Evaluation of the implementation of the North West Protocol on the management of severe malnutrition at Mafikeng Provincial Hospital and Thusong Hospital in the North West Province of South Africa.

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A mini-thesis submitted in partial fulfillment of the requirements for the degree of Masters in Public Health at the School of Public Health,

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May 2008

Keywords: Severe malnutrition, children, WHO guidelines, hospital, management, Ten steps, case fatality rates, evaluation, hospitals, North West.

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ABSTRACT

Background: Severe malnutrition is a major cause of mortality among children under the age of 5 years during hospital admissions. Causes of deaths include lack of knowledge and motivation among staff, lack of resources and use of outdated protocol. Centers that have used WHO guidelines "Ten steps" have managed to reduce case fatality rates. With the implementation of the WHO treatment guidelines the case fatality rates of severe malnutrition can be reduced to less than 5%. The reduction in case fatality rates has however not been achieved in many hospitals in South Africa. In 2005, the North West Province embarked on training of nurses in the implementation of the "Ten Steps" in several hospitals in the Province. The aim of this study is to evaluate the management of severe malnutrition in the two selected hospitals in North West Province.

Objectives: To assess the current practices of pediatric staff on the management of severely malnourished children at the two hospitals; To compare the practices of pediatric staff with the North West Protocol at the two hospitals; To determine if there is a change in case fatality rates after implementation of the North West Protocol at the two hospitals; To assess the availability of resources necessary for the caring of children with severe malnutrition.

Method: This is a post intervention descriptive study. Data was collected from October to November 2007 at Mafikeng and Thusong Hospitals. The population comprised children below five years of age admitted/ ever admitted in the hospitals, and diagnosed with severe malnutrition. Data was collected through a review of hospital records to obtain case fatality rates and to determine practices of health workers. Structured observations of health workers' activities in the management of malnourished children

was carried out to illustrate general case management together with the assessment of resources required for care of malnourished children.

Results: The extent to which the North West Protocol was followed was found to be better at Thusong Hospital than Mafikeng Hospital during observations (36% vs. 23.4%); record reviews (44.8 % vs. 31%) and retrospective record reviews (48.3 % vs. 44.8%). There was a sharp decrease in deaths due to severe malnutrition from 80.1% in 2005 to 23.4% in 2006 and then increased to 29.7% in 2007 at Mafikeng Hospital. At Thusong Hospital there was a steady increase in the case fataltiy rates from 24.6% in 2005 to 27% in 2006 then 29.7% in 2007.Severe malnutrition constituted a high percentage of total deaths in both hospitals. Thusong Hospital was more equipped with the equipment necessary for implementation of the guidelines (91%) as compared to Mafikeng Hospital (78.3%).

Conclusion: Case fatality rates was found to be high in both hospitals. The study revealed poor implementation of the North West protocol on the management of severe malnutrition in both hospitals.

DEFINITIONS OF TERMS

Severe Malnutrition - severe malnutrition is classified as bilateral pedal edema and/or severe wasting, defined as <70% median or -3 SD weight for height, or clinical signs of severe malnutrition (WHO, 2000).

Wellcome classification of severe malnutrition (Waterlow, 1972)

Weight * (% of standard)	Oedema	
	Present	Absent
80-60	Kwashiorkor	Underweight
< 60	Marasmic Kwashiorkor	Marasmus

* Standard = 50th percentile Boston value

Case Fatality Rate - a percentage of children dying of severe malnutrition during a specific period.

Kwashiorkor - a clinically recognizable syndrome of protein energy malnutrition characterized by low weight or failure to thrive and peripheral oedema. The child may also have skin changes and fine pale sparse hair.

Marasmus - a clinically recognizable syndrome of protein energy malnutrition characterized by severe wasting due to loss of muscle and subcutaneous fat and under 60% expected weight for age (very low weight).

Marasmic – kwashiorkor - a mixed form of severe malnutrition that has features of both marasmus and kwashiorkor.

DECLARATION

I declare that Evaluation of the implementation of the North West Protocol on the management of severe malnutrition at Mafikeng Provincial Hospital and Thusong Hospital in the North West Province of South Africa is my own work, that it has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Goabaone Panky Mogomotsi May 2008

Signed……..

ACKNOWLEDGEMENTS

I thank the Lord for giving me the strength, the guidance and everlasting love through my studies and my stay in Cape Town. Gratitude goes to my husband, Zacharia Mogomotsi, for his continued love, patience and support, he allowed me this opportunity to leave our home to go and study while taking care of our little girl. Gratitude also goes to my supervisor, Thandi Puoane, for support, encouragement, for believing in my abilities and for her valued inputs. Gratitude also goes to the witting coaches, especially Ozeniel Rudzuvizo who has earnestly worked with me throughout my project, correcting all the grammar. I would also like to thank Mr Lesolobe who has provided me with all the information I needed for the province. I would like to thank the hospital staff and the mothers who made my work much easier by allowing me to work with them. I would also like to thank the administrative staff at University of the Western Cape who was always ready to answer our questions. Thank you all for making my studies pleasant. May God bless you all**.**

ABBREVIATIONS

SAVACG	South African Vitamin A Consultative Group
CSO	Central Statistics Office
NFCS	National Food Consumption Survey
WHO	World Health Organization
UNICEF	United Nations Children's Fund
SD	Standard Deviation
NCHS	National Center for Health Statistics
MUAC	mid Upper Arm Circumference
WHZ	Weight for Height Z scores
HIV	Human Immuno Deficiency Virus
AIDS	Acquired Immune Deficiency Syndrome
ORS	Oral Rehydration Salts
SOROL	South African Rehydration Oral Salts
ReSoMal	Oral Rehydration Salt Solution for severely malnourished children
NG	Nasogastric
IV	Intra venous
K	Potassium
Mg	Magnesium
RUTF	Ready to eat therapeutic foods
TB	Tuberculosis
CFR	Case Fatality Rates
UNAIDS	Joint United Nations Programme on HIV/AIDS

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CHAPTER 1

1.0 INTRODUCTION

1.1 Background Information

Investing in the health and well-being of children is a long-term investment in the future development of a nation. Children's nutritional status is a reflection of their overall health status (CSO, 2000). When children have access to adequate food supply, not exposed to repeated illnesses, and are well-cared for, then they can reach their growth potentials and therefore are considered well-nourished.

1.2 Global problem of Malnutrition

Malnutrition is an underlying cause of more than 50% of the 10 million child deaths that occur each year throughout the world, mainly from preventable causes like diarrhoea and respiratory infections (Black, Morris and Bryce, 2003). It is the direct cause of about 300 000 child deaths globally. The vast majority of all malnutrition related deaths occur in children who are mildly and moderately malnourished. However, the risk of death is greater for severely malnourished children (Pelletier, Frollingo and Habitcht, 1994). According to Pelletier *et al.* (1994), on average a child who is severely malnourished is 8.4 times more likely to die from infectious disease than a well-nourished child, while a moderately underweight child is 4.6 times more likely to die than a well nourished child.

1.3 Malnutrition in South Africa

Malnutrition in children remains a leading cause of morbidity and mortality in South Africa (Puoane, Sanders, Ashworth and Ntumbela, 2006). Several studies have been conducted in South Africa to determine nutritional status of children. The South African Vitamin A Consultative Group (SAVACG), found the prevalence of underweight, stunting and wasting to be 9.3%, 22.9%, 2.6% respectively in children aged 6-72 months (SAVACG, 1994). A study of the National Food Consumption Survey (NFCS) of children aged 1-9 years showed a 10.3% national prevalence of underweight, 21.6% stunting and 3.7% wasting (Labadarios *et al.*, 2001). The prevalence of malnutrition was found to be highest in rural areas, and particularly on commercial farms and in informal settlements when compared to urban areas.

1.4 Severe Malnutrition

Severe malnutrition is classified as bilateral pedal edema and/or severe wasting, defined as <70% median or -3 SD weight for height, or clinical signs of severe malnutrition (WHO, 2000). The prevalence of severe malnutrition is estimated at around 2% in the least developed countries and 1% in developing countries (UNICEF, 2005). This according to Briend, Prudhon, Prinzo, Daelmans, and Mason (2006), translates to about 10 million severely malnourished at one time.

Severe malnutrition is a major cause of death among pediatric hospitals in developing countries (Puoane *et al*., 2006). On average 25-30% of children with severe malnutrition die during hospital treatment, and this trend has been documented since the 1950's (Schofield & Ashworth, 1996). The high case fatality rate has been attributed to poor case management of severe malnutrition by health workers (Schofield & Ashworth, 1996), and according to the authors,

improving case-management has the potential to avert approximately 0.5 million malnutrition deaths annually.

1.5 WHO guidelines

Guidelines for treatment of severe malnutrition were set out by WHO (1999) in the form of a manual written specifically for physicians and senior health workers, to decrease case fatality rates. The WHO protocol follows ten steps to effective management of severe malnutrition in two phases; stabilization phase - whereby life threatening problems are identified and treated and then a rehabilitation phase - whereby children are rehabilitated in order to pick up weight. Studies show that following this protocol can substantially reduce case fatality rates even in resource poor areas (Ashworth, *et al.*, 2004; Deen *et al.*, 2003).

1.6 Implementation of the WHO Guidelines in South Africa.

In South Africa, the implementation of the WHO protocol was successfully initiated in 1998 in the Eastern Cape, Limpopo and Kwazulu Natal Provinces, and then later in 2005 in the North West Province. Results from such implementation indicated a reduction in case fatality rates and a change in practices of health workers (Ashworth *et al*., 2004; Karaolis *et al.*, 2007; Puoane *et al.*, 2004; Deen *et al.*, 2003).

1.7 North West Province

The North West is regarded as the sixth largest of the nine provinces in South Africa with 3.4 million residents, constituting 8.3% of the national population (Tladi, Baloyi and Van Boom, 2002). Over sixty percent (65%) of the population live in rural areas. The province is

characterized by high unemployment rates (38%), as compared to the national average (33.8%) and inequality in terms of access to resources and poverty. Poverty affects 62% of the province population, the second highest figure for South Africa, with literacy rate of about 70%, which is below the national average of 82.8%.

In 1998, thirty three percent (33%) of the North West population was younger than 14 years (Tladi *et al*., 2002). The prevalence of moderate under-nutrition and severe malnutrition for children under five years was found to be 15.3% and 1.3% respectively (Department of Health, 2005). A mortality audit conducted in the province found under-five mortality rate to be around 5.7%, with severe malnutrition constituting 16.3% of the deaths (Krug, Pattison and Power, 2004).

This research aims to investigate practices of health workers regarding management of severe malnutrition in two hospitals in the North West province, and these are Mafikeng Provincial Hospital (a level 2 hospital situated in the North West Capital City, Mafikeng) and Thusong Hospital (a district hospital, mainly surrounded by farms).

1.8 Problem statement

The baseline evaluation, which was conducted prior to the implementation of the North West protocol (Department of Health, 2007) in the management of severe malnutrition (see appendix 3), showed high case fatality rates (80% at Mafikeng Hospital and 24.6% at Thusong Hospital) and poor practices by health workers at the two hospitals. Since the baseline evaluation, no follow up studies have been done to assess the programme regarding changes in health workers'

practices in relation to the protocol and to evaluate whether there has been an improvement in the case fatality rates.

1.9 Justification

Studies show that even after implementing the WHO protocol on the management of severe malnutrition, some hospitals still record high case fatality rates (Ashworth *et al.*, 2004; Karaolis *et al.*, 2007; Deen *et al.*, 2003). Therefore there is need for rapid assessments to highlight areas needing improvement (Puoane *et al.*, 2001). The evaluation was also conducted to determine sustainability of the intervention in the two hospitals over the years. This is important as studies have shown that health workers have a tendency of not following the guidelines after training (Osterholt *et al.*, 2006). According to Dignan and Carr (1992), evaluation is needed for monitoring efficacy of programmes to aid in the planning of future programmes, and to provide defensible evidence of the value of current programmes. The two hospitals were chosen as they were among the first hospitals in North West Province to receive training in the implementation of the WHO guidelines. The evaluation was also undertaken so as to give a true picture of the practices of health workers, and also to establish the current case fatality rates at the two respective hospitals. There is also a need to establish the long-term effect of such interventions (sustainability) in these hospitals. The results are intended to be used to facilitate further improvement in the management of severe malnutrition at the two hospitals and other facilities in the province.

1.10 Outline of the thesis

The thesis consists of the introduction and background information of the study in chapter one. The literature review is in the next chapter (two) while chapter three is devoted to the description of the research design and methodologies. Chapter four covers presentations of the obtained results of the study, while chapter 5 is devoted to discussion of the findings. Chapter six addresses the conclusions and recommendations.

CHAPTER 2

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter explores the different diagnoses of malnutrition in hospitals, its causes, magnitude and consequences. The chapter also explores the broad management of severe malnutrition in hospitals, as to what extent the hospitals are applying the ten WHO guidelines, how feasible it is to practically apply the guidelines in resource-limited settings and what are the best possible ways of applying the guidelines.

2.2 Malnutrition

2.2.1 Background

"Malnutrition is a silent emergency, but the crisis is real, and its persistence has profound and frightening implications for children, society and the future human kind" (UNICEF, 1998:9). Globally 226 million children are stunted (shorter than they should for their age), 67 million are estimated to be wasted (they are below the weight they should for their height) and 183 children weigh less than they should for their age (UNICEF, 1998).

In Africa, one of every three children is underweight (UNICEF, 1998). According to UNICEF (1998) the malnutrition rates have been declining in most regions of the developing world, over the last two decades, except in Sub- Saharan Africa where malnutrition rates began increasing in most countries following the regional economic decline that began in the early 1990s.

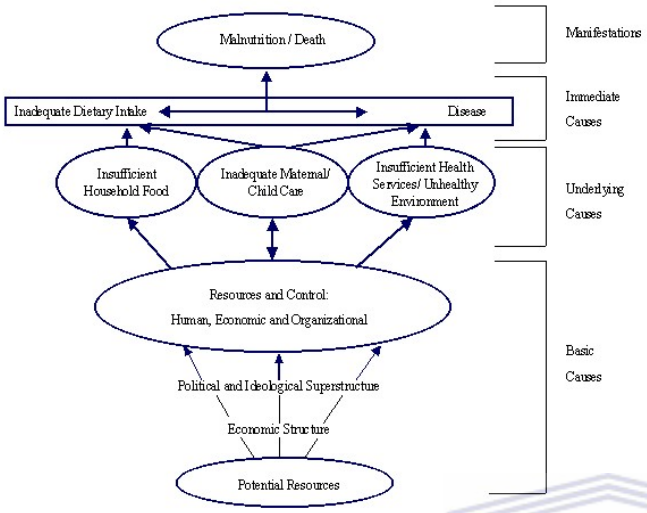
2.2.2 Different forms of Malnutrition

Malnutrition, defined in public health by poor anthropometric status, is mainly a consequence of inadequate diet and frequent infections leading to deficiencies in calories, protein, vitamins and minerals (WHO, 2002). Malnutrition can range from mild (underweight) to severe forms (stunting and wasting) including iodine deficiencies, iron deficiencies and vitamin A deficiencies.

2.2.3 Causes of malnutrition

According to the UNICEF conceptual framework the two most significant immediate causes of malnutrition are illnesses and inadequate dietary intake (UNICEF, 1998). Some of the underlying factors which result in poor food intake and illness include inadequate access to food in a household, insufficient health services, inadequate maternal and child care, and an unhealthy environment with limited access to clean water and safe waste disposal. Poverty and lack of resources are some of the basic factors that lead to malnutrition, however, political, legal and cultural factors may also contribute to the basic factors.

FIGURE 1: UNICEF Conceptual Framework



Source: UNICEF, 1990

2.3 Severe Malnutrition

2.3.1 Classification

Some severely malnourished children develop clinical signs that are easily observed – severe wasting (or marasmus) and the syndrome kwashiorkor, with skin and hair changes and swelling of arms and legs. According to WHO severe malnutrition is classified as bilateral pedal edema and/or severe wasting, defined as <70% median or -3 SD weight for height, or clinical signs of severe malnutrition (WHO, 2000). The Wellcome classification defines severe malnutrition as a weight for age of < 60% of the normal value and/or the presence of edema (Waterlow, 1972).

Weight for height (WHZ), rather than weight for age (WAZ) is a better indicator of recent or ongoing weight loss or wasting (Trowbridge, 1979, cited by Bhan, Bhandari & Bahl, 2003).

Information from the literature indicates that the use of weight for height scoring is sometimes problematic and in most cases not undertaken in practice (Berkley *et al.*, 2005; Ashworth *et al.*, 2004) as the most important practical difficulty of anthropometric assessment is inaccurate measurements especially length. Ashworth *et al.* (2004) found out that in their study doctors used clinical signs and weight for age scores of less than 60% of the normal values, to diagnose severe malnutrition, and about half of the children met the WHO criteria for severe malnutrition. The authors therefore argue that use of a low weight for age alone can lead to inappropriate admission of stunted children.

It is also important to note that not following the recommended criteria above could in other instances, result in severe malnutrition being under-diagnosed or wrongly diagnosed (Hamer, Kvaum, Jeffries and Allen, 2004; Ashworth *et al.*, 2004). At small facilities, Brewster (2006) advocated for the use of underweight and mid upper arm circumference (MUAC) as the most feasible and useful anthropometric indices, as well as the use of some longitudinal growth charts. He strongly advocated that every protocol should acknowledge limitations of anthropometric assessment, which among other things, include inaccuracies of length measurements. Berkley *et al.* (2005) also found the use of MUAC and WHZ as very effective in predicting subsequent inpatient mortality among hospitalized severely malnourished children. There is therefore some need for a review of the current diagnostic methods of severe malnutrition in order to come out with some recommendations that would be more practical, appropriate and valid, especially in developing countries.

2.3.2 Consequences of Severe Malnutrition

Severe malnutrition in children is commonly found in conjunction with gastroenteritis, pneumonia, and other infections. The children usually undergo other physiological and metabolic changes, which include reduction in functional capacities of various organs and slowing down of some cellular activities (Ashworth, 2006). These changes put these children at certain risks of death from conditions such as hypoglycemia, hypothermia, electrolyte imbalance, heart failure, and untreated infections. Therefore they need careful assessment, special treatment and management.

