

**Assessment of clinical practices in
children admitted with severe acute
malnutrition in three District hospitals, in
the Western Cape, South Africa.**



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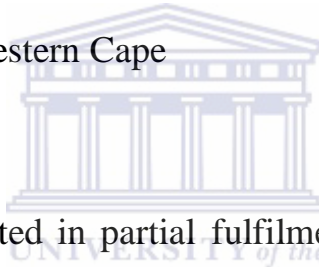
Assessment of clinical practices in children admitted with severe acute malnutrition in three District hospitals, in the Western Cape, South Africa.

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

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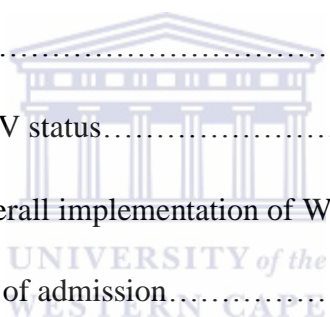
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ABSTRACT

Background: Severe acute malnutrition contributes disproportionately to child mortality rates despite availability of the WHO protocol, “Ten Steps”, to guide hospital management. Auditing morbidity and mortality rates of malnourished children at hospitals is useful to measure the effectiveness of hospital-based management compared to standards advocated by the WHO protocol. The study aimed to assess the adequacy of clinical management practices for severely malnourished children admitted to three district hospitals in the Western Cape as compared to the WHO guidelines.

Objectives: To describe prognostic indicators on admission such as clinical severity of malnutrition and co-morbidities such as HIV, TB, diarrhoea and pneumonia.

To assess the management practices of severe malnutrition against the key principles of management during the stabilisation phase as outlined by the WHO guidelines.

To describe the number of severely malnourished children who were treated for or died due to preventable complications (hypothermia, hypoglycaemia, dehydration, over-hydration, infection, electrolyte imbalance).

Methodology: A retrospective, descriptive study based on a folder review of medical records of 83 severely malnourished children admitted to the Stellenbosch, Helderberg and Eersteriver hospitals from September 2009 to June 2011 was done.

Structured data collection was undertaken to capture data to allow assessment of the clinician's management practices, and the adequacy thereof in implementing the first six steps of the WHO protocol guidelines.

Results The predominant co-morbidities in the sample were diarrhoea in 51% of cases and pneumonia in 33%. Thirteen percent were HIV infected, 28% of the sample had TB. Clinical signs were poorly documented by clinicians. The highest percentage of adequate management practices was for treatment of infections with 90% of patients receiving antibiotics. The second best management practice was for treatment of electrolyte and micronutrient deficiency. Hypoglycaemia and hypothermia were poorly managed as children developed these complications in the hospitals and yet these complications were still left untreated. Nineteen percent of the sample needed transfer to a specialist hospital.

Conclusion The study concludes that overall management practices for children admitted with severe acute malnutrition to three district hospitals in the Western Cape was poor and often did not adhere to the WHO guidelines. Doctors showed poor understanding of the need for accurate assessment and monitoring in order to reduce the mortality risk of these patients.

KEYWORDS

Severe acute malnutrition

Children

WHO guidelines

Ten steps

Western Cape

District Hospital

Management

Evaluation

Complications

Co-morbidities



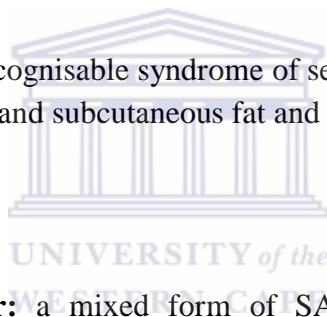
DEFINITION OF TERMS

Failure to thrive: a decrease in weight gain across two or more major percentiles.

Severe acute malnutrition: Weight-for-height measurement below -3 z-score and/ or symmetrical oedema involving at least the feet.

Kwashiorkor: clinically recognisable syndrome of severe malnutrition characterised by peripheral oedema, skin changes and fine, pale, sparse hair.

Marasmus: clinically recognisable syndrome of severe malnutrition characterised by severe loss of muscle and subcutaneous fat and child weighs less than 60% of expected weight-for-age.



Marasmic-Kwashiorkor: a mixed form of SAM that has features of both Marasmus and Kwashiorkor, including oedema.

Underweight: weight-for-age measurement below -2 z-score but more than -3 z-score in the absence of oedema.

DECLARATION

I declare that “Assessment of clinical practices in children admitted with severe acute malnutrition in three district hospitals, in the Western Cape, 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.

Adele Catherine Anthony

November 2013



Signed.....
UNIVERSITY of the
WESTERN CAPE

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ABBREVIATIONS

HAART: Highly Active Antiretroviral Treatment

HIV: Human Immunodeficiency Virus

MUAC: Mid upper arm circumference

ORS: Oral rehydration solution

SAM: Severe acute malnutrition

TB: Tuberculosis

IV: Intravenous

WHO: World Health Organisation



CHAPTER 1

1.0 INTRODUCTION

This chapter includes the general overview of malnutrition including the South African situation, and its impact on childhood morbidity and mortality. The concept of protocol-based management of malnutrition is introduced, the importance of monitoring and evaluating the implementation of these protocols in clinical practice and the general state of implementation of the protocol-based management of severe malnutrition in South Africa and specifically the Western Cape is discussed. The overall aim and objectives of the study including the rationale and the motivation for the study are also presented.

