-4 tsp/day)
	Severe Diarrhoea **(> 3 loose watery stools)**	12 cans Nutritionally complete Semi Elemental(3 cups/day)
Mildly malnourished	**Uncomplicated** **OR** **Mild to moderate diarrhoea** **(3 or less loose watery stools/day)**	8 cans Nutritionally complete lactose free supplement (2 cup/day)
		<u>OR</u> 4 cans Nutritionally complete lactose free supplement (1 cup/day) + 2 tubs Ready to use therapeutic feed (2-4tsps/day)
	Severe Diarrhoea **(> 3 loose watery stools)**	8 cans Nutritionally complete Semi Elemental(2 cups/day)

Appendix 4: Data Collection Table

Please note that this table is continuous and in spreadsheet form

	Patient Reference Number
	Gender
	DOB
	Date of Entry to Programme
	Date of Exit
	Exit Reason
	HIV Status
	HIV on ARV
	TB
	PEM
	GE
	CP
	Other Diagnosis
	Age in Months
	Weight
	Height / Length
	Height/Length-for-age z-score
	Weight-for-age z-score
	Weight-for-Height/Length z-score
	BMIAZ
	Mid Upper Arm Circumference
	Diarrhoea
	Vomiting
	Mouth sores/thrush
	Loss of Appetite
	Nutrition Risk Score
	Working
	Disability Grant
	Child Support Grant
	Pension
	Foster Care
	None
	Unknown
	Veg garden
	Pt on PEM Scheme
	Elec
	Paraffin
	Gas
	Water inside the house
	River Water
	Water Communal Pump

	Age in Months 1
	Weight 1
	Height / Length 1
	Height/Length-for-age z-score 1
	Weight-for-age z-score 1
	Weight-for-Height/Length z-score 1
	BMIAZ 1
	Mid Upper Arm Circumference 1
	Diarrhoea 1
	Vomiting 1
	Mouth sores/thrush 1
	Loss of Appetite 1
	Nutrition Risk Score 1
	Working 1
	Disability Grant 1
	Child Support Grant 1
	Pension 1
	Foster Care 1
	None 1
	Unknown 1
	Veg garden 1
	Pt on PEM Scheme 1
	Age in Months 3
	Weight 3
	Height / Length 3
	Height/Length-for-age z-score 3
	Weight-for-age z-score 3
	Weight-for-Height/Length z-score 3
	BMIAZ 3
	Mid Upper Arm Circumference 3
	Diarrhoea 3
	Vomiting 3
	Mouth sores/thrush 3
	Loss of Appetite 3
	Nutrition Risk Score 3
	Working 3
	Disability Grant 3
	Child Support Grant 3
	Pension 3
	Foster Care 3
	None 3
	Unknown 3
	Veg garden 3
	Pt on PEM Scheme 3

	Age in Months 6
	Weight 6
	Height / Length 6
	Height/Length-for-age z-score 6
	Weight-for-age z-score 6
	Weight-for-Height/Length z-score 6
	BMIAZ 6
	Mid Upper Arm Circumference 6
	Diarrhoea 6
	Vomiting 6
	Mouth sores/thrush 6
	Loss of Appetite 6
	Nutrition Risk Score 6
	Working 6
	Disability Grant 6
	Child Support Grant 6
	Pension 6
	Foster Care 6
	None 6
	Unknown 6
	Veg garden 6
	Pt on PEM Scheme 6

Appendix 5: Ethics Approval Letter – HREC (Medical) WITS

R14/49 Mr Neil Robert Stephen

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M130382

NAME: (Principal Investigator)	Mr Neil Robert Stephen
DEPARTMENT:	Community Paediatrics Mshiyeni Memorial Hospital, KZN, Umlazi King Edward VIII Hospital, KZN
PROJECT TITLE:	An Assessment of Outcomes of the Nutritional Supplemenation Programme of Children at Prince Mshiyeni Memorial Hospital, Umlazi,KwaZulu Natal
DATE CONSIDERED:	05/04/2013
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Dr Moherndran Archary
APPROVED BY:	Professor PE Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	25/10/2013

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Secretary in Room 10004, 10th floor, Senate House, University.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report.**

N. Stephen
Principal Investigator Signature

19/11/2013
Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix 6: Ethics Approval Letter – PMMH

HEALTH
KwaZulu-Natal

Prince Mshiyeni Memorial Hospital
Private bag X 07, MOBENI 4060
Mangosuthu Highway
Dr. M Aung: Senior Manager: Medical
Tel: 031-907 8304/8317, Fax: 031-9061044
Email: myint.aung@kznhealth.gov.za

Enquires : Dr. M Aung
Ref No. : 24/RECSH/13
Date: 30.08.2013

TO: Neil Robert Stephen

RE: LETTER OF SUPPORT TO CONDUCT RESEARCH AT PMMH

Dear Researcher;

I have pleasure to inform you that PMMH has considered your application to conduct research on **"An Assessment of Outcomes of the Nutritional Supplementation Programme of Children at Prince Mshiyeni Memorial Hospital, Umlazi, KwaZulu Natal"** in our institution.

Please note the following:

1. Please ensure that you adhere to all the policies, procedures, protocols and guidelines of the Department of Health with regards to this research.
2. This research will only commence once this office has received confirmation from the Provincial Health Research Committee in the KZN Department of Health.
3. Please ensure this office is informed before you commence your research.
4. The institution will not provide any resources for this research.
5. You will be expected to provide feedback on you finding to the institution.

Should the following requirements be fulfilled, a Permission/ Approval letter will follow.

- Full research protocol, including questionnaires and consent forms if applicable.
- Ethical approval from a recognized Ethic committee in South Africa

Thank you.

Regards,

Dr. M Aung
Senior Manager: Medical & Specialist in Family Medicine
MBBS(Rgn), PGDip in HIV (Natal), DO(SA)
M.Med.Fam.Med (Natal)

Appendix 7: Ethics Approval Letter – KZN DOH

health

Department:
Health
PROVINCE OF KWAZULU-NATAL

Health Research & Knowledge Management sub-component
10 – 103 Natalia Building, 330 Langalibalele Street
Private Bag x9051
Pietermaritzburg
3200
Tel.: 033 – 3953189
Fax.: 033 – 394 3782
Email.: hrkm@kznhealth.gov.za
www.kznhealth.gov.za

Reference : HRKM 268/13
Enquiries : Mr X Xaba
Tel : 033 – 395 2805

Dear Mr S.R. Stephen

Subject: Approval of a Research Proposal

1. The research proposal titled **'An assessment of outcomes of the nutritional supplementation programme of children at Prince Mshiyeni Memorial Hospital'**was reviewed by the KwaZulu-Natal Department of Health.

   The proposal is hereby **approved** for research to be undertaken at Prince Mshiyeni Memorial Hospital.

2. You are requested to take note of the following:
   a. Make the necessary arrangement with the identified facility before commencing with your research project.
   b. Provide an interim progress report and final report (electronic and hard copies) when your research is complete.

3. Your final report must be posted to **HEALTH RESEARCH AND KNOWLEDGE MANAGEMENT, 10-102, PRIVATE BAG X9051, PIETERMARITZBURG, 3200** and e-mail an electronic copy to hrkm@kznhealth.gov.za

For any additional information please contact Mr X. Xaba on 033-395 2805.

Yours Sincerely

Dr E Lutge
Chairperson, Health Research Committee
Date: 03/10/2013

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