Severely malnourished children also demonstrate marked behavioral anomalies in the acute phase (Grantham -McGregor, 1995). They are less active, irritable and their developmental levels are very low. A review of studies on the effect of severe malnutrition on mental development found that previously malnourished children showed a deficit in tests of cognitive function or intelligence especially if they return to poor environment, which include poor physical and economic resources, such as overcrowded homes with poor sanitation and water, few household possessions and low income (Grantham- McGregor, 1995). However the abnormal behavior seen is said to be transient and can improve rapidly if they participate in a stimulation program, or when health care and nutrition are provided continually.

2.3.3 Problem of Severe Malnutrition in hospitals

According to WHO , a case-fatality rate of >20% is considered unacceptable, 11–20% is poor, 5–10% is moderate, 1–4% is good and <1% is excellent (WHO, 1999). A review of the literature by

Schofield and Ashworth (1996), using data from 67 hospitals and rehabilitation units treating children with severe malnutrition, found that case fatality rates in hospitals treating severe malnutrition in developing countries, average between 20% and 30% and have remained unchanged since the 1950's, of which according to WHO is unacceptably high, despite understanding of the etiology and patho-physiology of the condition.

In a rural hospital in Zambia and with a child population of about 299 with severe malnutrition, case fatality rate was found to be 28.5% (Gernaat, Dechering and Voorhoere, 1998). Retrospective record review of admissions in Kenya also found that in about 7869 children admitted in hospitals, 12% were severely malnourished and 19% of those children died (Maitland, Berkley, Shebbe, Peshu, English and Newton, 2006). One study from the Gambia and another from Ghana found case fatality rates to be at 20% before implementation of the WHO protocol (Wilkinson, Scrace and Boyd, 1996; Deen *et al*., 2003)

In South Africa high case fatality rates in hospitals are also common. Puoane *et al.* (2001) reported some case fatality rates of 28% and 50% in two hospitals in the Eastern Cape before implementation of the WHO protocol. Deen *et al.* (2003) also reported case fatality rates of 35% in Mapulaneng hospital in the Northern Province of South Africa.

2.3.4 Case fatality rates and associated causes

A survey of treatment centers world-wide (n=79) have shown that a major cause of the high case fatality is due to faulty case management as a result of inadequate knowledge (Schofield & Ashworth, 1996). Inappropriate practices associated with high mortality rates range from overuse

of intravenous fluids for rehydration, inadequate feeding leading to hypoglycemia and hypothermia, untreated infections, prescribing diuretics for edema, failure to correct electrolytes, micronutrient deficiencies (Puoane *et al.*, 2001), to blood transfusion (Bachou, Tumwine, Mwadime and Tyllestar, 2006). Nolan *et al.* (2001), reviewed data from 21 hospitals from 7 countries and identified poor practices like inappropriate or late triage, inadequate initial assessment, delay in giving appropriate treatment, inadequate monitoring and failure to reassess.

According to Ashworth *et al.* (2004) of the 46 deaths experienced in their study, 37 of them were judged to be avoidable. Poor fluid management was shown to account for 28% of the deaths in children with severe malnutrition (Deen *et al.*, 2003; Karaolis *et al.*, 2007). Bachou *et al.* (2006) found that 30% of those with non severe dehydration were infused, and of these 43% died.

Other factors that affect mortality rates are the severity of the illness, especially the presence of sepsis. Sepsis and bacterial diseases were also found to be major cofactors in many of the deaths, complicating about 27% of the deaths (Maitland *et al.*, 2006). Karaolis *et al* .(2007) found sepsis to account for 46% of all the deaths, while in the study by Ashworth *et al.* (2004) sepsis was presumed to be the most frequent cause of the death accounting for 43% of deaths.

A qualitative study by Puoane *et al.* (2006) revealed some negative attitudes among health workers towards malnourished children and their mothers. The health workers blamed the mother for not adequately caring for the children at home, and placed less value on malnourished children as compared to other children.

2.4 Management of Severe Malnutrition

2.4.1 Development of the WHO guidelines

The high case fatality rates in hospitals prompted a number of initiatives by various groups aimed at improving care for severely malnourished children. Therefore up to date principles/guidelines were set out by WHO (1999) in the form of a manual written specifically for physicians and senior health workers at first referral level hospitals in developing countries. Subsequently, the guidelines were then used as a basis of training modules for health workers and have so far been extensively tested in South Africa (Schofield, 2003). The manual provides some practical guidelines for the management of patients with severe malnutrition as a way of promoting the best available therapies so as to decrease the risks of death, to shorten the length of time spent in hospitals as well as to facilitate both rehabilitation and full recovery of patients (WHO, 1999). General treatment of severe malnutrition involves 10 steps.

The following are the ten essential steps:

1. Prevent or treat hypoglycemia (low blood sugar),
2. Prevent or treat hypothermia(low body temperature),
3. Prevent or treat dehydration(loss of body fluids),
4. Correct electrolyte imbalance(salts in blood and cells),
5. Treat and prevent infections,
6. Correct micronutrient deficiencies (vitamins and minerals),
7. Start cautious feeding,
8. Give catch-up diet,
9. Provide loving care, play and stimulation,
10. Prepare for discharge and follow up.

Illustrations by Ashworth, Jackson, Khanum and Schofield (1996)

2.4.2 Different phases of management

Management of severe malnutrition is divided into two phases. The initial stabilization phase focuses on restoring homeostasis and treating medical complications and it usually takes 2 to 7 days of inpatient treatment, depending on the severity of the malnutrition and underlying diseases of the child upon admission. Life threatening problems such as severe infections including septic shock and severe dehydration, hypoglycemia and hypothermia must be identified and treated promptly. This phase includes dietary therapy with a milk based formula (F75) to be given frequently in small amounts to avoid overloading the system. The formula provides low amounts of energy and proteins, (75 kcal/100ml and 0.9g protein/100ml).

The rehabilitation phase focuses on rebuilding wasted tissues and this may take up to several weeks. As soon as the child's appetite improves it enters the rehabilitation phase, and the transition from stabilization phase should be gradual to avoid the risk of heart failure. The formula used in this phase is F100, which has a higher protein and energy content (provide 100 kcal and 2.9g protein per 100ml, aimed at an intake of 130 ml per kg body weight per day. The treatment procedures are the same for marasmus and kwashiorkor.

After the rehabilitation phase there is need for follow up, as recovery may take several weeks, their discharge from hospital should be carefully planned in order to provide outpatient care to complete their rehabilitation and to prevent relapse.

TABLE 1: Ten steps for treatment of severely malnourished children

Step	Action	Stabilization		Rehabilitation
		Days 1-2	Days 3-7	Weeks 2-6
1	Prevent or treat hypoglycemia	……..		
2	Prevent or treat hypothermia	……..		
3	Prevent or treat dehydration	……..		
4	Correct electrolyte imbalance	…….		
5	Treat and prevent infections	……..		
6	Correct micronutrient deficiencies	……No iron……..		With iron
7	Start Cautious feeding	…….		
8	Give catch-up diet for rapid growth			……..
9.	Provide loving care, play and Stimulation	……..		
10.	Prepare for follow-up and discharge			……..

Source: (Ashworth, Jackson, Khanum, and Schofield, 1996**)**

2.4.3 Feasibility of using the ten WHO guidelines in under-developed areas

Successful management of severe malnutrition requires that each child be treated with proper care and affection, and that each phase of treatment be carried out properly by appropriately trained and dedicated health workers (WHO, 1999).

Most studies suggest that the availability of sufficient resources, particularly skilled and motivated staff, for the management of severe malnutrition is vital for its success and effectiveness. Most under-developed areas have severe capacity constraints, very few skilled staff and high case fatality rates (Ashworth *et al.,* 2004). However it has been shown that hospital staff has the ability to identify and even rectify poor practices in a manner that can meaningfully reduce case fatality rates even in the most under-resourced circumstances. This has been evidenced through different studies (Puoane *et al.*, 2004; Wilkinson *et al.*, 1996; Ashworth *et al.*, 2004).

Wilkinson *et al.* (1996) attributed the decrease in case fatality rates in their study to some increased attention on the disease and intensive management of each and every case by nurses, although this may not be easy in very busy hospital wards. Karaolis *et al.* (2007) reported that the guidelines were largely feasible in their study, however not all the tasks were always performed fully or with sufficient care. Constraints reported for the ineffective implementation of the guidelines were understaffing, low morality and high staff turnover. Other constraints included doctors' poor knowledge, nurses' inattentiveness as well as poor communication among staff members.

Deen *et al.* (2003) intentionally selected two general hospitals that seemed to have good chances of implementing the guidelines and found out that while most of the main principles of the WHO's severe malnutrition guidelines were feasible, affordable and sustainable over a year period, some were feasible but not sustainable, and others not feasible. Case fatality rates were reported to be 18% in both hospitals after implementation of the guidelines from 35% in Mapulaneng hospital and 20% in Battor hospital, and therefore did not reach the target mortality rate of 5-10%. They reported that they were not able to change certain hospital policies and attitudes plus practices of some health workers. They attributed their improvement to the involvement of hospitals in the planning of changes from outset, acknowledgement of logistical limitations and local modifications of all generic protocols. However, most studies have found that the changes that were feasible were those that did not require some radical moves to the systems.

2.4.4 Different use of protocol

Despite the recommendation that all the ten steps in the WHO protocol be followed, none of those hospitals who recorded a reduction in case fatality rates (CFR) had ever followed all the steps. Wilkinson *et al.* (1996) only used two interventions; routine antibiotic combinations and hypoglycemia prevention and managed to reduce the case fatality rate from 20% to 6%.

Ahmed *et al.* (1999) used a standard protocol which included rehydration (avoidance of IV fluids as much as possible), immediate feeding, routine antibiotic therapy, Vitamin A and micronutrients supplementation, as well as hypoglycemia and hypothermia management. In this case, they managed to register case fatality rates of 9% in the standard protocol as compared to 17% for the non protocol situations.

Ashworth *et al.* (2004), succeeded to reduce the case fatality rates by introducing three-hourly day and night feeds, keeping children warm, giving oral dehydration and eliminating diuretics. They managed to reduce the CFR from 46% to 21% at Mary Theresa Hospital and from 25% to 18% at Sipetu Hospital before it rose again to 38%. For most of the studies, tasks that were not fully implemented were play and stimulation as well as effective follow-up systems (Karaolis *et al.*, 2007). According to Brewster (2006), feasibility of stimulation interventions in a hospital setting is limited, particularly in view of the shorter length of stay for the patients. One could therefore conclude that a few changes to improper practices that are manageable, given the constraints in each different setting, could have a positive impact on case fatality rates especially in resource-limited areas.

2.4.5 Reduction in mortality

Low mortality from severe malnutrition is certainly attainable, in their review by Schofield and Ashworth (1996), they found that of the 76 data sets examined , 15% had mortality levels below 19%, the lowest being 3.3%. Some studies have also managed to identify some specific health centers that had managed to decrease their case fatality rates to less that 10% after the application of the ten WHO guidelines on the management of severe malnutrition (Ahmed *et al.*, 1999; Wilkinson *et al.*, 1996; Khanum, Ashworth and Hutty, 1994).

2.4.6 Length of hospitals stay

The WHO manual focuses on an in-patient rehabilitation program up until wasting has been resolved that has an average duration of about 2-3 weeks (WHO, 1999). This is however a time that will not be very feasible in developing countries where resources are limited and more children are severely malnourished. Khanum *et al.* (1994) found out that the case fatality rate of 3.5% of children under treatment in hospitals was similar to that of children who were briefly admitted for one week in hospital and then continuing to get care at home. The authors pointed out that most mothers favored the home care-giving practices more than hospital care systems as the process could not interfere with their household chores.

According to Collins, Dent, Binns, Banwere, Sadler and Hamer (2006) most care-givers of malnourished patients come from the poorest families and the process has great demands on their time. It can therefore be concluded that the length of hospitals stay can be reduced in situations where mothers are willing to continue with the rehabilitation at home, and only if they are

appropriately educated.

2.4.7 Early deaths

Substantial evidence shows that most children die within the first 48 hours of admission, which may indicate that most of them are admitted or come into contact with facilities when they are already in a bad state. This, according to Deen *et al.* (2003) emphasizes the importance of access to care, referral patterns and late presentation of severe malnutrition. Brewster (2006) attributed the early deaths to poor diagnosis of severe malnutrition by health workers, poor management of severe malnutrition in the community, or high severity of the illness. There is therefore a need for primary health care providers to strengthen prevention with regards to severe malnutrition so that they can be able to identify children at risk early, and provide early and appropriate interventions.

Early deaths may also reflect poor practices during the critical stage of stabilization. Few deaths within the first 24 hours were found in the study by Ashworth *et al.* (2004), and they attributed this to introduction of 3 hourly feeds day and night, giving oral instead of IV fluids and keeping children warm, which may have prevented deaths from hypoglycemia, hypothermia and cardiac failure.

In their study Maitland *et al.* (2006) identified four signs at the bedside on admission of children that were the highest predictors of early deaths and these were; slow heart rate, weak pulse volume, depressed consciousness level and a delayed capillary refilling. Knowing the risk factors for early death is vital because those patients at risk can be given priority over others in order to prevent such fatalities.

2.5 Training of health workers on management of severe malnutrition

There is good evidence that adequate training of health workers in the management of severe malnutrition is essential if its implementation is to be effective. This can be done through some in-service training as well as incorporating the program into both the medical and nursing curricular. Training has been shown to alter the perceptions of health workers resulting in them having some better understanding of how severe malnutrition can be managed, hence improving their motivation and quality of care (Puoane *et al.*, 2006). Ashworth *et al.* (2004) found that after training of health workers, the case fatality rate at Sipetu Hospital was reduced from 25% to 18%. It only rose again to 38% when some untrained doctors were later recruited to the hospital, which indeed showed that training on its own has some significant and positive benefits. However one would note that training without provision of the necessary resources and a strong supervisory base would prove to be ineffective, as was demonstrated by the many studies in developing countries where such approaches had only managed to bring down the case fatality rates to 18%, and not less than that.

From the different studies the effect of training seems to wear off after some time. In their study, Ashworth *et al.* (2004) showed that even after training was done at most hospitals, some preventable deaths still occurred, and they attributed this to problems of staffing and low motivation.

2.6 HIV and severe malnutrition

According to Schofield and Ashworth (1996) in the 1990's case fatality rates of 50-60% were reported in children, making it unlikely that these high rates were linked to HIV. This was further supported by some subsequent studies that found no relationships between HIV and mortality in severely malnourished children (Gernaat, Dechering, and Voorhoere, 1998; Bachou *et al.*, 2006; Ticklay, Nathoo, Siziya and Brady, 1997).

However from the literature, most of the children admitted to hospitals with severe malnutrition are HIV positive. One study found a large proportion of severely malnourished children to be motherless, positive for infection with HIV, or seriously ill upon arrival at the hospitals (Deen *et al.*, 2003). Another study, although not significant, proclaimed that malnourished HIV positive children were found to have a higher risk of mortality (Bachou *et al.*, 2006). A mortality audit in the North West province found out that 61.9% of under-five deaths were attributed to AIDS or HIV related diseases. Furthermore, Yeung, Wilkinson, Escot, and Gilks (2000) found out that HIV positive children were more likely to be malnourished, less likely to respond to routine antibiotic therapy and much more likely to die during admission. Although HIV was found to have no direct impact on mortality, it was found to have an impact on childhood nutrition morbidity (Ticklay *et al.*, 1997). Once again, although HIV/AIDS was not an independent cause of death in severe malnutrition, it contributed a lot to the severity of the disease, and therefore needed to be seriously taken into consideration in the management of severe malnutrition.

2.7 Implementation of the Guidelines in South Africa

2.7.1 Adaptation of the guidelines in South Africa

In South Africa the WHO guidelines were adapted to develop the Eastern Cape protocol. The protocol was first piloted in 2 rural hospitals of the Eastern Cape in 1998. Key messages based on the WHO ten steps were formulated and a training course and guide developed to facilitate implementation in other hospitals in South Africa (Puoane *et al*., 2004).

2.7.2 Training of health Workers in North West province- intervention

In the North West trainings were conducted in 2005, as a capacity building on some health workers as a way of equipping them with both knowledge and skills necessary for the implementation of the management of severe malnutrition within the WHO frameworks. This was made easier with some technical assistance from the University of the Western Cape. Preparation for training included collection of baseline data on the current situation in the management of severe malnutrition. The duration of the training was 5 ½ days. Training was based on the WHO guidelines for the management of severe malnutrition "Ten Steps". For each of the steps the purpose and objectives for the steps was introduced. Physiological changes due to malnutrition were discussed and actions taken to prevent deaths during treatment. As part of the training an advocacy meeting was held with stakeholders involved in the care of severely malnourished children e.g. district health managers, matrons, professional nurses, dieticians, pharmacists and community liaison officers.

Action plans were developed for each hospital, to ensure full commitment of the health

personnel to the WHO guidelines. Subsequently the North West protocol was adapted from the Eastern Cape protocol. Ongoing trainings were conducted in the province afterwards.

2.8 Barriers to implementation of the guidelines

Several studies document that health workers have a tendency of not following treatment guidelines (Osterholt *et al.,* 2006), therefore this have a negative impact on the expected outcome. Cabana *et al.* (1999) reviewed 76 articles describing at least one barrier to adherence to clinical practice guidelines and found seven general categories of barriers.

1. Lack of awareness due to the many guidelines produced.
2. Lack of familiarity- according to the paper casual awareness does not guarantee familiarity of guidelines and ability to apply them correctly.
3. Lack of agreement- physicians may not agree with a specific guideline or concept of the guidelines.
4. Lack of self efficacy- the believe that one can actually perform a behavior
5. Lack of outcome expectancy- if the physician believes that a recommendation will not lead to an improved outcome the physician will be less likely to adhere
6. Inertia or previous practices- physician may not have the motivation to change from previous practice.
7. External barriers e.g. time limitations.