1.1 Background to the study

Malnutrition is recognised globally as one of the biggest contributors to childhood illness and mortality. The United Nations' Millennium Development Goal Four places emphasis on reducing child mortality rates by developing interventions through understanding the determinants of child mortality (UN, 2001). In South Africa, there is even possibly an underestimation of the impact of malnutrition on morbidity and mortality due to failure in identifying malnutrition as the reason for admission or death (Swart, Sanders & McLachlan, 2008). A South African study by Krug *et al* (2008) found 69% of deaths in children under 5 years of age are related to under-nutrition and a case-fatality rate of 38% for severe malnutrition.

Since underlying clinical factors, co-morbidities and health system infrastructure differ in various countries, this highlights the need to expand the understanding of child health epidemiology at a country level to enable proper targeting and prioritisation of interventions and resource allocation (Black, Morris & Bryce, 2003). Thus auditing morbidity and mortality rates of malnourished children at hospitals is useful as it measures the effectiveness of hospital-based management of SAM.

Golden *et al* (2000) commented that given the high mortality rates linked to severe malnutrition, little research is being carried out to improve the management of severe acute malnutrition (SAM) and the concern is that knowledge from previous research and experience is not being applied systematically.

The guidelines and standards for the in-hospital management of severely malnourished children are advocated by the World Health Organisation (WHO) protocol, the “Ten Steps” (WHO, 1999). This protocol, based on years of research, has been shown to dramatically reduce mortality due to SAM as the protocol takes into account the altered physiological state and reduced homeostatic mechanisms in severe malnutrition and clinical problems that arise as a result (WHO, 1999). The protocol aims to provide a stepwise approach which enables all clinicians to identify and monitor those children at risk of complications and prescribe treatment to reverse and avoid complications.



1.2 Implementation of WHO protocol in South Africa

In South Africa, Puoane *et al* (2001) and Puoane *et al* (2004) assessed the management of SAM in two rural district hospitals in the Eastern Cape. Initial high case-fatality rates for the two hospitals were attributed to faulty, outdated practices and lack of resources. The studies showed that identification and correction of poor practices reduced case-fatality rates by 25% in both hospitals even though resources were limited (Puoane *et al*, 2001; Puoane *et al*, 2004). In a post-intervention follow-up study; after training and support to implement the WHO protocol was given to 11 rural hospitals in the Eastern Cape, differences in quality of care and case-fatality rates in the hospitals were shown to be influenced by in-service training, supervision, leadership, teamwork, and managerial support (Puoane *et al*, 2008).

These studies recommend that similar studies be undertaken in other provinces in South Africa to identify deficiencies in the management of severe malnutrition in different hospitals since the retrospective review in these studies does limit the generalisability.

No similar research has been done in the Western Cape, except for an audit done at Red Cross Children's Hospital, a tertiary hospital in Cape Town (Petersen *et al*, 2006). The results reported a high case fatality rate of 19% at baseline. The study concluded that the WHO protocol was not adhered to and that more training of staff was needed (Petersen *et al*, 2006).

1.3 Motivation for the study

The Western Cape Provincial Nutrition Directorate aimed to implement the WHO protocol within the Western Cape, as outlined in the Annual Performance Plan for the Western Cape for 2011/2012, so as to improve inpatient care of severely malnourished children. Careful planning is needed to implement these steps. This study provides a situational analysis of current practices in district hospitals.

1.4 Rationale for study

This study aimed to assist in identifying strengths and weaknesses in clinical management of SAM in the three district hospitals in the Western Cape through assessing the clinical management practices of doctors and morbidity and mortality rates for children with severe malnutrition admitted to these hospitals. The clinical practices were compared to standards advocated by the World Health Organisation (WHO) protocol so as to strengthen the evidence base for the wider implementation of the WHO guidelines and training of medical staff.

Also, elucidating other factors, such as co-morbidities, impacting on outcomes of severely malnourished children will assist in making recommendations towards adapting management protocols to suit the disease profile of different communities.

This study focussed on the first seven steps of the ten step protocol which address the initial clinical condition of the patient and lessen the patient's risk of developing complications and death. These first steps require specific actions

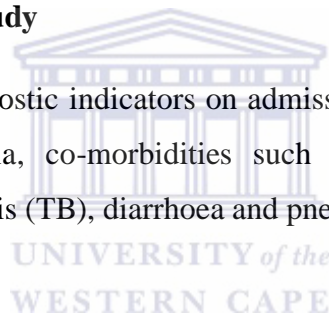
from the doctor to ensure stabilisation of the patient's condition. Record of the actions implemented should be documented in patient folders. The last three steps of the protocol, which involve the multidisciplinary team in hospital and in the community, were not evaluated within this study since actions relating to these steps are often not documented in the patient folders.

1.5 Aim of the study

To assess the adequacy of clinical management practices in severely malnourished children admitted to selected district hospitals in Cape Town, Western Cape.

1.6 Objectives of the study

1.6.1. To describe prognostic indicators on admission such as clinical severity of malnutrition, septicaemia, co-morbidities such as Human Immunodeficiency Virus (HIV), Tuberculosis (TB), diarrhoea and pneumonia.



1.6.2. To assess the management practices of severe malnutrition against the key principles of management outlined by the WHO guidelines for managing children with severe malnutrition (prevention of hypothermia, hypoglycaemia, dehydration, treating infections, correct feeding, electrolyte imbalance).