Ashworth *et al.* (2004) found in their study that doctors often displayed reluctance to undertake aggressive antibiotic treatment without clinical or laboratory evidence. Newly qualified doctors were also reluctant to prescribe potassium thinking it to be dangerous. Deen *et al.* (2003) also

found the barriers to implementation to be the inability by hospitals to change certain hospital policies e.g. mothers of severely malnourished children were allowed in the wards at certain time briefly during the day, despite the potential impact on the care and sensory stimulation of the children. According to Karaolis *et al.* (2007) high doctor turnover and an unsupportive health system were some of the factors that eroded the gains made in improving mortality rate. Inexperienced doctors were left to treat patients without having been adequately trained.

2.9 Overcoming barriers

Deen *et al.* (2003) found that successful implementation in their study depended on the availability of authoritative guidelines, an external support system, a participatory approach and a willingness to change on the part of the institution. Participatory research was also advocated by Puoane *et al.* (2004), whereby a formation of the hospital nutrition team was put in place and involved in all stages of the research which identified shortcomings in the clinical management and took action assisted in the reduction of case fatality rates. Another important factor was the involvement of relevant hospital, provincial and district management personnel.

2.10 Methodologies used

Evaluation is defined as the collection and analysis of information by various methodological strategies to determine the relevance, progress, efficiency, effectiveness, and impact of the program activities (Rossi and Freeman, 1993).

The common methods used in previous studies to collect data to evaluate health workers included structured observations of health workers, record reviews, interviews (in-depth and

focus group discussions) with health workers and care-takers and assessment of resources (Karaolis *et al.,* 2007; Puoane *et al.,* 2006). An advantage of using all the methods is in the combination of strengths from each of the methods used as it compliments quantitative aspects of the design with some qualitative methods to understand better the underlying problems. However, use of existing data may pose a problem of incompleteness in records (Puoane *et al.,* 2004).

CHAPTER 3

3.0 RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter specifically focuses on the methodological strategies that were used in this study. It addresses aspects such as the study population, research design, instruments used and methods of data collection. Finally the methods of data analysis, ethical concerns and limitations of the study will be discussed.

3.2 The Aim

The overall aim for this study is to evaluate the implementation of the North West Protocol "Ten Steps" on the management of severe malnutrition two years after intervention was introduced at Mafikeng and Thusong hospitals.

3.3 Study Objectives

The following objectives were set to be achieved:

1. To assess the current practices of pediatric staff on the management of severely malnourished children at the two hospitals.
2. To compare the practices of pediatric staff with the North West Protocol at the two hospitals.
3. To determine if there was a change in case fatality rates after implementation of the North West Protocol at the two hospitals.

4. To assess the availability of resources necessary for the caring of children with severe malnutrition.

3.4 Research Design

A post intervention study design to describe the practices of pediatric staff including the changes in case fatality rates following the implementation of the North West Protocol “ten steps” on management of severe malnutrition .

3.5 Research setting

The study was conducted at Mafikeng Provincial Hospital and Thusong Hospital. Mafikeng Provincial Hospital, a level 1 hospital has 412 active beds of which 60 are in the pediatric ward. The hospital is situated in the capital city of the North West province and is just a few kilometers from town. It serves a population size of around 810 416 and it admits around 12-15 children with severe malnutrition per month.

Thusong Hospital, a level 2 hospital comprises of 175 active beds of which 36 are in pediatrics. The hospital is about 30 kilometers from Mafikeng along the main road and is surrounded by farms. It serves a population of 148778 and it usually admits around 7-9 severely malnourished children per month.

3.6 Study Population and Sampling

Sampling for this study was done in three phases

Phase 1. Gaining access to the pediatric ward

The researcher approached hospital management of the two hospitals and was granted

permission to conduct the research. In the pediatric ward the researcher approached the heads of pediatrics who informed the staff on the nature of the study. The researcher also presented the aims and objectives of the study to the pediatric staff and what it entailed, and therefore all the health workers agreed to be observed.

Phase 2: Sampling of children for observations

Purposive sampling was used in this study. According to Patton (1990), in purposive sampling, subjects may be selected because they meet some criterion. The researcher approached mothers of all children under the age of five who were admitted in the pediatric ward with a diagnosis of kwashiorkor, marasmus and marasmic-kwashiorkor and requested permission for their children to be observed. Written consent was obtained from mothers after explaining the purpose of the study in their preferred language. All mothers who were approached agreed to participate in the study.

Phase 3: For retrospective review of records

The researcher went through the ward's admission register to obtain a list of all children who had been diagnosed with kwashiorkor, marasmus and marasmic-kwashiorkor from September 2007 to October 2007(prior to this study) to obtain file numbers. The file number was used to retrieve files from either the mortuaries or record rooms. The records were used to assess the associated practices of health workers within those two months.

3.7 Data Collection

Data was collected from November 2007 to December 2007 for a period of 18 days (nine in each hospital) through observation of ward activities to acquire direct information on the practices of health workers as well as on conditions of wards, without having to depend on the participants' memory and interpretation. Eighteen children were admitted and diagnosed with severe malnutrition during this period (10 in Thusong and 8 in Mafikeng Provincial). Records of children were also reviewed. A total of 15 records were retrieved from the months of September and October (8 from Thusong Hospital and 7 from Mafikeng Provincial Hospital). Information from these records was used to determine practices of health workers over a wide range of time. Reviewing records was found to be a convenient and inexpensive way to obtain information that had been collected already.

Tools used to collect data included structured observation checklists which were adapted from those previously used in the Eastern Cape Province to collect data on case management of severe malnutrition (Karaolis *et al.*, 2007). These are attached as appendices.

3.7.1 Observation of the current practices of pediatric staff

All activities carried out on these children were carefully observed and their records were used to complement information from observations. Structured observation checklists of children diagnosed with severe malnutrition was used to capture in detail each and every aspect of implementation of the guidelines. The activities were noted in the checklist at the time of the event. At all times, the researcher was mainly focusing on the treatment of hypoglycemia,

hypothermia, dehydration, infections and feeding. These activities are very crucial in preventing unnecessary deaths and are normally performed during the stabilization phase of treatment (normally within the first 2-7 days of admission).

Observations were carried out on the following:

- Feeding practices – to determine if mothers were taking the correct volume of milk formula as milk was prepared from the kitchen/milk room and put on a stand in the ward for mothers to collect. In addition, observations were made to determine if the children were taking all the feeds and to note if appropriate actions were taken as needed. Observations were also done to ascertain if what was recorded in the feeding chart had actually been given.
- Antibiotics and other medication - To determine if the correct types and amounts were indeed given, and if they were given on time as prescribed.
- Doctors ward rounds – to assess interaction between nurses and doctors, and between doctors and caregivers, as well as the type of advice given to mothers.
- Feed preparations- to determine if the milk feed was prepared according to recipes, if the utensils and preparation areas were clean, and if the correct measuring utensils were actually used.
- Ward conditions- to determine if the ward was clean and warm enough,
- Admission procedures – to determine the procedures used for their new admissions from outpatient to the ward and to establish if they were practicing some triage. Also to ensure that they were feeding children immediately upon admission, as well as the testing and treating of hypoglycemia.

All these observations were carried out both days and nights including weekends. The researcher had to spend as much time as she could in the wards in order to ensure that she obtained information from all children admitted at different times of the day. The main aim was to try and have a true picture of what was really happening in the wards while capturing all practices in action from the initial contact with the child.

3.7.2 Record Reviews of Children in the Wards

Patient records of children that were admitted during the study period were also reviewed in order to complement information derived from the activities observed. This was indeed very useful to the researcher as it could allow her to find out on other activities that were transpiring in wards when she was not there. This could then allow her to validate if what ever she observed was really and indeed what was in the records. Patient records were also reviewed to find out on the nature of the prescriptions from doctors or nurse, as well as other information like diagnosis, HIV status, and communication amongst health workers.

3.7.3 Retrospective reviews of records

The researcher reviewed records of all children that were admitted in the pediatric wards of the two hospitals from September to October 2007. A total of 15 records were retrieved. Information from these records was used to determine practices of health workers over a wide range of time. The researcher went through the records to assess all the medication prescribed by the doctors; if they were actually given the medication as well as the times of administration; feeding schedules (the times at first feed and consecutive feeds, as well as quantities of the given of the given feeds), weighing schedules, the nursing care as well as the doctors and dieticians notes. The aim

was to assess practices over a wide range of time.

3.7.4 Comparison of the practices of pediatric staff with the North West Protocol

Data obtained from records and observations at the two hospitals was compared to the North West protocol to identify any possible gaps. This is discussed under the results section.

3.8 Case fatality rates

Case fatality rates were obtained in two phases in order to make some comparisons with the baseline data as well as to determine the overall trend:

- one year after training (July 2005 to June 2006)
- second year after training (July 2006 to June 2007)

The researcher first went through the ward's admission registers to obtain the lists of all children who had been diagnosed for kwashiorkor, marasmus and marasmic-kwashiorkor in the two years. Numbers of deaths were obtained and percentages were calculated

3.9 Audit of supplies.

A resource checklist was used to verify and ensure that all the required resources were available, and this was done with the help of a ward sister who was familiar with the knowledge and location of the items

3.10 Data Analysis

The collected data was analyzed to give some information on the current status on the practices of health workers and the general trend of case fatality rates since implementation of the

guidelines. Information from observation was compared to the North West protocol, in order to establish the extent of compliance.

Data was analyzed using the EPI Info 3.3 statistical package for descriptive statistics (frequencies and percentages of age, sex, average length of stay), while case fatality rates were calculated manually using the following formula:

$$\text{Case fatality rate} = \frac{\text{Number of children dying of severe malnutrition during a specific period}}{\text{Number of children admitted with severe malnutrition in the same period}} \times 100$$

3.11 Ethical Statement

Ethical approval was sought from the University of the Western Cape, and the ethical committee in North West Province, Department of health. Participation in the research project was voluntary and participants were fully informed about the aims and benefits of the research. Oral and written consent was also sought from hospital authorities, health workers as well as mothers of all the children that were under study. All research participants' had full rights of anonymity and confidentiality and were assured that they could withdraw from the study at any time when they felt like with no consequences.

3.12 Reliability and Validity

The tools used in this study were based on the WHO guidelines and adapted from the Eastern Cape Province (Karaolis *et al.*, 2007), where they had been tested and used. Reliability was ensured by the use of one researcher to collect all data.

- Use of different methods to collect the data (record reviews and observations) also ensured validity and reliability of the data collected.

- Advantages of using a checklist was to ensure uniformity in the way data was collected
- Discussions of data collection tools with scientists who had expertise in the field also ensured validity of the collected data.
- To ensure reliability the researcher undertook a course on the management of severe malnutrition for her to be familiarized with the activities as well as preparing her on what to expect during the data collection.
- The researcher was fluent in both Setswana and English and this therefore made it easier for her to relate well with both health workers and mothers. She was not a threat and hence the completion of all checklists was made much easier.
- Use of one researcher practically ensured consistency and at the same time excluding any possible inter research variability.
- The checklists for auditing of resources were not given to the health workers to fill in, but instead the researcher had to ask for evidence for each and every resource item that was claimed to be present.
- Observer bias was overcome with the use of objective instruments such as a checklist.

3.13 Study Limitations

The method of observing people has its own limitations in that it is highly time consuming and at the same time people have a tendency of changing behavior when under observation (Rossi & Freeman, 1993). However with the problem of behavior changes, it has been noted that such aspects usually do change over time, and therefore the researcher had to ensure that she spent at most nine days at each hospital. The method was very useful in acquiring direct information on the practices of health workers as well as on conditions of wards. Furthermore, the approach

provided the best opportunity to identify any unanticipated outcomes since the study was generally carried out under a natural setting.

The use of purely quantitative methods has been criticized in evaluations as it does not give the quality of the effects observed (Key, Hudson and Armstrong, 1976).According to Leedy & Ormrod (2001) qualitative methods are often used in evaluations to answer questions about the complex nature of phenomena, with the purpose of describing and understanding phenomena from the participants view. Another limitation was that the study outcomes were going to be generalized to the North West province and not to the whole country, considering that only two hospitals were used. Again the use of secondary data to compare case fatality rates could not have been the best approach.

CHAPTER 4

4.0 RESULTS

4.1 Characteristics of subjects

A total of 33 children were included in the study, 18 were at Thusong Hospital and 15 at Mafikeng Provincial Hospital. Observations were done on 18 of the children, (10 at Thusong and 8 at Mafikeng Hospital). Fifty two percent were males and 48% females with ages ranging from 4 months to 5 years (average age in months was 15.4 ±11.5 S.D). Eleven children (34%) came from a family with a history of tuberculosis (TB), and ten (31%) were HIV positive. Twenty children (60%) were marasmic, three (8%) with marasmic-kwashiorkor and 10 (29%) with kwashiorkor. Those with marasmus presented with other infections including gastroenteritis and pneumonia. From the record review average length of stay at Thusong Hospital was 5.6 ± 5.9 (S.D) days; while Mafikeng Hospital was 12.3 ± 3.9 (S.D) days.

4.2 Practices of the pediatric staff in the two hospitals.

Data presented in table 2 and 3 was collected through observations and retrospective record reviews.

- Column 1 presents the recommended practices as stipulated in the North West Protocol.
- Column 2 presents activities that were observed in the ward during the study period.
- Column 3 presents review of records of children admitted in the ward during the study
- Column 4 presents retrospective reviews of children admitted in the months

September to October 2007.

TABLE 2: Current practices of pediatric staff in the management of severely malnourished at Thusong Hospital.

Recommended practice (North West Protocol)	Actual Practice (children admitted in ward)		Retrospective reviews of children admitted in September to October. n= (8)
	Observations of ward activities (n= 10)	Review of records of children admitted in the ward n=(10)	
Step1*:* Prevent and treat Hypoglycemia			
-Dextrostix test on admission	Children were not tested on admission	No records of children tested on admission	No records of children tested on admission
-Feed within 30 minutes of admission	Only 2 children fed on admission	Although 2 children were fed on admission this was not reflected on records	Only 1 child record indicate being fed on admission
-Feed 3 hourly day and night = 3 points	Children fed 3 hourly during the day but not at night = 0/3	Records indicate children were fed 3 hourly day and night. = 1/3	Records indicate children were fed 3 hourly day and night. = 1/3
Step 2: prevent and treat hypothermia			
Take under arm temperature on arrival	Temperature taken on arrival in all children	Records showed that temperature was taken on arrival in all children	Records showed that temperature was taken on arrival for all the records.
- keep child warm and dry	Children kept warm and dry	Room temperature and frequency of napkin changes were not reflected on records	Room temperature and frequency of napkin changes were not reflected on records.
-keep room warm = 3 points	Room temperature was warm = 3/3	= 1/3	= 1/3
Step 3: prevent and treat Dehydration		Records showed:	Records showed:
- Do not give IV fluids except in	6 Children were on IV fluids and	2 children were prescribed IV fluids and	-5 children were prescribed IV fluids,

shock. - Give ORS orally if child dehydrated give slowly than usual -Monitor signs of over hydration every half hour = 3 points	not in shock. ORS was not given to any of the children. Pulse and temperature monitored 4 hourly. =0/3	not in shock. 4 children were prescribed ORS Pulse and temperature recorded 4 hourly = 0/3	and there was no indication that they were in shock. -2 children were prescribed ORS Pulse and temperature recorded 4 hourly 0/3
Step 4: **Electrolyte imbalance** From day 1 give -Potassium -Magnesium -Mineral Mix (Zn, Mg, Cu) - Do not give diuretics for edema. = 4 points	 5 children were given potassium 1 child was given magnesium 2 children were given mineral mix Diuretics were not given for all the children. = ¼	Records showed: 5 children were prescribed potassium 1child was prescribed magnesium 2 children were prescribed mineral mix Diuretics were not prescribed for all the children = ¼	Records showed: 7 children were prescribed potassium 1 was prescribed magnesium (3 on other days) 4 children were prescribed mineral mix Diuretics were not prescribed for all the children. = 2/4
Step 5: **Infections** From day 1 - give broad spectrum antibiotics - give antibiotics on time =2 points	 7 children given broads spectrum antibiotics 3 given amoxyl - Antibiotics were sometimes given 30 minutes to an hour before time. = 1/2	Records showed: 7 children were prescribed broad spectrum antibiotics 3 prescribed amoxyl - records showed antibiotics were given on time =2/2	Records showed that -5 children were prescribed broad spectrum on day 1, others on other days. - records showed antibiotics were given on time =2/2
Step 6: **Micronutrient deficiencies** From day 1 give : -Folic acid	 5 were given folic acid and 3 given the wrong dose (2.5mg),	Records showed -5 children were prescribed 5ml of folic acid and 3 were prescribed 2.5 mg	Records showed: - 5 prescribed folic acid on day 1

-Multivitamin - Vitamin A -Do not give iron in the stabilization phase -Give iron only in rehabilitation phase = 5 points	6 given multivitamin 7 given Vitamin A (3 over 12 months were given the wrong dose) 1 child given iron during stabilization Iron not given during rehabilitation =1/5	- multivitamin prescribed for 6 children -7 children were prescribed Vitamin A (3 prescribed wrong doses). Iron was not prescribed during stabilization Iron was not prescribed in the rehabilitation phase. = 2/5	-6 children were prescribed multivitamin -6 children were prescribed Vitamin A . 2 children prescribed iron in stabilization Iron was not prescribed in the rehabilitation phase. =3/5
Step 7: **cautious feeding** -Give correct amount of starter formula based on weight of the child -encourage the child if reluctant to eat. -weigh the children daily - plot the weight daily = 4 points	8 children were given F75 as starter formula (7 given the correct amount) - none of the children were encouraged to eat though not eating well -children were weighed daily - weight was plotted daily 3/4	Records showed: F75 was prescribed for 8 children (7 with correct volumes) -weight was charted -weight was plotted = 3/3	Records showed: 7 children were prescribed correct amount of F75 -weight was charted -weight was plotted =3/3
Step 8: **catch-up growth** -For 2 days replace starter formula with same amount of catch up formula during transition - after transition increase the feed by 10 mls each time -encourage child to eat as much	There was an increase of 10mls-20mls from F75 to F100 during transition. No subsequent increase of feeds by 10 mls after transition Children not encouraged to eat	Records showed -an increase of 10mls in volume from F75 to F100 during the transition phase -no subsequent increase by 10 mls after transition	Records showed -an increase of 10mls in volume from F75 to F100 -no subsequent increase by 10mls after transition

as possible = 3 points	= 0/3	= 0/2	= 0/2
Step 9: **Loving care, play and stimulation** -provide tender loving care -help and encourage mother to feed and play with baby. -give structured play = 3 points	Mothers were not encouraged to give tender loving care, nurses did not provide any loving care to the children -mothers were impatient with the children and scolded them for refusing to eat. -There was no schedule for structured play in the ward. = 0/3	There were no records of schedule on structured play. 0/1	There were no records of schedule on structured play. 0/1
Step 10: **Preparation for follow up after discharge.** -Obtain background information from the mother that will guide you on the type of education to give -give health education on what and how often to feed children at home Give a referral letter for Follow up **= 3 points**	Background information was taken from the mothers Health education was provided, healthy eating tips, nutritional advice how to make F100 at home and how to take care of children -a referral letter was provided **= 3/3**	Background information was recorded health education noted to be given -referral letter noted to be given = 3/3	Background information was recorded referral letter noted to be given 2/3
Total = 33	**12(36%)**	**13/29 (44.8%)**	**14/29 (48.3%)**

Scoring key:

- **A point was given when an activity was performed accordingly.**
- **Some of the activities were not applicable for the records so fewer points were given for the step (e.g provision of loving care).**

The above table shows the extent to which health workers followed the North West protocol "ten steps" on management of severe malnutrition. The results show that health workers better managed severely malnourished children in the retrospective reviews (48.3%) as compared to record reviews of children in the ward (44.8%) and observations (36%). The results show a difference in observations and what is being recorded.