1.6.3. To describe the number of severely malnourished children who were treated for or died due to preventable complications (hypothermia, hypoglycaemia, dehydration, over-hydration, infection, electrolyte imbalance).

1.7 Outline of 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 presents the results of the study, while chapter five 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 outlines factors influencing the need for severely malnourished children to be managed in hospital and the role of implementing clinical protocols in guiding management of these patients and the impact on clinical outcomes.

The significant impact of malnutrition on under-5 survival rates worldwide has resulted in an extensive body of literature. Databases used included Medline, Pubmed, Science Direct and Ebscohost. The search focussed on keywords “Severe Acute Malnutrition”, “Kwashiorkor” and “Marasmus”. The literature search was limited to studies researching hospital-based management of SAM in developing countries since resources and clinical environments are likely to approximate those found in district level hospitals in South Africa.

The review initially outlines the disproportionate public health impact of SAM on hospital in-patient morbidity and mortality in the developing world. The WHO protocol is introduced and studies are reviewed that emphasise how clinical protocols improve clinical outcomes and the factors that promote successful implementation of the guidelines.

The aspect of persistent case fatality in Sub-Saharan Africa, despite training in the WHO protocol is focussed on, as well as the risk factors contributing to higher mortality in severely malnourished children such as HIV and TB co-infection.

The literature review aims to provide a perspective on how important monitoring and evaluation of the effectiveness of implementing the WHO protocol is and the importance of addressing any weaknesses detected through training, dissemination of knowledge or resource allocation.

2.2 Worldwide public health importance of SAM

Malnutrition poses a major public health problem throughout the developing world with over a third of all deaths in children under 5 years of age attributable to underlying undernutrition (UNICEF, 2008). SAM occupies a unique position between clinical medicine and public health since most cases can be prevented by economic development and poverty alleviation measures with no need for clinical input (Collin *et al*, 2006). There remains a great discrepancy in translating scientific knowledge of what is needed to treat malnutrition into actual practice in most institutions (Collins *et al*, 2006).

2.3 WHO classification of severe malnutrition

Based on the 2006 WHO Child growth standards (WHO, 2009), underweight is defined as a weight more than 2 standard deviations (or z -scores) below the median expected weight-for-age. This low weight could be due to stunting (low height-for-age) or wasting (low weight-for-height). Severe wasting is a weight-for-height measurement of below -3 z -score.

The standardised criteria for diagnosis of SAM are one or more of: weight-for-height z -score of below -3 , presence of bilateral pitting pedal oedema of nutritional origin and mid upper arm circumference (MUAC) of less than 11.5cm (WHO, 2009). When these new cut-off criteria are applied these identify children that were previously identified as moderate malnutrition according to the National Centre for Health Statistic reference for anthropometric criteria (WHO, 2009). Syndromes of malnutrition are described as Kwashiorkor or Marasmus (Ashworth *et al*, 2003). Kwashiorkor is defined as a clinically recognisable syndrome of severe malnutrition characterised by peripheral oedema, skin changes and fine, pale, sparse hair. Marasmus is defined as a clinically recognisable syndrome of severe malnutrition characterised by severe loss of muscle and subcutaneous fat and child weighs less than 60% of expected weight-for-age.

2.4 Anthropometry in accurate case definitions

Adequate treatment of patients depends on defining the case accurately. Bejon *et al* (2008) in analysing the fraction of all hospital admissions and deaths attributable to malnutrition among children in a district hospital in Kenya found that malnutrition underlay half of the inpatient morbidity and mortality and further argued that the contribution of malnutrition to these rates were underestimated by using conventional clinical definitions of severe malnutrition.

Ashworth *et al* (2004) suggested that problems in the mortality of SAM stem from failure to identify these children at hospital admission. The authors found that patients were treated who did not conform to the WHO definition of SAM since clinicians used visible signs and weight-for-age less than 60% of normal as their case definition. Using low weight-for-age can lead to inappropriate admission of stunted children (Ashworth *et al*, 2004).

Weight-for-height, rather than weight-for-age measurement, is a better indicator of recent weight loss. Weight on admission can potentially be confounded by dehydration while MUAC is unlikely to vary markedly with dehydration. (Berkley *et al*, 2005; Bejon *et al*, 2008). Berkley *et al* (2005) acknowledged the practical issues faced in measuring weight and height on all admissions in a busy ward managing sick children which results in these measurements not being done accurately or at all.

Given the challenges in measuring weight-for-height, evaluation of malnutrition is commonly performed by observing the clinical sign of visible severe wasting. Berkley *et al* (2005) suggested that MUAC is a good objective measure in classifying the degree of malnutrition compared to the subjective assessment of visible wasting as a bedside test in district hospitals.

Bejon *et al* (2008) also put forward evidence that MUAC was a more reliable marker of acute wasting than weight-for-age and height-for-age z -scores, the latter of which measures stunting. This previous study also suggested that MUAC may be better in identifying earlier those less severely ill children in need of nutritional rehabilitation.

2.5 Hospital based management of SAM

Children meeting the diagnostic criteria for SAM, who lack appetite and have added medical complications, need to be admitted to hospital since these children require intensive medical care (WHO, 1999).