TABLE 3: Current practices of pediatric staff in the management of severely malnourished children at Mafikeng Hospital.

Recommended practice (North West Protocol)	Actual Practice		Retrospective reviews of children admitted in September to October n= 7
	Observations of ward activities N= 8	Review of record of children admitted in the ward N=8	
Step1: Prevent and treat Hypoglycemia			
-Dextrostix test on admission	Glucose levels not tested on admission but tested every morning	There were no records of glucose testing on admission. Records indicated glucose levels everyday.	No records of glucose testing on admission
-Feed within 30 minutes of admission	Only 1 child was fed on admission.	There were no records of children being fed on admission.	No records of children being fed on admission.
-Feed 3 hourly = 3 points	This was not achieved =0/3	It was recorded that all children were fed 3 hourly = 1/3	Records indicate that that 3 children were fed 3 hourly =1/3

Step 2: prevent and treat hypothermia - Take under arm temperature on arrival -keep child warm and dry - keep room warm = 3 points	Temperature was taken on arrival in all children Children were not kept warm Rooms were cold = 1/3	Records show that temperature was taken on arrival in all children. Room temperature and frequency of napkin changes were not reflected on records. =1/3	Records show temperature was taken on arrival Room temperature and frequency of napkin changes were not reflected on records =1/3
Step 3: prevent and treat Dehydration - Do not give IV fluids except in shock -Give ORS orally if child dehydrated, give slowly than usual - monitor signs of over hydration every hour = 3 points	-5 children were on IV fluids -3 children were given ORS -signs of over hydration monitored 4 hourly =0/3	Records showed: -5 children were prescribed IV fluids - 2 children were prescribed ORS - signs of over hydration monitored 4 hourly 0/3	Records showed: -3 children were prescribed IV fluids -None of the children were prescribed ORS - signs of over hydration monitored 4 hourly =1/3
Step 4: **Electrolyte imbalance** From day 1 give: Potassium Magnesium mineral Mix (Zn, Mg, Cu)	-4 children were given K - 2 children were given Mg -mineral mix was not included in the feed.	Records showed: - 4 children were prescribed potassium -2 children prescribed magnesium -Mineral mix was prescribed for 2 children	Records showed : -7 children were prescribed K - 6 children were prescribed magnesium - none of the children were prescribed mineral mix

Do not give diuretics for edema. = 4 points	-Diuretics were not given for all the children = 1/4	-Diuretics were not prescribed for all the children = 1/4	Diuretics were not prescribed for all the children =3/4
Step 5: **Infections** From day 1 give broad spectrum antibiotics Give antibiotics on time = 2	8 children were given broad spectrum antibiotics Antibiotics were given 30-minutes to 1 hour before time = 1/2	Records showed: - 8 children prescribed broad spectrum antibiotics - antibiotic were recorded to be given on time =2 /2	Records shows: -6 children were prescribed broad spectrum antibiotics - antibiotics were recorded to be given on time =2/2
Step 6: **Micronutrient deficiencies** From day 1give : -Folic acid -Multivitamin -Vitamin A - Do not give iron in the stabilization phase -Give iron only in rehabilitation phase = 5 points	Folic acid was given to 3 children All children were given multivitamins 5 children were given Vitamin A (2 were given the wrong doses. Iron not given in the stabilization phase Iron not given in the rehabilitation phase = 2/5	Record showed: - 3 children were prescribed folic acid - All children were prescribed multivitamins - 5 children prescribed Vitamin A with two prescribed wrong doses -Iron was not prescribed in the stabilization phase -Iron was not prescribed in the rehabilitation phase. = 2/5	Records showed: -5 children were prescribed Folic acid - 6 children were prescribed Multivitamin (1 given on day 14 -7 children were prescribed Vitamin A) -Iron was not prescribed in the stabilization phase -Iron was not prescribed in the rehabilitation phase. =4/5
Step 7: **cautious feeding**	-5 children were given the	Records shows: -5 children were prescribed the correct	Records shows: -7 children were

-Give correct amount of starter formula based on weight of the child. -encourage the child if reluctant to eat. -weigh daily - plot daily =4 points	correct volume of F75 -Children not encouraged to eat -Children were weighed daily -weight was not plotted in a graph. = 2/4	volume of F75 -weight was recorded - weight was no plotted in a graph =2/3	prescribed the correct amount of F75 -Weight was not recorded Weight was not plotted in a graph. =2/3
Step 8: **catch-up growth** -For 2 days replace starter formula with same amount of catch up formula. - Subsequently increase the feed by 10 mls each time -encourage child to eat as much as possible =3	There was an increase of 10mls-20mls from F75 to F100 during transition. There was no subsequent increase of feeds by 10mls after transition. -children not encouraged to eat = 0/3	Records showed: -an increase of 10-20 mls in volume from F75 to F100 during the transition phase -no subsequent increase of feeds by 10 mls after transition = 0/2	Records showed: -2 children were recorded as given correct amount of F100 on transition -there was no subsequent increase of feeds by 10 mls after transition =0/2
Step 9: **Loving care, play and stimulation** -provide tender loving care -help and encourage mother to feed and play with baby. -give structured play	Children were not provided with any tender loving care from both mothers and caregivers Mothers were not encouraged to feed or play with baby - there was no play schedule in the ward	There were no records of play and stimulation	There were no records of play and stimulation

= 3	=0/3	0/1	0/1
Step 10: **Preparation for follow up after discharge.** -Obtain background information from the mother that will guide you on the type of education to give. -give health education -give a referral letter for follow up =3	 Background information not taken from mother -no health education or nutrition advice - no preparation for follow up =0/3	 No records of background information No records of health education given No records of referral letter given 0/3	 No records of background information No records of health education given referral letter given 0/3
Total= 33	**7 (23.4%)**	**9/29(31%)**	**13/29 (44.8%)**

Scoring key:

- **A point was given when an activity was performed accordingly.**
- **Some of the activities were not applicable for the records so fewer points were given for the step (e.g provision of loving care).**

The above table shows the extent to which health workers followed the guidelines "ten steps" on management of severe malnutrition. Similar results as that of Thusong Hospital were found at Mafikeng Hospital whereby severely malnourished children were seen to be managed well in the retrospective reviews (44.8%) as compared to record reviews of children in the ward (31%) and observations (23.4%). The extent to which the guidelines were followed was found to be better in Thusong Hospital than Mafikeng Hospital during observations (36% vs. 23.4%); record reviews (44.8% vs. 31%) and retrospective record reviews (48.3 % vs. 44.8 %).

4.3 Case fatality rates

TABLE 4: Total pediatric admissions and death rates at Thusong Hospital from 2005 -2007

	2005	**2006**	**2007**
Total Admissions	582	867	1050
Total Deaths	91	88	83
% of all admission dying	15.6%	10.1%	7.9%

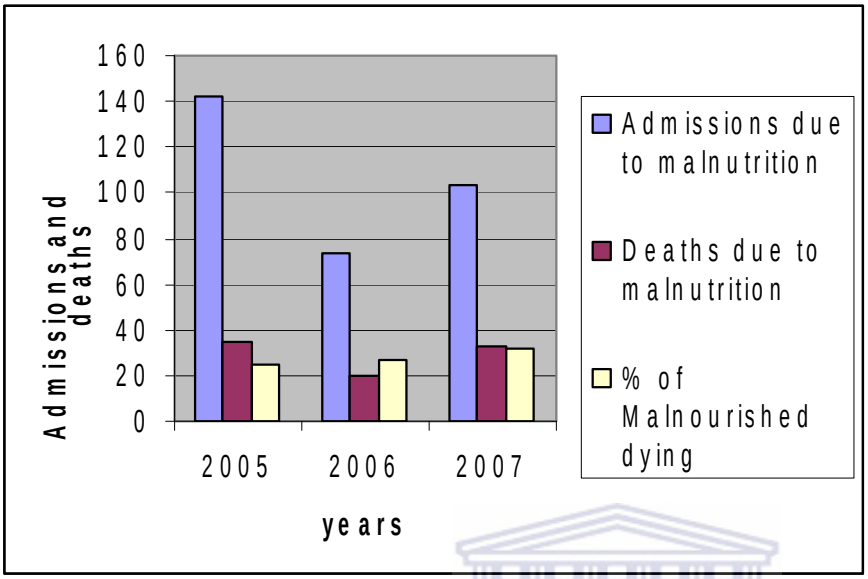
The percentage of all the children who died in the pediatric ward decreased from 15.6% in 2005 to 10.1% in 2006 and another decrease to 7.9% in 2007.

TABLE 5: Total pediatric admissions and death rates at Mafikeng Hospital from 2005-2007

	2005	**2006**	**2007**
Total Admissions	2911	2215	1918
Total Deaths	211	221	155
% of all admission dying	7.2%	9.97%	8%

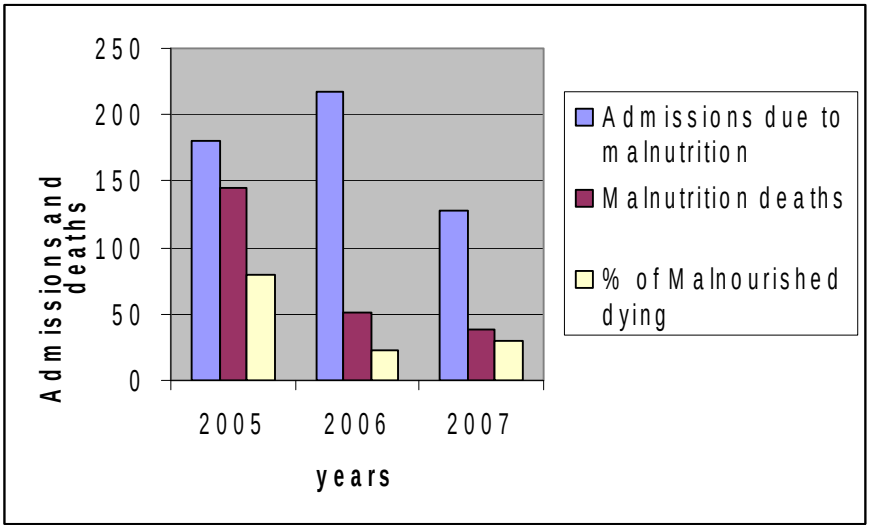
The percentage of all the children who died in the pediatric ward increased from 7.2% from 2005 to 9.9% in 2006 and then decreased to 8% in 2007.

FIGURE 2: Severe Malnutrition admissions and case fatality rates at Thusong Hospital



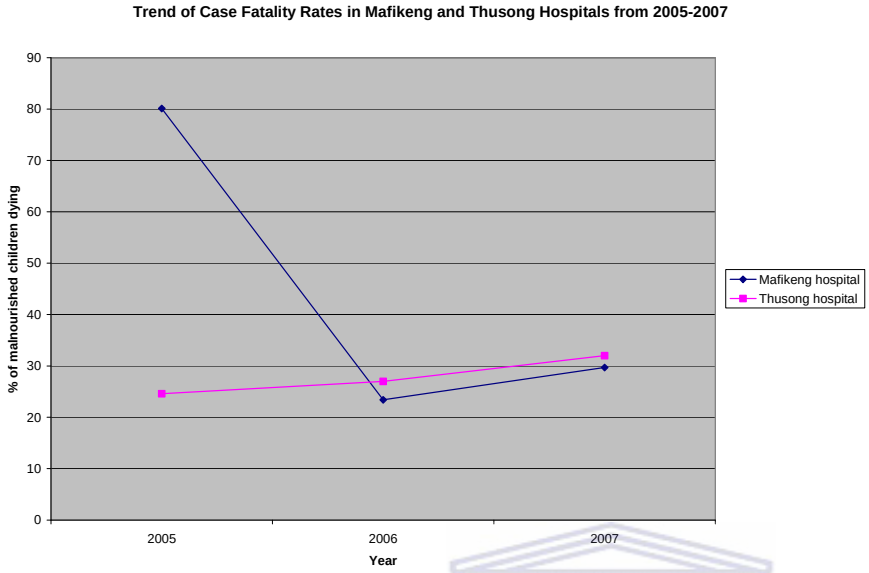
The above graph shows the number of admissions, deaths and death rates due to severe malnutrition at Thusong Hospital before and after training of health workers. Admissions due to malnutrition decreased from 142 in 2005 to 74 in 2006 and then increased to 103 in 2007. Deaths due to malnutrition decreased from 35 in 2005 to 20 in 2006 and then increased to 33 in 2007. Case fatality rates increased from 24.6% in 2005 to 27% in 2006 to 32% in 2007. Severe malnutrition constituted 38.5% of total deaths in 2005 , 22.7% in 2006 and 40% in 2007.

FIGURE 3: Severe Malnutrition admissions and case fatality rates at Mafikeng Hospital



The above graph shows the number of admissions, deaths and death rates due to severe malnutrition in Mafikeng hospital before and after training of health workers. Admissions due to malnutrition increased from 181 in 2005 to 218 in 2006 and then decreased to 128 in 2007. Deaths due to malnutrition decreased from 145 in 2005 to 38 in 2007. Case fatality rates decreased from 80.1% in 2005 to 23.4% in 2006 and then increased to 29.7 in 2007. Severe malnutrition constituted 68.7% of the total deaths in 2005, 23% in 2006 and 24.5% in 2007.

FIGURE 4: Trend of Case Fatality Rates at Mafikeng and Thusong Hospitals from 2005-2007



The above table shows the trend in case fatality rates over the years. There was a sharp decrease in deaths due to severe malnutrition from 80.1% in 2005 to 23.4% in 2006 and then increased to 29.7% in 2007 at Mafikeng Hospital. At Thusong Hospital there was a steady increase in the case fatality rates from 24.6% in 2005 to 27% in 2006 and then to 32% in 2007.

4.4 : Equipment/ Supplies

TABLE 6: Inventory of Supplies

	Mafikeng Hospital	**Thusong Hospital**	**Comments**
IV fluid	Y	Y	
Glucostik/ Dextrostix or Glucometer	Y	Y	
Glucose/ Dextrose	Y	Y	
ORS solution	Y	Y	
KCl **or** Slow K	Y	Y	
Mineral/ Trace element mix **or** MgSO4	Y	Y	
Antibiotics: - Co-trimoxazole - Metronidazole - Ampicillin - Gentamicin - Chloramphenicol - Mebendazole	 Y N/A Y Y N/A N/A	 Y Y Y Y N/A Y	Antibiotics with **N /A** were ordered when needed in both hospitals.
Vitamin A	Y	Y	
Folic acid	Y	Y	
Multivitamin	Y	Y	
Iron	Y	Y	
Feed ingredients: - Milk - Oil - Sugar	 Y Y Y	 Y Y Y	
Accurate weighing scales for feeds	N/A	Y	Plastic spoons were used to measure sugar and oil in MPH
Food blender	Y	Y	
NG tubes	Y	Y	
North West Protocol	N/A	N/A	
Total	18/23 (78.3%)	21/23 (91%)	

N/A- Not Available

The above table shows inventory of supplies in the hospitals during period of data collection. Thusong Hospital was more equipped with the equipment necessary for implementation of the guidelines (91%) as compared to Mafikeng Hospital (78.3%).

4.5 Ward Observations

Additional Observations were made with regards to ward conditions, feeding preparation, weighing of children and nurses handover.

4.5.1 Ward conditions

Both hospitals did not have the North West protocol , which guides health workers on the appropriate management. There was no visible 10 steps guidelines in the wards and there were no charts kept at the end of beds. There was no soap for handwashing and washing of feeding cups for mothers. The wards at Thusong Hospital were very clean and well lit.

At Mafikeng Hospital the toilets were very dirty. The wards were overcrowded, according to the sister in charge the medical ward had a capacity of maximum of 35 children but there were 47 children with their mothers. From observation all the children were being bottle- fed, and the bottles very dirty.

4.5.2 Feeding preparation

In both hospitals the feeds were prepared from fresh milk, sugar and oil and was prepared once a day.At Thusong Hospital the staff sometimes added mineral mix to the feeds. This happened when there were children who had been prescribed mineral mix in their files. So a separate milk feed was prepared , one labelled " mineral mix", the other labelled "without mineral mix".

A small room was reserved in the ward for milk preparation at Thusong Hospital. Utensils used and the working area were all very clean. The recipe was cleary visible on the wall and was

according to the North west protocol. Also available was a measuring food scale, a refrigerator and a blender, so milk was well prepared without separating out. On observation even though there was a recipe on the wall most of the feeds were not prepared correctly, especially measuring of ingredients.

At Mafikeng Hospital milk feeds were prepared in the kitchen where food for the whole hospital was prepared by the kitchen staff. Milk preparation was not a priority . Feeds were either prepared very late in the day or not prepared at all. There was no recipe on the wall and milk was prepared in the office. After preparation, milk was stored in a refrigerator in the ward. The recipe and the preparation was not according to the guidelines as shown below:

TABLE 7: Recipe for Milk preparation at Mafikeng Hospital

	Recommended recipe (North West Protocol)	Mafikeng (Actual Practice)	Recommended Practice(North West Protocol)	Mafikeng (Actual Practice)
	F75		**F100**	
Oil	4 tsps	6 tsps	4tsps	10 tsps
Milk	300ml	2 liters	880	2 liters
Sugar	20tsps	10 tsps	15 tsps	12 tsps
water	Make up to 1 litre	1 litre	Make up to 1 litre	1 litre

Table 5 shows the recipe that was used at Mafikeng Hospital for prepration of milk formula. It clearly shows poor understanding of the recipe.

4.5.3 Weighing procedure

In both hospitals chidren were weighed daily using either the salter scale or bathroom scale for children who were able to stand.. Care was taken to make sure that all children were weighed properly . However especially at Mafikeng Hospital , some of the weights were not plotted.

Calculation of weight gain was also not done in both hospitals.

4.5.4 Nurses's hand over

In both hospitals only 2 nurses participated in the handing over sessions for the morning and afternoon shift, the first nurse to arrive and one going off duty participated. All admissions were discussed briefly and with no mention of how the children were feeding and their progress. The oncoming staff would take rounds, mothers would be briefly asked about the progress of their children however no action was taken, when the mother/caregiver reported any problems.

CHAPTER 5

5.0 DISCUSSION

5.1 Background

This study set out to evaluate the implementation of the North West Protocol on the management of severe malnutrition at two hospitals that were providing different levels of health care, one at district level and the other at referral level. The results showed overall poor management of the North West protocol at the two hospitals.

The results from the observations that were made during this study, clearly demonstrated the existence of some poor practices and lack of understanding among health workers on the management of severe malnutrition at both hospitals. This was despite the fact that it had only been two years since the implementation of the North West Protocol. Both hospitals did not have copies of the North West Protocol neither did they also have "the ten steps" to successful management of severe malnutrition. Ideally these "ten steps" are supposed to be placed on walls in pediatric wards, visible to all staff so that they can easily refer to them. Contrary to what was expected, the ten steps were just printed on a small page and then put in a file at Mafikeng Hospital, while at Thusong Hospital, the ten steps were not even available at all. These documents principally provide guidance on proper management of severe malnutrition especially to those health workers who would have never received formal training on the subject matter.

5.2 Overall shortcomings

Most of the shortcomings identified in this study, occurred during the first 24 hours of patient admission. This is in line with findings from most of the previous studies where it has been

shown that about a third of the affected children do die within the first 24 hours of admission (Bachou *et al.*, 2006; Maitland *et al.*, 2006). This is the period during which most life-threatening problems are identified and at the same time treatable. From such observations, some crucial procedures that include oral rehydration of children with diarrhea, feeding them within 30 minutes of admission and also feeding every three hours, were not adequately followed. This therefore ended up putting most children into a danger of developing hypoglycemia, which is one of the major causes of death in severely malnourished children during admission (Bhan, Bhandari and Bahl, 2003).

In outpatient department, affected children were also left to queue just like all the other ordinary child patients resulting in them being admitted in very bad states (very hungry and hypoglycemic) as has also been found to be the case in some studies (Ashworth *et al.*, 2004). According to Nolan *et al*. (2001), inappropriate triage nursing has been shown to result in very high mortality rates due to failure to identify severe malnourished children as special cases. Therefore there is a fundamental need to train all outpatient staff (nurses, doctors and paramedics) to do triage so that they can provide appropriate emergency treatments as specified by the protocol.

5.3 Overall Achievements

Despite the shortcomings outlined above, there were also some positive achievements observed at the two hospitals. Mothers were allowed to stay in the hospitals with their children. This is very important as it will allow mothers/caregivers to be actively involved in feeding their children every 2-3 hours and also sleep with the children to ensure warmth. Some essential

supplies were also made available to support case management.

5.4 Comparison of the practices of pediatric staff to the North west protocol

The following session discusses the findings of this study in relation to the actions recommended by the protocol.

Steps 1 & 7 : Prevent and Treat hypoglycemia and initiate "start up" feeding

Hypoglycemia was common at the two hospitals and almost all the children experienced this problem at some stage during admission. Hypoglycemia was also found to be common in most studies (Ahmed *et al.*, 1999; Deen *et al.*, 2003, Puoane *et al.*, 2001). Efforts to feed children frequently proved to be a big challenge especially at Mafikeng Hospital where children used to spend some days with no prepared milk feeds. At Thusong Hospital, the problem of infrequent feeding was also mostly noticed at night, a time during which most of the deaths occur (Schofield and Ashworth, 1996). The problem of infrequent feeding was also identified in other studies (Deen *et al.*, 2003, Puoane *et al.*, 2001). Schofield and Ashworth (1996) also reported that in their study (to determine anecdotal evidence of faulty practices) between 11% and 56% of the respondents reported practices such as failure to feed and keep the child warm at night.

Hypoglycemia and hypothermia often occur together and are signs of possible serious infection and are also usually associated with very high case fatality rates (WHO, 2000). Therefore, efficient management of this step is crucial and has been shown to be effective in reducing case fatality rates (Wilkinson *et al.*, 1996). Puoane *et al*, (2004), used participatory research to

improve hospital management of severe malnutrition in the Eastern Cape and found that after intervention malnourished children were fed straight away and 3 hourly day and night. This approach was found to be useful especially in reducing case fatality rates as it involved the hospital team in all stages of the research. Involving the team encouraged them to reflect on their own practices and therefore plan accordingly.

Despite the availability of the equipment used for diagnosing hypoglycemia at both hospitals, it was realized that such equipment was never fully utilized especially on admission to test for hypoglycemia. In their study Karaolis *et al*. (2007) assessed the feasibility of implementing the guidelines on severe malnutrition in the Eastern Cape and reported that a glucometer was rarely used to test for hypoglycemia because the junior nurses lacked confidence with the new equipment.

It was also found that for those children who were found to be hypoglycemic, no action was taken to alleviate the problem. This clearly indicated that health workers at both hospitals were ignorant or probably not aware at all of the North West protocol. There were only a few trained health workers on the management of severe malnutrition in the concerned wards of the two institutions during the study period (only 1 at Thusong Hospital and 2 at Mafikeng Hospital, of which one was recently trained). Other nurses who had received training were mostly transferred to other wards. This shortage of trained staff clearly impacted on the effective management of the affected and suffering children.

The protocol also recommends that children be fed the milk formula using cups, yet at Mafikeng

Hospital, it was observed that all the children were being fed using bottles, and such bottles were very dirty. This issue could have had contributed to the severity of the children's illnesses as there was a likelihood of the development of diseases such as diarrhea, and chest, ear or urine infections.

Step 2 : Prevent and Treat Hypothermia

Severely malnourished children have lost fat so they have less protection from cold conditions. They also have less glucose available to use for energy and heat generation, and therefore always need to be kept warm (Ashworth & Burgess, 2003). Low body temperature is associated with increased mortality in children with severe malnutrition, and therefore needs to be monitored and get corrected.

Although hypothermia was found to be rare at both hospitals, efforts to keep the children warm especially at Mafikeng Hospital were not up to standard. The malnutrition wards were always kept cold, with windows and doors often left open. Despite the fact that mothers were allowed to stay and sleep in the wards at Mafikeng Hospital, they were not encouraged to sleep with their children at night in order to keep them warm. Puoane *et al.* (2001) also assessed the management of malnutrition in their study and found that there was no provision made for mothers to sleep with their babies at night. Mothers' sleeping with their children is regarded as a critical intervention especially in the case of staff shortage (Puoane *et al*., 2004). Mothers were also not encouraged to practice skin-to-skin contacts with their children, as this practice usually enhances bonding and at the same time helps warm the children.

At Thusong Hospital, the rooms were kept warm at all times and mothers were always

encouraged to sleep with their children at night. Some studies have found that keeping children warm was just an easy task to implement (Ashworth *et al.*, 2004; Deen *et al.*, 2003). Identification of hypothermia was not according to the Protocol in both hospitals. Under-arm temperature was measured every 4 hours instead of the 2 hourly temperature measurements recommended in the protocol. Similar results were reported by Karaolis *et al*. (2007) who found that in their study temperatures were rarely checked on admission and no routine measurements were made.

Step 3: Prevent and treat dehydration

The North West Protocol had recommended a restriction of intravenous (IV) fluids unless a child was in shock. Restriction of IV fluids assists in lowering the risk of flooding the circulation and overloading the heart (Ashworth *et al*., 1996), therefore rehydration should always be done orally. However, at both hospitals, it was found that over fifty percent of the children were rehydrated intravenously even when they were not in shock. Unfortunately, several studies had indicated a high case fatality rate due to infusion of fluids to children who are not severely dehydrated (Bachou *et al.*, 2006; Ashworth *et al.*, 2004; Puoane *et al.*, 2001). Schofield and Ashworth (1996) also surveyed current practices of severe malnutrition management in 79 hospitals worldwide and found the use of IV fluids to be high in 22% of the centers

Dehydration in severely malnourished children can also be confused with septic shock, therefore children on IV fluids need to be monitored for signs of fluids overload (increase in pulse, respiration, oedema and puffy eyelids) at every hour (Ashworth *et al.*, 1996). This step was

poorly implemented at both hospitals, there was no monitoring of signs of fluid overload, instead pulses and respirations were taken routinely every four hours. Similarly Ashworth *et al*. (2004) who assessed the feasibility of using the guidelines also found that there was there was a problem of poor fluid management among health workers who did not recognize the danger of cumulative fluid loss.

A possible reason for not following this step properly is that in severe malnutrition, it is difficult to estimate dehydration status using clinical signs (WHO, 2002). The usual signs (absent tears, sunken eyes and fontanel, scanty urine output) may be present in malnourished children who are not dehydrated. Therefore there is need for all health workers treating these children to be well-trained to know when to rehydrate orally or intra-venously.

Some studies do report that with the introduction of the guidelines, hospitals were able to restrict the use of IV fluids only to those in shock (Ashworth *et al.*, 2004; Karaolis *et al.*, 2007; Deen *et al.*, 2003; Puoane *et al*., 2004). Puoane *et al*. (2004) reported that wall charts which outline the 3 signs of shock were developed in hospitals in the Mt Frere region to address management of rehydration (Puoane *et al.*, 2004)

At Thusong Hospital almost all the children were admitted from clinics already on IV fluids. This practice demonstrated a gap in knowledge between the community/clinic health workers in the management of severe malnutrition. Therefore there is need to extend training to those who are at first contact with the children, so that they can be able to identify and refer such children earlier, and also to be able to provide treatment in the clinics to those without complications.

Training these health workers will also be beneficial as they will be able to educate the caregivers on the signs of severe malnutrition (loss of appetite, hair changes, skin lesions, beginning of wasting and or edema), and consequently refer their child earlier to a medical institution in a less severe condition. Krug *et al.* (2004) conducted a mortality audit in the Mafikeng region, and found that delays in seeking care and infrequent clinic attendance by community members were among the main problems that contributed to high case fatality rates at the hospitals.

WHO recommends a modified rehydrating solution (Re So Mal), for severely malnourished children, with low sodium content to reduce risk of heart failure (Schofield and Ashworth, 1996). However at the two hospitals the normal Oral Rehydrating Solution (ORS) was used to rehydrate children. Schofield and Ashworth (1996) also reported that the use of the high sodium fluid (ORS) was employed by 75% of the institutions that were under study. Some studies also reported that some hospitals found the preparation of Re So Mal to be too complicated (Deen *et al., 2003;* Puoane *et al.,* 2001). The oral rehydration solution was also hardly ever given to the children at the two hospitals, and when given, it was poorly monitored. At Mafikeng Hospital mothers were also responsible for giving ORS without any guidance.

Step 5 :Treat infection

Severely malnourished children especially those with marasmus were found to present with gastro enteritis and pneumonia. According to WHO (1999) nearly all these children have bacterial infections and many have several infections caused by other organisms, however the signs used to detect infections (such as fever) are often absent in these children, hence the

recommendation for using antibiotics routinely. According to Puoane *et al*. (2004) actively looking and treating commonly associated condition like parasites and tuberculosis is an important aspect of care.

Antibiotics were administered routinely in both hospitals, however at Thusong Hospital some children were precribed and given amoxyl, which is not among the recommended broad spectrum antibiotics. This questioned the doctors' knowledge and understanding of the management of severe malnutrition, as routine antibiotic therapy has been shown to reduce deaths due to missed infections (Wilkinson *et al.*, 1996). While some studies found routine administration of antibiotics to be feasible (Deen *et al*., 2003), others did not (Karaolis *et al.*, 2007; Ashworth *et al.*, 2004). According to Ashworth *et al.* (2004), doctors failed to prescribe the recommended antibiotics, resulting in sepsis contributing to 43% of the deaths. In their review, Schofield and Ashworth (1996) also found that only 24% of the study centers provided antibiotics routinely.

Effectiveness of the treatment was sometimes also compromised by the health workers not giving the medication on time especially at night at both hospitals. It is important that the antibiotic regime be strictly adhered to in order to achieve positive outcomes.

Severely malnourished children are also susceptible to infection due to their compromised immune system, therefore it is important for them to be separated from other patients in the ward to avoid cross infections (WHO, 2000). On the first day of observation all the children were mixed up in the medical ward, despite the fact that there was a room reserved for severely

malnourished children in the ward. In the second day of research at both hospitals, all severely malnourished children were moved to the malnutrition room. This was one aspect whereby health workers changed their behavior due to observation.

Step 4 and 6 :Correct electrolyte imbalance and Micronutrients deficiency

All severely malnourished children have potassium (K) and magnesium (Mg) deficiencies that adversely affect a number of metabolic functions, including fluid and electrolyte balance (Schofield and Ashworth, 1996). According to Schofield and Ashworth (1996) in the absence of Mg, K repletion is impaired, hence the recommendation for routine supplementation of both K and Mg.

Electrolyte imbalance has been found to be among the common causes of death, especially potassium deficiency in severely malnourished children (Ashworth *et al.,* 2004). Potassium was provided to some children in both hospitals, while magnesium was not very popular and was seen to be given more at Mafikeng Hospital. Schofield and Ashworth (1996) also reported that less than half of the centers surveyed gave potassium supplements and only 26 % gave magnesium. Some studies found potassiums was available in the hospitals, however it was not prescribed (Karaolis *et al,.* 2007) . Despite these findings, some studies found supplementing with potassium and magnesium to be easily implemented (Deen *et al*.,2003; Ashworth *et al.*, 2004). In their study Puoane et al. (2004), children were given extra potassium, while magnesium was given sometimes daily in the form of a mineral electrlyte mixture.

Malnourished children already have excess sodium in their cells (Ashworth *et al*., 1996), so

sodium intake should be restricted. However, our study shows that severely malnourished children were provided with the same meals (which are high in salt) as those given to adults without modification. Similar results were reported by Puoane *et al*. (2001), who also found that children were given adults foods.

The mineral mix which contain copper and zinc, was supposed to be added to the feeds during milk preparation. Copper and zinc play an important role as cofactors in the scavenging of free radicals, thus preventing lipid peroxidation and cell membrane damage (Schofield and Ashworth, 1996). The mineral mix was never added in the milk feed at Mafikeng Hospital. At Thusong Hospital the mineral mix was added to the feeds of those children who had a prescription. Similar results were observed by Schofield and Ashworth (1996), whereby only a few centres provided copper (14%) and zinc (25%) .

All children with severe malnutrition also have vitamin and mineral deficiencies (WHO, 2000). Deficiencies in the intake or absorption of micronutrients have serious consequences for health and mental and physical function. Clinical manifestations of these deficiencies are anemia, night blindness and children being susceptible to infections. As with the electrolytes, some of the children were given the vitamins and minerals while others were not. Deen *et al.* (2003) found that in their study some vitamins and minerals were excluded from the drug list while for others the supply was irregular.

Multivitamins are very important for the restoration of depleted tissues. Schofield and Ashworth (1996) found that multivitamin supplementation was provided by 79%, of the centers. Vitamin A

and folic acid were given to children in both hospitals. However, some doctors had a tendency of prescribing incorrect doses of folic acid and Vitamin A at Thusong hospital. Karaolis *et al.* (2007) also found that doctors had a tendency of prescribing wrong doses. In their review by Schofield and Ashworth (1996), vitamin A and folic acid were provided by 60% and 66% of the centers respectively.

Although anemia is common in children with severe malnutrition, it is recommended that iron supplements be withheld in the initial phase of treatment until the child is eating and starting to gain weight (Ashworth *et al.,* 1996). Giving iron early can make the infection worse by damaging the cell walls and stimulating growth of some harmful bacteria (Ashworth and Burgess, 2003). Some children at Thusong Hospital were given iron in the stabilization phase, this was also found to be the case by Schofield and Ashworth (1996), in 31 % of the centers studies. In both hospitals none of the children were given iron supplements in the rehabilitation phase. This indicates lack of understanding of the different stages of treatment in the two hospitals.

Step 7: Feed cautiously

Early dietary management involves restricted protein and energy intake, to maintain basic physiological processes (Ashworth *et al.,* 1996). Higher intakes are inappropriate and may be dangerous in the first few days of treatment because the malnourished child would be unable to deal with the extra metabolic stress therefore overloading the heart, kidney and intestines (Schofield and Ashworth, 1996). At Mafikeng Hospital, only half of the children were given the

correct amount of starter formula and these were mainly those with kwashiorkor. Schofield and Ashworth (1996) also found that over 50% of the institutions studied failed to administer the ideal amounts of protein and energy to the children. At Mafikeng Hospital both the starter formula and a soft diet were prescribed for some children, indicating poor knowledge by the health workers.