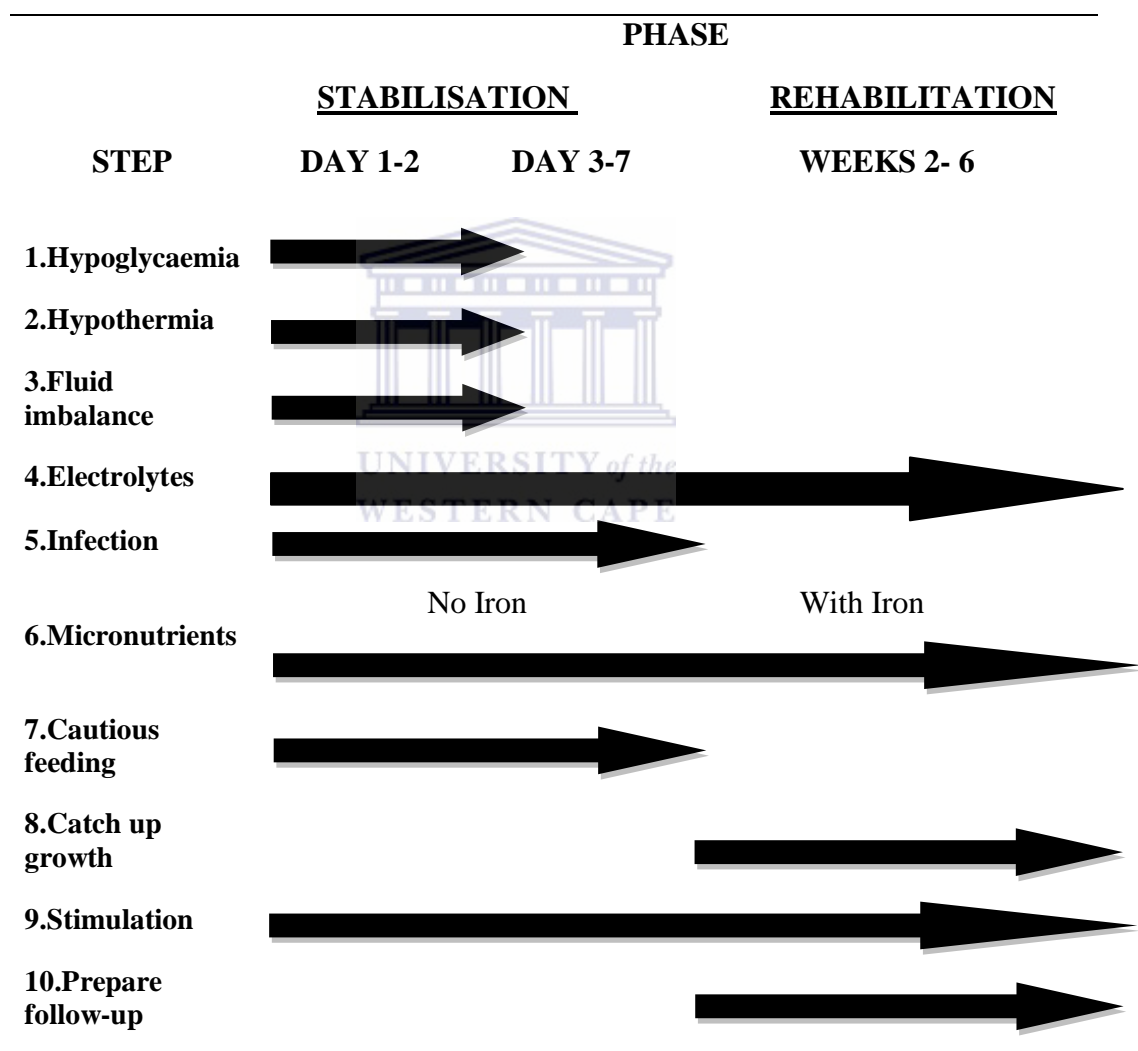
The WHO protocol (illustrated in Figure 1.) for managing SAM comprises a stabilisation and a rehabilitation phase. The stabilisation phase prevents and treats the most common complications which kill malnourished children within the first 1-7 days of admission. These complications include hypoglycaemia, hypothermia, infections, dehydration and electrolyte imbalances (WHO, 2000). Infections are treated by administering broad spectrum antibiotics; a combination of parenteral Ampicillin and Gentamicin, that are effective against enteric Gram-negative bacilli bacteraemia (Chisti *et al*, 2009). Another important step is correcting micro-nutrient deficiencies (WHO 2000). Most malnourished children have deficiencies in potassium and magnesium which results in retention of sodium and water thus WHO recommends potassium and magnesium supplementation and salt restriction during the stabilisation phase (Ashworth & Burgess, 2003). It is also advisable to replace vitamin A, Zinc, Iron, Folic acid, copper and Selenium, which are often deficient in SAM, because these antioxidant micronutrients and vitamins strengthen the immune system, improve mucosal function, improve growth and decrease morbidity and mortality due to illness such as diarrhoea, measles and pneumonia (Walton & Allen, 2011). Iron supplementation is not to be given during the stabilisation phase as it promotes bacterial growth.

Since malnourished children have reduced iron-binding capacity, withholding iron during antibiotic therapy helps treat infections effectively. Iron is to be given once the child starts to gain weight and not suffering acute sepsis or infections (Walton & Allen, 2011).

The rehabilitation phase includes cautious energy-rich feeding, catch-up growth, stimulation through play, and preparation for discharge by assuring the ability of the family to provide adequate nutrition through education, social support mechanisms and follow-up (WHO, 2000).

Figure 1: Diagrammatic presentation of WHO “Ten Steps” protocol

Illustrations by Ashworth, Jackson, Khanum and Schofield (2003)



2.6 Case-fatality rates linked to SAM

Case-fatality rates at hospitals in developing countries treating SAM average 20-30% and by the mid-1990s case-fatality rates had remained unchanged despite the availability of clinical management protocols for more than 30 years that have the capability of reducing case-fatality rates to at least 5%, (Schofield & Ashworth, 1996). It must be noted that although SAM may not rank high among hospital admissions, it contributes to a disproportionate percentage of deaths in hospitals (Karaolis *et al*, 2007).

Schofield & Ashworth (1996) and Karaolis *et al* (2007) argued that high case-fatality rates are due to faulty case management and weaknesses in health systems rather than inherent problems in the guidelines. However, current coverage of the WHO recommendations is poor worldwide (WHO, 2005). To achieve a reduction in deaths due to SAM by 55%, wider application of the WHO protocol is recommended, as well as that all children at high risk of death from SAM need to reach a health facility capable of delivering the WHO protocol effectively (Bhutta *et al*, 2008).

In Kenya, a prospective audit done by Nzioki *et al* (2009), to determine current practices in inpatient care of severely malnourished children and the proportion of children appropriately managed according to the WHO guidelines, found that quality of care of children with SAM was inadequate as the staff do not follow the WHO guidelines. Factors stated as contributing to this were staff shortages, inadequate infrastructure and limited understanding of the needs of a child with SAM. Improving the care of these children requires a focussed curative, medical approach together with a holistic approach to tackle socioeconomic root causes of SAM to prevent malnutrition.

2.7 Efficacy of clinical protocols for facility–based management of SAM

Ahmed *et al* (1999), using a protocol in Bangladesh similar to WHO guidelines, showed that use of standardised protocols to treat severely malnourished children with diarrhoea “...removes a large amount of discretion in management decisions and offers a comprehensive treatment regimen” (Ahmed *et al*, 1999, p1922). This previous study demonstrated substantially reduced mortality rates with use of the standardised protocol. Studies conducted in Colombia (Bernal *et al*, 2008) and Ethiopia (Berti *et al*, 2008), assessing case-fatality rates following implementation of malnutrition protocols, considered clinical skills, continuity of staff and adaptation of guidelines to local resources important factors in improving outcomes. Another trial in Bangladesh, found a locally adapted protocol easy to follow and as efficacious as the WHO protocol when using locally available foods and vitamin mixes, highlighting important implications in introducing protocol-based management of malnutrition in hospitals with limited resources (Hossain *et al*, 2009).

Conclusions drawn from an observational study by Karaolis *et al* (2007) in Eastern Cape, South Africa, concurred that WHO guidelines for SAM are largely feasible, even in small rural hospitals with limited resources and strict adherence to the guidelines would prevent deaths from the known treatable causes. Karaolis *et al* (2007) advocated that successful implementation of the WHO guidelines can be achieved through training, set protocols and support and supervision of inexperienced doctors.

2.8 Factors increasing mortality risk

Despite known risk factors for death in malnourished children, no hospital study in sub-Saharan Africa has demonstrated a case-fatality rate below 5% (Bachou *et al*, 2006 (a)). Studies investigating reasons for failure to further improve outcomes ascribed this to HIV infection, inadequate care, prescription errors and over-prescription of intravenous fluids and blood transfusions (Deen *et al*, 2003; Puoane *et al*, 2004; Bachou *et al*, 2006(a)).

The interaction between bacteraemia and SAM is well-defined and may develop rapidly and be difficult to detect. A study in a Kenyan and a Tanzanian hospital found infections to be associated with the majority of deaths (Sunguya, Koola & Atkinson, 2006). The authors of this previous study advocated prompt and appropriate management in order to reduce case-fatality rates. Bachou *et al* (2006 (a)) failed to show an association between infections and deaths and attributed these findings to routine use of broad spectrum antibiotics.

Results of improved mortality were shown in an earlier study when routine broad-spectrum antimicrobials were prescribed to all children admitted with SAM (Wilkinson, Scrace & Boyd, 1996). Further studies showed that severely malnourished children with bacteraemia have associated complications of hypothermia and hypoglycaemia and are at high risk for death unless treated with correct antibiotics (Van den Broeck *et al*, 2005; Babirekere-Iriso, Musoke & Kekitiinwa, 2006). Lazzerini & Tickell (2011) cited several epidemiological studies that documented a high prevalence of pneumonia, bacteraemia and urinary tract infections in children with malnutrition and highlighted the lack of good clinical studies on the use of antibiotics in malnourished children. The authors advised that local patterns of susceptibility to antibiotics should be taken into account in the choice of antibiotic. This systematic review showed that the use of broad-spectrum antibiotics such as Ampicillin and Gentamicin, in hospitalised children with SAM, is supported.

A more recent “before and after” study showed that although management according to the WHO protocol can reduce deaths due to blood and intravenous infusions, the overall case-fatality remained unchanged between the two groups because of HIV-infection, sepsis, severe dehydration, hypothermia and hypokalaemia (Bachou *et al*, 2008).