The milk feeds are made to provide sufficient nutrients for the day. Therefore, it is necessary that these children are well monitored during feeding times to make sure they receive the recommended volume and finish it. None of the children were monitored to determine whether they finished, spilled or refused to eat, therefore no action was taken to this effect. As a result children were not improving and therefore had to stay for a long time in the stabilization phase. Weight gain was supposed to be calculated on a weekly basis to determine the progress of the children, however, this was not done. This is probably due to lack of commitment among nurses as well as due to lack of monitoring of the implementation of the treatment guidelines

Recording of milk intake and output was poorly done. There was a tendency by these health workers to record that children finished all the feeds even when it was not the case. Measurement and recording of feeds was also found to be implemented inconsistently in other studies (Deen *et al.*, 2003).

Health workers in our study expected carers to participate in treatment tasks, especially feeding but failed to explain why and how this should be done or to supervise them. The care takers were seen tampering with the milk feeds during feeding times. Some fed their children more than they

needed, and others gave their children feeds other than the prescribed ones. This indicated that they did not appreciate or understand their children's condition and treatment. Similarly, Karaolis *et al.* (2007) reported that carers were also responsible for dispensing feeds but were poorly supervised. It is therefore crucial that mothers are involved and educated about the condition and treatment of their children from the onset, to enhance compliance.

Step 8: Rebuild wasted tissues

It is important to change to a catch up diet (F100) as soon as children have regained their appetite and they have reduced/minimal oedema, so as to rebuild wasted tissues (Ashworth & Burgess, 2003). This is so because the starter formula does not contain enough energy and protein for rapid weight gain. However, these children were not monitored to determine accurately the time when they were ready to transit to a catch up phase. As a result children spent too long on the stabilization phase. It is important to make the transition to free feeding gradually and monitor children carefully. If transition is too rapid, heart failure may occur (WHO, 2002). Transition was poorly implemented, none of the staff adequately gave the correct amount on transition from F75 to F100 at the two hospitals.

Children on F100 are expected to gain weight due to the high energy and protein content of the feed. They are also supposed to be given unlimited amounts of the formula until the prescribed maxium volume for the day has been reached, this was not done in either hospital. Children were fed the same amounts for a very long time, hence longer hospital stay without any weight gain.

The findings of this study are similar to those of Karaolis *et al.* (2007) who found that transition to the rehabilitation phase was haphazard and about 70% of the children were transferred too soon or too late. This step was also found to be implemented inconsistently in a study by Deen *et al.* (2003). This inconsistency is mainly due to poor monitoring of the children by health workers, to determine the readiness of children to go into the next phase.

Step 9: Provide stimulation, play and loving care

In severely malnourished children there is delayed mental and behavioral development, therefore the child needs interaction with other children and adults during rehabilitation (Ashworth and Burgess, 2003; Grantham- Mcgregir, 1995). Love and care, a cheerful stimulating environment, structured play therapy and mother's involvement in the care of the child are important components of therapy, as they promote the development of language and motor skills (WHO, 2002). There were neither special play sessions nor toys in the wards of the two hospitals . Mothers were also not encouraged to play with their children.

The nurse's reaction to these children were mixed, some nurses blamed the mothers for the condition of their children, while some felt pity and tried to be friendly to the children. However, this step was poorly implemented. For most of the studies, play and stimulation were among the tasks that were not fully implemented (Puoane *et al*., 2004; Karaolis *et al.*, 2007; Ashworth *et al*., 2004). According to Brewster (2006), feasibility of stimulation interventions in a hospital setting is limited, particularly in view of the shorter length of stay for the patients. However, if mothers were educated and shown how to play and stimulate their children, this would have been

achievable, as mothers spent the whole day in the ward doing nothing.

Step 10: Prepare for follow-up and discharge

As recovery may take several weeks, their discharge from hospital should be carefully planned in order to provide outpatient care to complete their rehabilitation and to prevent relapse. Follow up is also crucial to provide continuity of care and support and an opportunity to evaluate the children's progress (Ashworth *et al.*, 1996).

Health workers need to gain a clear picture of the home environment and find realistic ways of providing the child with sufficient nutrients (Ashworth *et al*., 1996). At Thusong Hospital the dietician discussed with care takers on how to care for children at home especially with feeding, the mothers were given a referral letter and some health education materials. Mothers were also shown how to prepare F100 at home. However because the milk formula needs to be prepared freshly by experienced staff to avoid bacterial contamination it is not advisable for nutrition rehabilitation outside the medical setting. A ready to use therapeutic food (RUTF) would be more suitable as a take home (Ciliberto *et al.*, 2005). The RUTF has been shown to result in higher rates of recovery than the use of F100 since the children had a more rapid weight gain and fewer symptoms of infection.

Almost all children admitted at Mafikeng Hospital were readmissions. Their hospital records indicated that these children were discharged with very low weights. This may have been due to the fact that children were discharged while they were not yet fully recovered. Therefore, there is need for a rehabilitation center where these children could be referred to until they reach a

satisfactory weight gain, this will also help in reducing the workload in the hospitals. The rehabilitation center will be focusing mainly on continued nutritional assessment of the children after discharge, provision of RUTF and other medication needed by the child to prevent relapse, together with health education on caring and healthy eating practices provided to caregivers.

At Mafikeng Hospital there was no preparation for follow up and there was also no issuing of a referral letter. Deen *et al.* (2003) found that over half of the patients in their study were provided with a referral letter to the clinics. At these clinics it was found that clinic staff lacked awareness of the follow-up programme. Referral systems that are able to track at "risk children" are important.

In the absence of a nutrition rehabilitation center, good communication with outpatient and community services is essential and will facilitate making arrangements for the child's care during rehabilitation and therefore prevent relapse. According to Ashworth *et al.* (2004), effective community follow-up may be possible if clinic staff and community health workers were trained and motivated.

Diagnosing severe malnutrition

As with other studies the Wellcome classification of weight for age criteria of less than 60% of the median reference values and clinical signs were used to diagnose severe malnutrition in both hospitals (Ashworth *et al.*, 2004). In their study Ashworth *et al.* (2004) found that using this classification resulted in about half of the children in their study meeting the WHO criteria for severe malnutrition.

Weight for height, rather than weight for age is a better indicator of recent or ongoing weight loss or wasting (Trowbridge, 1979, cited by Bhan, Bhandari & Bahl, 2003). However use of weight for height has been found to be problematic and in most cases not undertaken in practice (Berkley *et al.*, 2005; Ashworth *et al.*, 2004) due to the practical difficulty of anthropometric assessment like inaccurate measurements especially of length. Therefore other means of diagnosing may be tried that are equally effective like the use of MUAC to diagnose severe malnutrition (Brewster, 2006).

Milk preparation

A recipe on the preparation of milk feeds have been set out in the North West protocol. Following the recipe is crucial as it has been designed to suit the fragile states of the children. If not followed, the feeds may be too strong or too dilute and therefore complicate the condition of the children.

Milk preparation at Thusong Hospital although not up to standard was found to be satisfactory and this proved that it was feasible to prepare this type of milk feeds in poorly resourced settings. At Mafikeng Hospital, milk preparation was poorly prepared, there was no supervision of the kitchen staff on the preparation of milk. Therefore children received a completely different mixture, and this impacted negatively on the children's progress.

5.5 Case fatality rates

Very high case fatality rates were witnessed at the two hospitals, and these rates are considered unacceptable by WHO (WHO, 1999). These results accord with previous findings in some African countries of high case fatality in hospitalized malnourished children (Gernaat *et al.*, 1998; Ashworth *et al.*, 2004). Severe malnutrition was also found to constitute high percentages of the deaths in the pediatric wards of the two hospitals.

Several studies show a reduction in CFR after training of health workers. This was also observed at Mafikeng hospital where there was a drastic reduction in CFR from 80% to 23% one year after training. However this was not sustained but increased again to 24.5% in the following year. This trend was also observed by Ashworth *et al.* (2004) and attributed to untrained doctors recruited to the hospital. According to Deen *et al*. (2003) case fatality rates may also be reduced artificially by early discharge. From observation, since this was a busy hospital, there was a tendency to discharge some children early to make room for others.

There was a problem of poor record keeping at Mafikeng Hospital, some data were missing and some outcomes not stated. Poor documentation of patient care was also found to be a problem in the Mafikeng region during a mortality audit of the region (Krug *et al.*, 2004).

Despite better implementation of the North West protocol at Thusong Hospital, it was surprising that CFR never went down, instead it increased steadily. This may be due to a number of factors. Thusong Hospital being a district hospital admits a lot of referrals from the clinics, which might reflect poor management of severe malnutrition in the community. From observation almost all

of the children admitted from the local clinics were on IV fluids. This raises concerns about identification of severe malnutrition as an early intervention of malnutrition at the clinic level. Therefore as already noted in the thesis, training is vital at the clinical level, and should include the following areas:

- Identification of severe malnutrition using clinical signs
- caring for severely malnourished children with or without complications
- when to refer to the hospital for admission
- Physiological changes in a severely malnourished child and how to manage certain conditions especially dehydration.
- Community based rehabilitation of malnutrition

According to Brewster (2006), high mortality rates may also be due to high severity of illnesses other than poor quality treatment. Brewster, Manary and Graham (1997) found a significant difference in the severity of illness for three groups in different facilities. Maitland *et al*. (2006) also identified four signs at the bedside on admission of children that were the highest predictors of early deaths; slow heart rate, weak pulse volume, depressed consciousness level and a delayed capillary refilling. These results indicate that there are other factors that may affect case fatality rates and that hospitals need to be aware of.

5.6 Availability of resources

Availability of resources needed for managing these children was satisfactory especially at Thusong Hospital. However, it was realized that some of the resources in both hospitals were not

fully utilized, especially the SOROL for rehydration, iron for the rehabilitation phase, as well as the nasogastric (NG) tubes for feeding of children who are normally reluctant to eat.

5.7 Poor Organization and Supervision

There was no adequate supervision of health workers, this gave rise to a relaxed environment, which led to nurses recording feeds incorrectly, and giving no extra care to the children. According to Biai *et al.* (2007), supervising health workers to adhere to a standardized treatment protocol is associated with a great reduction in hospital mortality. In their study all health workers were trained and therefore, were able to provide extra care and attention to patients.

From observation there was a shortage of staff in both hospitals, especially those who were trained on the management of severe malnutrition. Increasing the number of staff may not be possible. However, retaining trained staff in the pediatric ward, and intensifying training to new and existing health workers may be more cost effective and may bring about the desired outcomes. Although some studies indicate staff rotation to be among the factors that reduce staff retention (Cangelosi *et al*, 1998), in this study staff rotation was found to impact negatively on the quality of care. Therefore hospitals need to decide on the areas that nurses could be easily rotated without compromising quality of care

Thusong Hospital had a good recording system. They calculated the percentage of deaths and admissions due to severe malnutrition on a monthly basis. However, there did not seem to be any action taken, or strategies in place to try and reduce case fatality rates. According to Heywood

and Rodhe (2002), information is routinely collected by health facilities and it is seldom used in decision making. Information should be incorporated into hierarchy of decision-making and action mechanism at every level. Therefore, there is need to create an environment where actions are based on information.

5.8 Training of health workers

Training has been shown to alter perception of health workers resulting in them having some better understanding of the management of severe malnutrition, thereby improving quality of care and thus reducing case fatality rates (Puoane *et al.*, 2006). However, in their study, Ashworth *et al.* (2004), found that even after training, there were still some preventable deaths which occurred in some hospitals attributing this to problems of staffing and low motivation. Trainings were conducted in the two hospitals in 2005, however from observation only a few of the health workers were adequately trained. This hampered successful implementation, either one or two staff nurses were trained and had to give training to those in the ward, or those trained were transferred to other wards. One other observation was that there was not much support from other health workers and doctors alike given to those who had been trained. Many authors advocate for the inclusion of the management of severe malnutrition in the nurses and doctors curriculum.

According to Diaz-Monsalve (2004) isolated courses seems to have little or no impact if the general context is not favorable. Participatory research methods and strong support from the central manager have been found to be among the factors that contribute to positive training outputs (Puoane *et al*., 2004; Diaz- Monsalve, 2004). In Puoane *et al.* (2004) a hospital nutrition

team was put in place and involved in all the stages of the research and this resulted in a reduction in case fatality rates.

5. 9 Severe malnutrition and HIV

According to UNAIDS/WHO (2006), South Africa's AIDS epidemic remains one of the worst in the world and shows no evidence of a decline. According to the document almost one in three pregnant women attending public ante-natal clinic were living with HIV in 2004 and the trend showed a gradual increase in HIV prevalence. A reasonable number of children in this study were HIV positive (31%). HIV has been shown to have an impact on childhood nutrition morbidity (Yeung *et al.,* 2000*)* and has contributed to the severity of the disease. Krug *et al*. (2004) conducted a mortality audit in the Mafikeng region and found that about 61.9% of under five deaths were HIV related, showing a tremendous burden of HIV in the South African population, especially among children under the age of five. Given this tremendous burden it has been argued that achieving a mortality rate of as low as 5% may not be achievable in developing countries (Brewster, 2006; Heikens, 2007).

Attitudes of health workers towards malnourished children and their mothers have been found to be negative, with health workers blaming mothers for not adequately caring for the children at home (Puoane *et al.*, 2006). This kind of negative attitude was also experienced in both hospitals, where nurses were openly mocking the mothers, and this may have impacted badly on the care of such children.

5.10 Comparison of different methodologies to collect data

The results show overall better management of severe malnutrition at Thusong Hospital as compared to Mafikeng hospital in both observations and record reviews. Despite the fact that practices of health workers faired better in the records as compared to observations, some of the information noted in the files of the patients as compared to what was being observed was wrong e.g. nurses recording that children were fed milk at the correct time and finished it even when there was no milk at that particular time. This problem was also observed by Karaolis *et al.* (2007), whereby health workers were administering antibiotics several hours before they were due and , but signed as if they had given them on time.

This observation questions the reliability of using record reviews when evaluating practices of health workers. Direct observation, though time consuming was found to give a better picture of case management. However, it will be useful for researchers to use both methods (direct observation and record reviews) as they complement each other.

This study did not take into consideration qualitative methods to find out and appreciate the problems that hindered smooth implementation from both managers and health workers. The major complaints from health workers included shortage of staff and lack of training among the health workers. Both hospitals had a lot of student nurses who could have been used for activities like recording feeds and supervising such feeding time and monitoring such children to report any problems that could occur.

5.11 Limitations

Since the sample size was small, the findings may not be a true reflection of all hospitals in North West, but it is a true reflection of the sites and sufficient to make recommendations to the provincial government. Use of secondary data to compare case fatality rates, may not be the correct record, especially in Mafikeng Hospital, where record keeping was very poor. Despite these limitations the results suggest that introduction of a protocol needs to be coupled with training for everyone involved together with continuous support and monitoring, introducing induction courses for new members and supplying with the necessary resources especially human resources for the desired outcome to be realized. Use of retrospective record reviews, although easy to do was found to be problematic. Some records were not completed and therefore some of the data was missing.

CHAPTER 6

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

This study revealed poor management of severe malnutrition in both hospitals, the extent to which each step was implemented was below standards set by the North West protocol. The health workers who managed severely children clearly demonstrated poor understanding of the disease and lacked knowledge of the North West protocol on treating such children. The results from observations clearly showed what was happening on the ground, and revealed a lot of poor practices by health workers which need immediate attention. Reducing case fatality rates should be a priority among the two hospitals as it contributes a significant number of children who die in the hospitals.

Case fatality rates in both hospitals were very high and unacceptable. Despite the fact that implementation of the protocol was better in Thusong hospital, there was no improvement in CFR after implementation of the guidelines, indicating that there are other factors that affect case fatality rates apart from good management that needs to be taken into consideration .There was an improvement in CFR in Mafikeng Hospital after a year of implementation which deteriorated 2 years after implementation. This may have been due to bringing in new health workers who have never received training on severe malnutrition. This clearly demonstrates the effects of staff turnover over the quality of care. In both hospitals, supplies needed to implement the guidelines were adequate.

These results also show that training a few health workers does not change the situation much. All health workers need to be trained and retained in the pediatric ward. Regular monitoring and supervision is crucial to detect periodically areas that needs strengthening, therefore a comprehensive monitoring tool will need to be developed to address this issue. The results also show that adequate staff is needed for the management of severe malnutrition, as nurses needs to pay special attention to these children.

6.2 Recommendations

Both Hospitals

- More in-service trainings and refresher courses for health workers- both formal and informal (nurses and doctors) in both hospitals.
- Periodic monitoring of management of severe malnutrition in hospitals is crucial.
- Retention of core trained staff in the pediatric unit
- A wall chart with the “ten steps” to successful management of severe malnutrition be developed
- Strong supervision in both hospitals is required to monitor implementation of the protocol.
- Triage for severely malnourished children should be a priority.
- There is need for an improved record keeping system especially in Mafikeng hospital.
- Hospitals management should make sure milk is prepared safely and according to the recipe.

Provincial Level

- Advocate for provision of RUTF for rehabilitation at home.
- Provincial guidelines for management of severe malnutrition should be disseminated to all hospitals.
- Develop & standardize educational material for mothers
- There is need for Provincial trainings on a yearly basis.
- Strengthen referral system for all involved in the care of severe malnourished children(clinics and hospitals, specialists)
- Develop health education materials for hospitals and the community- wall charts for the

hospitals to remind pediatric staff of special procedures especially during the first 24 hours.

- Strengthen growth monitoring programme, through training of community health workers to be able to identify severe malnutrition, and for early identification for those children at risk (use of MUAC Tapes).
- Establishment of nutrition rehabilitation care in the province is needed.
- Supervised feeding programs in the community is crucial.

CHAPTER 7

7.0 REFERENCES

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APPENDICES

Appendix 1: Consent and Information Sheets for caregivers and Health workers

MAIKANO KA PATLISISO

Project title: Evaluation of the implementation of the WHO treatment guidelines "Ten Steps" on the management of severe malnutrition in Mafikeng and Thusong hospitals in the North West Province of South Africa.