A study in Kenya by Maitland *et al* (2006), showed mortality rates reduced to only 19%, despite no evidence of faulty practices. Thirty percent of deaths occurred in the first 48 hours of admission with invasive bacterial disease a major co-factor in many of the deaths.

They found that children presenting with lethargy, hypothermia, hypoglycaemia and hypovolemic shock were at greatest risk for early mortality (Maitland *et al*, 2006). A similar study, in Ethiopia, assessing treatment outcomes, attributed early deaths to the critical condition of children on admission (Berti *et al*, 2008). Late mortality in the same study was postulated to be due to electrolyte imbalances.

A study in Nairobi found low serum phosphate levels directly associated with mortality (Kimutai *et al*, 2009). The hypophosphataemia is due to re-feeding causing fluid and electrolyte shifts (Boateng *et al*, 2010). Kimutai *et al* (2009) recommended monitoring of serum phosphate levels, routine phosphate supplementation and cautious progressive nutrition by reducing volume and caloric density of the feeds.

In attempting to reduce mortality risk in the severely malnourished child, there is a strong call for better clinical characterisation at triage and appropriate clinical treatment of complications on admission which includes antimicrobial therapy and targeted supportive treatments as outlined in the WHO protocol (Maitland *et al*, 2006). Maitland *et al* (2006) showed that the WHO-recommended danger signs of lethargy, hypothermia and hypoglycaemia had 52% sensitivity and 84% specificity in predicting early mortality.

Clinical assessment of severely malnourished children is difficult, especially when assessing dehydration and infection, since clinical signs are often distorted by the overall appearances and abnormal physiological responses linked to malnutrition. (Bhan, Bhandari & Bahl, 2003). The need for close clinical care and laboratory monitoring for metabolic disturbances is emphasised so as to recognise and treat complications early (Berti *et al*, 2008).

Lapidus *et al* (2009), reviewing mortality rates in a nutritional program in Niger, found that clinical signs of apathy, pallor, anorexia, fever and age below 1 year were risk factors for death.

Since most deaths in the study occurred within 7 days of admission, the authors urged clinicians to prioritise, detect and treat any children with SAM presenting with these risk factors vigorously (Lapidus *et al*, 2009).

A study by Ashworth *et al* (2004), in the Eastern Cape, South Africa, found that high death rates were attributable to avoidable errors by clinical staff. Avoidable causes of death included sepsis due to failure to prescribe appropriate antibiotics, dehydration and over-hydration due to poor fluid management and failure to correct electrolyte imbalances (Ashworth *et al*, 2004). This highlights the need to improve medical training to equip doctors to treat these common conditions effectively.

2.9 Influence of co-morbid illness on case-fatality rates of SAM

Deen *et al* (2003) stated that, even with adequate implementation of WHO guidelines, achieving mortality rates below 5% in sub-Saharan Africa was not straightforward given severe co-morbidity on the sub-continent in the context of overloaded, under-resourced health services.

Recognising the impact of co-morbidity is needed to enable effective, appropriate interventions. HIV and TB have led to an epidemic of secondary severe malnutrition with higher rates of complications and case-fatality (Heikens, 2007). A study in Malawi found that HIV-infected children were more likely to die and advocated the need for routine HIV testing and treatment among all malnourished children (Chinkhumba *et al*, 2008).

Two separate studies, one in Malawi and the other in Uganda, aiming to determine the impact of HIV infection on the management of SAM, showed case-fatality rates were significantly higher in HIV-positive children since immunosuppression increases the risk of sepsis (Kessler *et al*, 2000; Bachou *et al*, 2006(b)). Studies showing no association between mortality and HIV-positive status suggest that small sample size may account for the lack of association (Babirekere-Iriso *et al*, 2006).

The authors suggests that if patients are managed appropriately according to the WHO protocol then future studies may show unmask the effect of HIV on mortality in severely malnourished children (Bachou *et al*, 2006(b)).

The rise in South Africa's under-five mortality by the year 2000 has been attributed to paediatric HIV which accounted for 40% of these deaths (Bradshaw, Bourne & Nannan, 2003). Heikens (2007) highlighted that consideration needs to be given to severely malnourished children with HIV and TB since they differ in their pathophysiological and clinical response to the WHO therapeutic guidelines.

A study in Johannesburg, South Africa, found severely malnourished HIV-positive children have a fivefold higher mortality than HIV-negative children despite good clinical care and access to antiretroviral therapy (De Maayer & Saloojee, 2011). The authors recommended that the WHO guidelines in high HIV prevalence settings need to be modified to include routine HIV and TB testing and offer guidance on criteria and timing of TB treatment and initiation of antiretroviral therapy.



2.10 Role of continuous evaluation

The literature reiterates the need for continuous evaluation of programmes and auditing of case-fatality and complication rates and co-morbidities to provide a measure of the effectiveness of hospital management of severe acute malnutrition and to address weaknesses in health systems in order to sustain these interventions and assure overall quality of care of children admitted to hospital especially since many deaths due to severe acute malnutrition are preventable.

CHAPTER 3

3.0 RESEARCH DESIGN AND METHODOLOGY

This chapter outlines the research setting, study design, study population and sampling size, data collection methods. The chapter goes on to explain data analysis, validity and reliability, limitations and ethical considerations of the study.