Ke laleditswe go tsenelela dipatlisiso tse tsa go tokafatsa tlhokomelo ya bana ba ba tlhaelang dikotla mo dikokelong. Ke tlhaloseditswe ka dipatlisiso tse, ebile ke kgonne le go botsa dipotso, ka bo ka bona le dikarabo. Ke letlelela ngwanake gore a tsenelele dipatlisiso tse, ke tlhaloganya gore ke ka mo ntsha mo go tsone nako nngwe le nngwe, tlhokomelo ya ngwanake e sa kgoroletsege ka gope. Ke tlhaloganya gape gore leina la me kana la ngwana ga lena go dirisiwa ka gope mo dipatlisisong tse.

Leina la motlhokomedi _____ Monwana- Kgwedi _____

Fa a sa itse go kwala

Leina la mosupi yoo itseng go kwala _____ Monwana – Kgwedi _____

CONSENT FORM FOR HEALTH WORKERS

***Project title*: Evaluation of the implementation of the WHO treatment guidelines "Ten Steps" on the management of severe malnutrition in Mafikeng and Thusong hospitals in the North West Province of South Africa.**

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

Participant's name……..

Participant's signature…….

Date……

INFORMATION SHEET FOR HEALTH CARE PROVIDERS

Project title: Evaluation of the implementation of the WHO treatment guidelines "Ten Steps" on the management of severe malnutrition in Mafikeng and Thusong hospitals in the North West Province of South Africa.

Dear……

I am Goabaone Panky Mogomotsi, a student studying at the University of the Western Cape. I am doing research on the implementation of the WHO "Ten Steps "to successful management of severe malnutrition in the health facilities of North West and would like you to participate in this study.

Why are we doing this?
Severe Malnutrition is a common cause of death in hospitals in South Africa. Therefore successful Management of severe malnutrition is essential in order to reduce the high death rates. It is therefore necessary that all the health workers involved in the caring of these children know exactly what to do. This study will therefore assist us in identifying gaps in practices related to management of severe malnutrition. Findings from the study will be used to reinforce training where needed or give recommendations where appropriate.

Procedure
I will observe activities and procedures that you carry out to children admitted to your ward diagnosed with severe malnutrition. Records of children will also be looked at. All information collected will be treated confidentially, and only the researcher will have access to it. Furthermore I will go through the hospital register to determine the number of deaths. A checklist will be used in all the observations. No names will be recorded on the checklists, only numbers will be used as a form of identification.

What can participants expect?
Once the project is completed, a meeting will be called and the results will be presented to you.

Can you refuse to participate?
Yes you may refuse to be observed while giving care to children should you wish to, and you can withdraw from the study at any time, without giving a reason. The outcome of the observation will not be disclosed to your supervisor and will not have any repercussions on your professional career.

Any further questions?

More information may be obtained from Panky Mogomotsi (0764308138)
Or from my supervisor Dr Thandi Puoane (021 959 3085. If you are willing to participate in the study please read and sign consent form.

CONSENT FORM FOR MOTHERS/CAREGIVERS

***Project title*: Evaluation of the implementation of the WHO treatment guidelines "Ten Steps" on the management of severe malnutrition in Mafikeng and Thusong hospitals in the North West Province of South Africa.**

I have been invited to take part in the research on improving the hospital management of severely malnourished children. The Information has been read to me. I had the opportunity to ask question and have been answered to my satisfaction. I consent voluntarily for my child to participate in this study and understand that I have the right to withdraw my child from the study at any time without in any way affecting my child's care. I also understand that confidentiality will be maintained and that the findings of the study will only be used for research purposes.

Name of the Mother/Caregiver _____ Signature and date _____

If illiterate

Name of Independent Literate Witnesses _____ Signature and date _____

INFORMATION SHEET FOR MOTHERS/CAREGIVERS

***Project title*: Evaluation of the implementation of the WHO treatment guidelines "Ten Steps" on the management of severe malnutrition in Mafikeng and Thusong hospitals in the North West Province of South Africa.**

Dear……

I am Goabaone Panky Mogomotsi, a student studying at the University of the Western Cape. I am doing research on the implementation of the WHO "Ten Steps "to successful management of severe malnutrition in the health facilities of North West and would like you to participate in this study.

Why are we doing this?
Severe Malnutrition is a common cause of hospital admissions in South Africa. Therefore successful Management of severe malnutrition is essential in order to reduce the high admission rate. It is therefore important for us to make sure that children receive proper care while they are in hospitals. This study will therefore assist us in identifying gaps in practices related to management of severe malnutrition. Findings from the study will be help us to improve the situation where needed.

Who are the participants?
All children suffering from severe malnutrition.

What do we expect from participants in the study?
I will be mainly observing most of the activities and procedures involved in the caring of your child. Furthermore I will go through your child's records if you allow me. All the information collected will be treated confidentially, and only the researcher will have access to it. No names will be written on the checklist used to collect information.

What can participants expect?
Once the project is completed, feedback will be given to the hospital manager so as to take action where needed.

Can you refuse to participate in the study?
Yes if you do not wish for your child to be observed you are free to say so and you may withdraw you child from the study at any time, without giving a reason, this will not affect/influence the care given to your child. The study is completely voluntary .

Any further questions?
More information may be obtained from Panky Mogomotsi (0764308138) or from my supervisor Dr Thandi Puoane (021 959 3085. If you are willing to participate in the study please read and sign consent form.

TLHALOSO KA PATLISISIO

***Project Title*: Evaluation of the implementation of the WHO treatment guidelines "Ten Steps" on the management of severe malnutrition in Mafikeng and Thusong hospitals in the North West Province of South Africa.**

Go……..

Leina lame ke Goabaone Panky Mogomotsi, ke moithuti mo sekolong sa unibesithi ya Western Cape. Ke dira dipatlisiso mabapi le ka fa bana baba tlhaelang dikotla ba tlhokomelwang ka teng mo dikokelong mo North West, jaanong ke kopa gore wena le ngwana wa gago le tsenelele dipatlisisio tse.

Botlhokwa jwa dipatlisisio

Tlhaelo dikotla e baka gore bana ba felele ba okelwa mo dikokelong bale bantsi mo Aferika Borwa. Jalo, go botlhokwa thata gore bana ba, ba bone tlhokomelo ee faphegileng. Jaanong dipatlisiso tse di tlaa leka go leba mathata a baoki ba kopanang le one fa ba tlhokomela bana ba, jalo re leke go tokafatsa seemo.

Ke mang yoo o ka tsenelelang?
Bana ba ba tlhaelang dikotla mo dikokelong.

Resolofela eng mo go lona?
Ke tla bo ke lebeletse ka fa baoki ba tlhokomelang bana ba lona ka teng. Ke tla lebelela gape dikarata tsa bana tsa kokelo. Ke tla bo ke dirisa di pampitshana go kwalela se ke se bonang mo go tsone. Sengwe le sengwe se ke se kwalang ga sena go bonwa ke ope ko ntleng ga nna fela. Ga kena go kwala maina a gago kana a ngwana mo dipampiring tse.

Le ka solofela eng?

Ha ke fetsa dipatlisisio ke tla rorela maduo go mookamedi wa kokelo gore kgato e tsewe go tokafatsa seemo fa go kgonega..

Ao ka gana go tsenelela dipatlisiso?

Eye, fa o sa batle ke leba ka fa ngwana wagago a tlhokomelwang ka teng o ka nkitsise. Le fa o tseneletse o ka nna wa tswa fela o sa fe mabaka ape.Go tsenelela mo kega boithaopo, ga gona go kgoreletsa ka fa ngwana wagago a tlhokomelwang ka teng.

Ona le dipotso tse dingwe?

O ka nteletsa ko Panky Mogomotsi (0764308138)
Kana o leletsa motlhokomedi wame Dr Thandi Puoane (021 959 3085.
Fa o eletsa go tsenelela tswee tswee saena lekwalo la maikano.

Appendix 2: Checklists- Tools used in data collection

FEED PREPARATION OBSERVATION

Date:
Time Start: **Time End:**
Hospital:
Number of children on malnutrition ward:

Coding: 1=YES; 2=NO; 9=NOT APPLICABLE

Feed Preparation	**Code**	**Notes**
Area clean		
Hands washed		
Ingredients used (State them)		
Recipe visible: - Wall - In book/ binder - Other		
Correct recipe used: - F75 - F100		
Correct measurements - Scales - Scoops: level packed heaped - Cup: level packed heaped - Other		
Electrolyte mix added		
Method of blending: - Blender - Whisk or fork - Spoon - Other		
Oil remaining in receptacle		
Source of water: - tap - bottled		

RESOURCES/ STOCK TAKE FORM

Essential supply availability

Date:

	Mafikeng Hospital	**Thusong Hospital**
IV Fluids Glucostik/ Dextrostix or Glucometer		
Glucose/ Dextrose		
KCl **or** Slow K		
Mineral/ Trace element mix **or** MgSO4		
Antibiotics: - Co-trimoxazole - Metronidazole - Ampicillin - Gentamicin - Chloramphenicol - Mebendazole		
Vitamin A		
Folic acid		
Multivitamin		
Zinc and Copper (if not trace element mix)		
Iron		
Feed ingredients: - Milk powder - Oil - Sugar		
Accurate weighing scales for feeds		
NG tubes		

WARD CONDITIONS

Date:
Time Start: **Time End:**
Hospital:
Number of children on malnutrition ward:
Number of staff present: **Scheduled:**

Coding: 1=YES; 2=NO; 9=NOT APPLICABLE

	Code	Notes
Temperature		
Cleanliness		
Lighting		
Running water on ward: - for staff - for carers		
Soap available; - for staff - for carers		
Staff wash hands between child contacts		
Carers wash hands prior to feeding		
Feeding equipment washed with soap		
Clean toilets available: - for staff - for carers		
10 Step Guidelines easily accessible to staff		
Charts kept at bed end		
Interaction: - Nurses interact with children - Mothers interact with children - Nurses interact with mothers		

WEIGHING OBSERVATION

Date:
Time Start: **Time End:**
Hospital:
Child ID:
Number of children on malnutrition ward:

Coding: 1=YES; 2=NO; 9=NOT APPLICABLE

	Code	**Notes**
Done by: - Matron - Sister - Aide - Doctor - Other		
Type of scale: - Bathroom - Salter scale - Pan scale - Other		
Correct technique: - Scale zeroed - Child undressed - Child allowed to hang freely - Needle stopped moving - Read at eye level		
Correctly recorded		
Correctly plotted		
Weight change accurately calculated		
Weight change correctly recorded		
Comments		

WARD ACTIVITIES OBSERVATIONS

Date:
Time Start: **Time End:**
Hospital:
Number of children on malnutrition ward:
Number of staff present: **Scheduled:**

Coding: 1=YES; 2=NO; 9=NOT APPLICABLE

	Child 1		**Child 2**		**Child 3**	
Child ID						
Time since admission (hrs/days)						
Phase: - < 48 hrs - Start - Catch up						
Current problems: - IV - Diarrhea - Vomiting - Hydration - Oedema - Respiratory distress - Temperature						
Child kept: - Covered - Dry -						
ORS given if required: - correct amount given - monitored for rehydration						
Feeding: Start time End time						
Fed on time						

Type: - Starter - Catch up - Meal - Other						
Correct amount given						
Who fed: - Nurse - Carer - Self - Other						
Feeding method: - Cup - Spoon - Bottle - NG - Other						
Child held during feed						
Breastfeeding						
Extra snacks						
Oil separated out						
Amount eaten: - All - ¾ - Half - ¼ - Very little - None						
If reluctant encouraged to eat						
Fed until full in catch up phase						
Left overs measured						

Left over's recorded						
Feeds/ Meals recorded accurately						
Vomited: - Amount recorded - Feed reoffered						
NG: - Position checked - Allowed to run						
Medications: - Charted - Time given - Given as charted - Route						
Minerals (charted/ given): - K - Mg - Mineral Mix - Folic acid - Zn - Cu - Fe - Vitamin A - Multivitamin						
Method of administration: - Spoon - Dropper - Medicine cup - Added to food - NG - IV - Other						
Vital signs- temperature: - Times taken - Recorded						

Respirations: - Times taken - Recorded						
Pulse: - Times taken - Recorded						

NEW ADMISSION OBSERVATION

First 4-6 hours from arrival to OPD/WARD

Date:
Time start: **Time end:**
Hospital:
Child ID:
Number new admissions-With malnutrition: **General:**
Number of children on malnutrition ward:
Number Staff present: **Scheduled:**

Coding: 1=YES; 2=NO; 9= NOT APPLICABLE

	Code	Notes
Appearance: - Appears in shock - Lethargic but not in shock - Alert		
IV Fluids given: -Type -Rate -Duration		
Vital signs: Pulse and Respiration: - Checked each hour -Recorded accurately each hour		
Hypoglycemia: -Time until 1st Glucostix -Fed before test -Used Correctly -Hypoglycemic -2nd Glucostix done -IV glucose if the child is unconscious		
Feeding: -Time until 1st feed -Time until 2nd feed -Type of feed (Starter, Catch up, Formula, Other) -Correct amount given		

Hypothermia: -Rectal temp on arrival -Rewarming if Hypothermic -Clothed/covered each hour		
Rehydration: -Given ORS -Quantity -F75 given at 6 hours		
Medications: -Time to 1st antibiotic -Type -Route		
Electrolytes given: -K -Mg -Mineral mix -Vitamin A -Fe -folic Acid -Zn -Cu -Multivitamin		
Weighed on admission: -Time until weighed -Weighed correctly -Recorded correctly -Plotted correctly		
Time in queue(If OPD)		
Time out of queue(If OPD)		
Examined: -Hydration -Oedema -Infection -Shock		
Time until transferred to ward (if OPD)		
Medical and dietary history taken from carer		
Comments		

CHILD RECORD REVIEWS

Date:
Hospital:

Coding: 1= YES; 2= NO; 9= NOT APPLICABLE

Child ID			
Outcome			
On admission			
Age			
Sex			
Weight (kg)			
Height /Length (cm)			
SD weight / height below median			
Oedema grade			
HIV status			
New/Readmission			
Location admitted to			
Date & time admitted			
LOS on ward			
Date transition onto F100			
Hypoglycemia			
F75 given within 30 minutes arrival			
Dehydration			
IV fluid if in shock			
IV fluids if not in shock			
ORS if dehydrated			
Correct amount ORS: -Prescribes -Charted as given			
Monitored for signs of rehydration hourly			
Watery stools			
Electrolytes Imbalance			

Diuretic given			
K: -Prescribed -Charted as given			
Mg: -Prescribed -Charted as given			
Infection			
Antibiotics: -Type -Prescribed from day 1 -Charted as given			
Micronutrients			
Vitamin A: -Prescribed from day 1 -Charted as given			
Folic acid: -Prescribed from day 1 -Charted as given			
Zinc: -Prescribed from day 1 -Charted as given			
Multivitamin: -Prescribed from day 1 -Charted as given			
Iron: -Prescribed only after transition to F100 -Charted as given			
Feeding			
F75 given as a starter feed			
Correct amount			

prescribed			
Charted as given 3 hourly			
NG prescribed if required			
Transition to F100 at correct time			
Correct F100 prescribed at transition			
Charted as given			
Volume F100 increased appropriately			
Total daily feed calculated			
Monitoring			
Weighed daily			
Weighed accurately plotted			
SD correctly calculated with WHO charts			
Daily weight gain calculated and recorded amount			

NURSING HANDOVER OBSERVATION FORM

Date: **Time:**
Time Start:
Hospital:
Number of children on malnutrition ward:
Number of staff present: **Number Scheduled:**
Shift: AM PM

Coding: 1= YES, 2= NO, 9= NOT APPLICABLE

	Code	Notes
All on-coming nurses participate		
Every patient discussed		
New admissions discussed		
10 steps plans discussed: - **If not feeding** - **Advance to catch-up phase** - **Changes in volumes** - **Discharge planning**		
Comments		

Appendix 3: The North West protocol

Protocol on managing severely malnourished children at hospital level

Prevent and Treat Hypoglycemia and Initiate 'Start-up' Feeding (WHO Steps 1 & 7):

A common cause of mortality and morbidity is hypoglycemia, which can be prevented with frequent (3 hourly) regular feeding both night and day (never missing a feed) and prevention of hypothermia plus aggressive treatment of infection.

- Initiate feeding immediately with start-up formula. Feed using a cup or spoon, NOT by bottle:

Start- Up Feeding (F75)
Volume: 130ml/kg divided into:

- 3 hourly feeds 8 times a day
- 2 hourly feeds 12 times a day where hypothermia and/or hypoglycaemia are a problem.

Type of feed:

- Start-up formula (recipes provided in appendix), provide 75Kcal and 0.9g protein/100ml.
- If unavailable, use infant formula modified to give a comparable energy and protein content.
- If a child refuses, give the feed by nasogastric tube, and assess the child for oral sores/infections If a child is not finishing feeds and the 24-hour intake is less than the amount prescribed, insert a nasogastric tube and give the unfinished amount by this route. If the child is vomiting continuously commence half DD iv line

Test blood glucose on arrival.
Treat hypoglycemia:

- Treat asymptomatic hypoglycaemia (blood glucose under 3mmol/l or, where a blood glucose machine is unavailable, under 4mmol/l by visual reading) with a feed of start-up formula or 10% glucose (50ml) or sucrose solution (1 rounded teaspoon of sugar in 3½tablespoons of water), whichever is available most quickly. Recheck the blood sugar in 30minutes; repeat as above if desired blood glucose level not reached.

- Treat symptomatic hypoglycaemia (fits/decreased level of consciousness), severe hypoglycaemia (<1.5mmol/l) by 5ml/kg IV of 10% dextrose solution. If only 50% dextrose is available, dilute 1 part of this solution with 4 parts of sterile water.

  Test blood glucose 3 hourly in severely ill children

Prevent and Treat Hypothermia (WHO Step 2)

Hypothermia is present when the under-arm temperature is below 36°C, and indicates the need to immediately warm up and feed the child.

Prevent hypothermia:

- Measure under-arm temperature 3 hourly.
- Keep the child covered at all times, especially at night, and including the head.
- Avoid draughts in the ward.
- Keep the child dry.
- Avoid exposure (such as bathing).
- Use mother-child skin-to-skin contact (Kangaroo care) to keep children warm.