3.1 Research setting

The research was conducted in three district hospitals (Helderberg, Stellenbosch and Eersteriver hospitals) in Cape Town, Western Cape. District level care was targeted since, in keeping with the referral system within the metropole, most children would be referred to the district hospital for assessment for initial stabilisation and admission as needed. The children are managed at the district hospital mostly by medical officers with generalist training. All the district hospitals in the current study refer all complicated clinical cases to Tygerberg Hospital which is a specialist tertiary level hospital. The 3 hospitals were chosen since the geographical district had a high prevalence of malnutrition (Personal Communication Hilary Goeieman, Nutrition Directorate, Western Cape Health, 17 July 2010).

The assumption was that the medical officers should have received some instruction relating to the WHO Ten Steps protocol, either at an undergraduate level or from senior doctors in supervisory roles. Assessing how these doctors manage and stabilise children presenting with SAM would be a good reflection of basic knowledge levels and the need for further training.

3.1.1 Helderberg Hospital

Helderberg Hospital, in Somerset West, Cape Town, is part of the Eastern sub-district of the Western Cape Department of Health. It is a 162-bedded hospital with 17 beds in the paediatric ward and is staffed by 2 general medical officers.

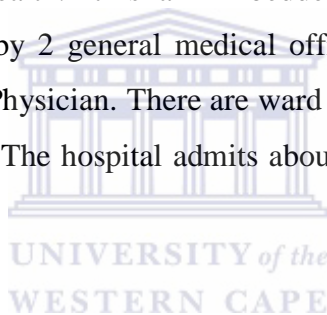
The medical officers are supervised by a Family Physician. There are weekly ward rounds conducted by paediatric specialists. The hospital admits about 50 malnourished children per annum.

3.1.2 Stellenbosch Hospital

Stellenbosch Hospital, in Stellenbosch, Cape Town, is part of the Cape Winelands sub-district of the Western Cape Department of Health. It is an 85-bedded hospital with a 16-bedded paediatric ward staffed by 2 general medical officers. The hospital admits about 40 malnourished children per annum.

3.1.3 Eersteriver Hospital

Eersteriver Hospital is part of the Khayelitsha-Eastern sub-district of the Western Cape Department of Health. It is a 124-bedded hospital with an 18-bedded paediatric ward staffed by 2 general medical officers. The medical officers are supervised by a Family Physician. There are ward rounds conducted by paediatric specialists once a week. The hospital admits about 20 malnourished children per annum.



3.2 Study design

This was a descriptive, retrospective study using quantitative data collection methods to review folders of children admitted with severe malnutrition to the selected district hospitals.

3.3 Study population and sample size

The study population was all severely malnourished children admitted to Helderberg, Stellenbosch and Eersteriver Hospitals between 01 September 2009 and 30 June 2011.

A cohort study design was initially selected since the researcher wanted to describe how the current management practices of severe acute malnutrition in the

three hospitals as compared to the WHO protocol recommendations impacted on case-fatality and complication rates of these patients exposed to these practices. Sample size was calculated using the Epi Info, 3.4.3, November 2007 version. Option of “sample size and power” was selected followed by selection of “cohort or cross-sectional study” option. Confidence interval of 95% was used to keep the probability of making a Type 1 error to lower than 5% and power of 80% was selected to have a less than 20 percent probability of a Type 2 error (Bhopal, 2007).

Initially it was intended that folders be assessed for exposure to proper management practices during the initial stabilisation phase as defined in the WHO protocol guidelines (WHO, 2000). When all first seven steps were done then folders were to be classified as “exposed”, whereas as those not meeting all the criteria were to be classified as “unexposed” to adequate management. Folders of children who died were to be classified as “unexposed” to adequate management. The sample calculated was 88 for each group so a total sample size of 176 folders was needed. Since the total of malnourished patients admitted differed for the individual hospitals, the sample size was divided proportionately between the three hospitals.

However, the sample size was not realised due to hospitals not being able to access the admissions registers, admissions registers not accurately recording malnutrition as a diagnosis on admission or the registry departments being unable to track the folders. These problems were especially prevalent at Helderberg and Stellenbosch hospital.

A total of 83 folders were reviewed. A total of 34 folders were reviewed at Helderberg Hospital, 37 folders were reviewed at Eersteriver and a total of 12 folders were reviewed at Stellenbosch Hospital. Given the small total of folders reviewed, the small number of children that suffered complications and the fact that there was not a stark difference in the care of patients who were being exposed to proper management and those unexposed to good clinical care, so it was no longer possible to have two separate cohorts. The folders were reviewed

using retrospective, quantitative study design on how many of the seven main preventative management steps of the WHO protocol were implemented.

3.4 Data Collection

A non- random convenience sampling strategy was used. The medical records of all severely malnourished children admitted to Helderberg, Stellenbosch and Eersteriver Hospitals between 01 September 2009 and 30 June 2011, as recorded in the admissions register, were reviewed. Data were collected by the main researcher and an assistant who were both medical doctors. The medical superintendents of each of the hospitals signed the consent forms to allow access to the hospital records which was accompanied by an information sheet explaining the details of the study (Appendix 1&2).

Data were collected in line with the study objectives. Data was recorded on a pro-forma sheet (Appendix 3). Variables studied were defined on the capture sheet.