Treat hypothermia:

- Immediately place the child in skin-to-skin contact (Kangaroo care) with the mother's chest and/or abdomen and wrap both with blankets.
- If the mother is absent, clothe and wrap the child (including the head) with a warmed blanket.
- Place a heater nearby.
- Monitor temperature during re-warming to avoid hypothermia or uncorrected hypothermia. Check the temperature 2 hourly until it rises to over 36.5°C.

Prevent and treat Dehydration (WHO Step 3)

Many children with severe malnutrition also suffer from diarrhea, and may therefore become dehydrated.

To prevent dehydration in the child with diarrhea:

Replace approximate volumes of stool losses with South African Oral Rehydration Solution (SOROL) after each stool is passed.

After each stool give:
< 2 years old 50-100ml of ORS
>2 years old 100-200ml of ORS
Give in small frequent sips using a cup and spoon a spoon especially after loose stools or vomiting.

Encourage continued breastfeeding if breastfed.
If not breastfeeding start feeding with start-up formula immediately.

Treat diarrhea and diarrhea dehydration with South African Oral Rehydration Solution :

- Give 5ml/kg over every 30 minutes for 2 hours (orally or if refused, by nasogastric tube).
- Thereafter give 10ml/kg every hour for the next 4-10 hours until dehydration is corrected
- Replace SOROL with starter formula at 4, 7, and 10 hours.
- Monitor for signs of overload at least every hour and stop if necessary e.g increases in pulse rate by 25 bpm and respiration by 5 breath per minute, increased edema and puffy eyelids.
- Monitor for signs of ongoing dehydration e.g. decreased urine out put, excessive thirst, persistent diarrhea and vomiting, sunken eyes and fontanel and consider the need for more aggressive treatment if dehydration fails to resolve.
- Monitor for shock.
- Recording of baseline as well as subsequent vitals are important

Shock is present if child has cold hands and feet, delayed capillary refill time of longer than 3 seconds, and peripheral pulses, which are difficult to feel.

Fluid overload is present if there is a gallop rhythm and enlarging liver, fast breathing or chest in drawings, which were not present before.

To start treatment of shock:
Give this treatment only if the child has signs of shock and is lethargic or has lost consciousness

- Give oxygen by mask/ head box/ nasal cannula.
- Insert an IV line (and draw blood from emergency laboratory investigations)

- Weigh the child to calculate the volume of the fluid given
- Give IV fluids 15ml/kg over 1 hour. Use one of this solutions in order of preference
  -Ringer's lactate with 5%glucose (dextrose) or
  -Half normal saline with 5% glucose (dextrose) or
  -Half-strength Darrow's solution with 5% glucose (dextrose) or if these are unavailable
  -Ringer's lactate
- Measure the pulse and breathing rate at the start of every 5-10 minutes

If there are signs of improvement (pulse and breathing rate fall)

- Give repeat IV 15ml/kg over 1 hour, then
- Switch to oral or nasogastric rehydration with SOROL 10ml/kg/hr up to 10hours
- Initiate feeding with F-75
- Keep IV line incase it is needed again
- Start feeding F-75 at 4,7, and 10 hours

If the child fails to improve after the first 15ml/kg IV, assume the child has septic shock:

- Give maintenance IV fluid (4ml/kg/h) while waiting for blood
- When blood is available, transfuse fresh whole blood at 10ml/kg slowly over 3hours, then
- Initiate re-feeding with F-75

If the child deteriorates during IV rehydration (breathing increases by 5 breath/min or pulse by 25 beats/min), stop the infusion because IV fluid can worsen the child' condition

Precautionary Measures in the Treatment of shock:

- Use a pediatric giving-set (60 drops per milliliter
- IV Ringers Lactate to treat shock when present
- Use dial flow or ivac pump to regulate the drops
- If unable to start a reliable IV line in a few minutes, use intravenous route at 15ml/ kg or tube at 5ml/kg
- Do so with care to avoid circulatory overload and heart failure
- Monitor for signs of overload for every 10-25 minutes
- Shock from both dehydration and sepsis may co-exist in severely malnourished children. They are difficult to differentiate on clinical grounds alone.
- Children with hypovolaemic shock will respond to IV fluids. Those with septic shock often will not respond

Treat Infection (WHO Step 5)

Infection is common but signs of infection, such as fever are often absent. Therefore, all patients with severe malnutrition should be automatically treated with antibiotics. Severe infections may present with hypothermia.

Treat all admissions routinely as infected:

Bacterial Infection:
Uncomplicated child (no danger sign present). Must receive antibiotics below:
- Co-trimoxazole 5ml suspension twice a day for 5 days (2.5ml if <4kg), OR
- Amoxycillin 15mg/kg 8 hourly orally for 5 days.

Complicated child. Must receive antibiotics below:
- Gentamicin 7.5mg/kg IM/IV 24 hourly for 7 days, AND
- Ampicillin 50mg/kg IM/IV 6 hourly for 2 days, THEN
- Amoxycillin 15mg/kg 8hourly for 5 days.

If child fails to improve in 48 hours:
- Confirm all above steps are being carried out.
- Confirm correct feeding
- Investigate aggressively for occult infection (chest/urine/blood/csf)

Where investigation or referral is not possible add:

- Chloramphenicol 25 mg/kg IM/IV/PO every 6 hours or 5 days.

OR
- Cefotaxine 50ml/kg six hours for 5-7 days

Treat all admissions for gastrointestinal infection:

- Oral Metronidazole 7.5 mg/kg three times a day for 5 days.

Correct Electrolyte Imbalance and Micronutrients Deficiencies (WHO Steps 4& 6)

All severely malnourished children have electrolyte imbalances

- Prepare salt free diet
- Treat and prevent electrolyte imbalances
- Give mineral/ trace element mix daily orally

Concentrated electrolyte mineral solution!		
Zinc sulphate	72g	36g
Copper sulphate (1g in 200ml) soln	40ml	20ml
Magnesium Sulphate powder	560g	280g
Potassium chloride powder	200g	100g
Aqua chloroform concentrate	50ml	25ml
Sterile water to make	2000ml	1000ml

Prepared at pharmaceutical unit within the hospital and given with F-75 of F-100
Add 20ml of the concentrated electrolyte solution to each 1000ml of milk feed (F-75 or F-100)

Treat and Prevent Vitamin Deficiency

Give Vitamin A according to the national protocol

-50 000 units start orally if <6 months
-If 6-12 months 100 000 units stat and
-If >12 months up to 5 years 200 000 unit stat

- Give folic acid 5mg daily
- Multivitamin Syrup 5ml daily
- Treat and prevent deficiency only after edema has subsidized and the child has started to gain weight.
- Iron Supplementation is not given until the child has completed antibiotics and infections have cleared

Give

0,5ml/kg/kg of ferrous Gluconate syrup divided into 2 doses daily (3mg/kg/day element iron){Ferrous Gluconate syrup EDL: 30mg elemental iron per 5ml}

At this stage gives:

Mebendazole 100mg BD orally for 3 days Albendazole as a stat dose

Initial feeding (F75)
(WHO Step 7)

Cautious feeding is required because of the fragile physiological state

The initial feeding contains 75Kcal (315kj)/100ml

Give

- 130ml/ kg/day (use the feeding chart) to provide
- Energy: 100 kcal/kg/day
- Protein: 1g/kg/day
- Feed every 2 or 3 hours day and night
- Feed through a cup and not a bottle

When to use a tube feed

- When the child take feed less than 80% of required feeds for more than two days
- When the child is very weak to take the feed orally
- There is persistent vomiting or oral thrush that makes swallowing difficult

The tube feed should be removed when:

- The child is taking three-quarter of the day' s feed orally

Or

- Can take two consecutive feed fully by mouth without vomiting

Diarrhea
Diarrhea is not normally caused by or exacerbated by the consumption of the starter formula- the formula has a low concentration of lactose because it is diluted to provide very little of nutrients other that energy.
The following is the sequence that need to be followed if the child with diarrhea
The commercial formula should be replaced in this sequence if diarrhea continues
On admission the starter formula should be prepared with:

Full cream/cows milk Acidified milk Soya milk Semi elementary milk.

The child can be intolerant to the feed if:

- Watery diarrhea occurs promptly after the starter formula is given
- the (F75) causes diarrhea

Replace the full cream milk with the lactose-free milk to develop F75.

Breastfeeding the child less than 6 months

- In the case HIV positive: mother to stop breastfeeding completely.
- In HIV negative: Breastfeeding to be given after F75 and be intensified during Rehabilitation phase.

Rebuild Wasted Tissues (WHO Steps 8)

Once the child's appetite returns to normal (usually within a week) and oedema had subsided the energy and protein content of feeds need to be increased:

- Use catch-up formula containing 100 kCal and 3g protein/100ml.
- If the child is older than six months; introduce a balanced soft mixed diet.

How to introduce catch up formula

- Replace start-up feeds with an equal amount of the catch-up formula. Then increase each feed by 10ml until some feed remains unfinished (usually when intakes reach about 200ml/kg/day).
- Give 7 feeds daily. If the child is used to eating family meals, give 4 feeds of catch-up formula and 3 specially modified family meals of high energy and protein.

Provide Stimulation, Play and Loving Care (WHO Step 9)

Stimulation, play and loving care will markedly improve the child's response to treatment and decrease the period of hospitalization.

- From admission, provide tender loving care.
- Hospital staff should be welcoming, reassuring, encouraging, friendly and approachable to the care giver and the child.
- Structure play and activity in a cheerful stimulating environment encouraging mothers to involvement as far as possible.
- Encourage rooming-in to afford the caregiver to learn during hospitalization.
- The pediatric ward should have a special playing session than an occupational therapist, psychologist, a nurse or a volunteer can facilitate
- Staff should teach caregivers how to make cheap or homemade toys

Some suggestions:

- Hang colorful objects from cot rails.
- Pick child up at least hourly for love, play and contact.
- Sing or have music playing.
- Use a kind, soothing voice.

Prepare for Discharge and Follow-up (WHO Step 10)

The ability of the family to provide adequate nutrition and care at home must be assured.

While still in the ward:

- Involve the parents/caregivers in feeding and caring for the child as soon as possible, as they will care for the child over the long term.
- Discharge the child when the child and home environment are ready (usually about 4 weeks after admission).

Signs of readiness for discharge include:

- Persistent and good weight gain.
- Good appetite.
- A smiling and playful child.

Check that the child has received all appropriate immunizations before discharge. Repeat Mantoux test.

On discharge:

- The child should leave with a supply of appropriate milk supplement/enriched porridge.
- The mother/caregiver should have a discharge summary of the child's stay in hospital.
- The family should be counseled, and taught to:

Prevent and manage diarrhea
- provide energy and nutrient dense foods at least 5 times a day
- increase the energy content in the normal diet by adding vegetable oil or sugar
- add protein and micronutrients to the diet by using beans, vegetables, peanut butter and meat/fish/egg
- Have a separate plate for the child in the home and carry out 'active feeding' (i.e. the feeder must actively promote and actually feed the child)
- Play with the child to improve his/her mental development.

Arrange for follow-up post-discharge:
Make a written referral and review date with the nearest PHC facility (clinic) and community health worker (if available) for home support and encouragement.

The social care system should provide social grants whenever applicable and the application process should begin before discharge:

- Child Support Grant (for children <7 years of age whose primary caregiver receives no remuneration and where the family income is below the means test)
- Foster Care Grant (for children formally in foster care and below the means test)
- Care Dependency Grant (for children between 1 and 18 years with severe or profound mental or physical disability and whose caregivers are below the means test)

Severe Malnutrition is expected to become notifiable in the North West Province: Notification should be carried out in the normal reporting manner.

Start –up Formula (F75)

Use either recipe A or B:

Recipe A	**Recipe B**	**Conversion to**
Teaspoons		
Whole Dried Milk (7)	**35g**	**-**
Fresh Cow's Milk/ Long life full cream	**-**	**300ml**
Sugar (20)	**100g**	**100g**
Vegetable Oil (4)	**20ml**	**20ml**

Water to make up: make up to 1000ml

Using an electric blender, mix the milk, sugar and oil with warm boiled water and make up to 1000ml mark. Blend at high speed. If no blender is available, mix the milk powder, sugar and oil to a paste, and then slowly add the warm boiled water, stirring vigorously. Make up to 1000ml.

OR

Preparation of starter formula with Nan Pelargon in case the child's diarrhea persist when the normally prepared starter formula is given for two consecutive days.

PER ONE LITRE

INGREDIENTS		ENERGY		PROTEIN		FAT
22sc Nan Pelargon (81g)		1733kj		9,2 g		21g
2tsp Vegetable oil	370kj		--		--	
65g Sugar		1020kj		--		--
TOTAL		3323kj		9.2g		21g

Catch up formula (F100)

Use either recipe C or D

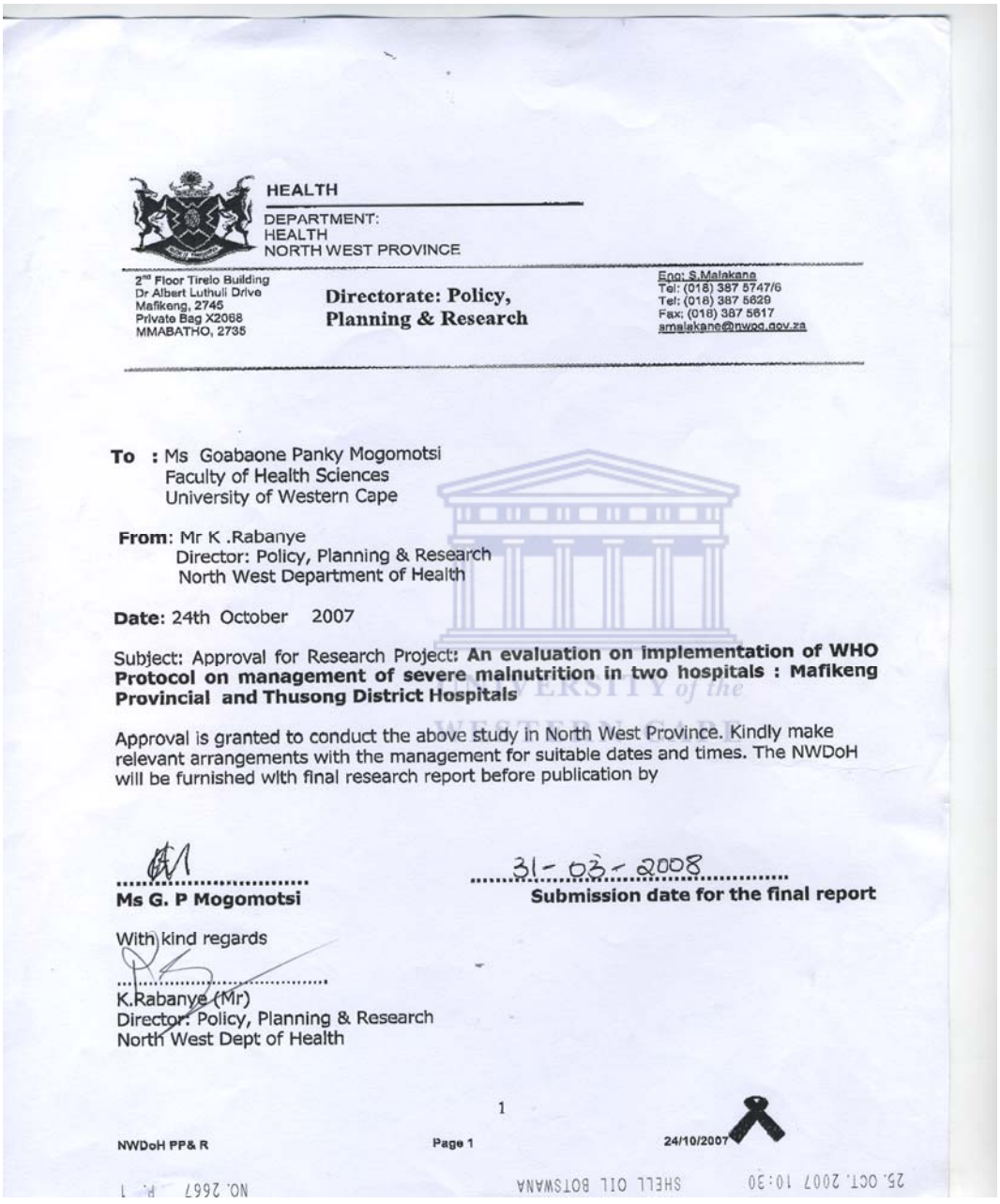
	Recipe C	or	Recipe D
Whole Dried Milk	**110g**		**-**
Fresh Cow's Milk/ Long life full cream	**-**		**880ml**
Sugar	**50g**		**75g**
Vegetable Oil	**30ml**		**20ml**
Water to make up:	**Make up to 1000ml**		**Make up to 1000ml**

Using an electric blender, mix the milk, sugar and oil with warm boiled water and make up to 1000ml mark. Blend at high speed. If no blender is available, mix the milk powder, sugar and oil to a paste, and then slowly add the warm boiled water, stirring vigorously. Make up to 1000ml.

OR

Energy Enriched Acidified Infant Milk e.g Pelargon (or Full Cream Infant milk), to each 1000ml of normally prepared Acidified Infant Milk (or Full Cream Infant Milk) add 2 ml of vegetable oil and 2.5ml of sugar.

Appendix 4: Approval for Research



HEALTH

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To : Ms Goabaone Panky Mogomotsi
Faculty of Health Sciences
University of Western Cape

From: Mr K .Rabanye
Director: Policy, Planning & Research
North West Department of Health

Date: 24th October 2007

Subject: Approval for Research Project: **An evaluation on implementation of WHO Protocol on management of severe malnutrition in two hospitals : Mafikeng Provincial and Thusong District Hospitals**

Approval is granted to conduct the above study in North West Province. Kindly make relevant arrangements with the management for suitable dates and times. The NWDoH will be furnished with final research report before publication by

.....
Ms G. P Mogomotsi

31-03-2008
Submission date for the final report

With kind regards

.....
K.Rabanye (Mr)
Director: Policy, Planning & Research
North West Dept of Health

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