Standardisation in measuring and categorising variables was achieved by defining criteria since observations for these variables needed to be reproducible since there were two clinicians involved in reviewing the folders.

1. To assess prognostic indicators on admission such as clinical severity of malnutrition, septicaemia, co-morbidities such as HIV, TB, diarrhoea and pneumonia.

The first part of the data tool collected data outlining demographic information, anthropometric measurements, malnutrition classification and the presence of co-morbidities on admission. The patient's clinical signs and vital observations recorded on presentation were collected. Subsequently, data were collected regarding initial investigations ordered by the doctors. These included the checking of electrolytes, blood glucose, blood culture, urine culture, chest x-ray and whether TB was suspected and whether the TB diagnostic workup was initiated.

2. To assess the management practices of severe malnutrition against the key principles of management outlined by the WHO guidelines for managing children with severe malnutrition

The second section of the data collection tool assessed whether doctors recorded information in the folders giving an indication that the doctors excluded the presence of hypothermia, hypoglycaemia, dehydration, infection and electrolyte imbalance and initiated management in line with the WHO guidelines in order to avoid any of these preventable complications.

3. To identify severely malnourished children who were treated for or died due to preventable complications

The final section of the data tool focussed on whether there was any record of the patient suffering any complication during the hospital stay. The final outcome (discharged, transferred, died) was recorded was the number of days this outcome.

3.5 Validity and Reliability

Management practices were assessed through use of a checklist based on criteria defined by WHO guidelines so as to ensure validity of data collected. Reliability of data collected was ensured by the researchers being medical doctors familiar in management practices of SAM.

The retrospective study design makes it difficult to control for random measurement error since meticulous anthropometric measurements for classification of severity of malnutrition would not always be done but rather were based on the clinical opinion of the doctor. Neither was it always obvious in the records as to the criteria applied to other variables, for example pallor, severe anaemia, apathy, description of hydration status, nor is there a way of standardisation of measurements by the doctor for such variables in order to limit random measurement error (Myer & Abdool-Karim, 2008).

Use of historical data in the form of the medical records posed a threat to the internal validity (or accuracy) of the study since information in the folders may not always be complete or accurately recorded.

It is acknowledged that information bias have been introduced through misclassification particularly in categorical variables such as different types of malnutrition or diagnoses of complications which is based on the clinicians' opinion which may be inconsistent and inaccurate. These errors may affect measures of association impacting on the validity and retrospective design makes elimination of this bias impossible.

Selection bias was minimised since the sample population was from medical records with no need to ensure agreement to participate in the study from the patients. Incomplete notes, patients being discharged early or being transferred out to other facilities may have introduced measurement bias.

3.6 Generalisability

This study has limited generalisability given that a non-probability sampling methods were used. It will not be possible to generalise results to similar district hospitals within South Africa since extrapolation of results cannot be done due to factors such as differing individual hospital infrastructure, staffing levels and training, differences in criteria for admission and discharge as well as differences in patient profiles regarding demographics and even co-morbidity. Results cannot be extrapolated to the wider community either since the hospital population is a selected population which is not necessarily a representative sample of the community from which these patients are derived.

3.7 Data analysis

Data were entered into an Excel spreadsheet. Data cleaning was done using the Statistical Package for Social Science (SPSS), Version 20.

Inconsistent or unusual values were flagged and corrected when possible. At study completion, the data were exported to SPSS, version 20, for assignment of value and variable labels, further cleaning and analysis.

Based on the study objectives and its design, the analysis used descriptive statistics. Univariate data were analyzed using descriptive statistics; frequency distributions, proportions, means, medians and standard deviations. It is acknowledged that there could have been overrepresentation from a specific group of patients or a specific hospital as a result of convenience sampling and that the sample may not have a normal distribution and certain statistics may be skewed.

3.8 Limitations

Review of records provides potentially useful health related information which is collected routinely as part of patient care but the format, completeness and accuracy may have been compromised since the information was recorded by a range of different people for clinical purposes and not methodically recorded for research purposes. Data are often incomplete, variables inconsistently defined and recorded differently by different people. Another shortcoming is that some variables may be unavailable in folders with no recourse to obtain this missing data.

Selection of folders for review was hampered since the diagnosis of malnutrition was not always listed in the admissions register. Folders were selected based on patients having prolonged stays, diagnoses known to be associated with malnutrition like pneumonia, diarrhoea, TB, HIV and vague descriptions of failure to thrive or being underweight. Folders were drawn and further sifted to see if the patient met the criteria for severe acute malnutrition. This may have introduced misclassification bias since gathering of the sample relied on the completeness of the clinical notes.

Methods employed to select folders may have introduced overrepresentation of certain categories of patients while some cases could have been missed. The issue of missed cases is relevant to patients who had died. The folders of patients who had died were requested but these folders could not be traced.

3.9 Ethical Considerations

The research proposal was approved by the Ethics committee and the Senate Research Committee of the University of the Western Cape (Appendix 4). Permission to conduct the study in the hospitals was granted by the Department of Health, Western Cape (Appendix 5). Confidentiality of patients was not breached and no human subjects were involved in the study. With regard to data entry, the study database was password protected.



CHAPTER 4

4.0 RESULTS

4.1 Characteristics of sample

Table 1: Summary of characteristics of sample

Total folders reviewed	<i>n</i> =83
Males	<i>n</i> = 44(53%)
Females	<i>n</i> =39 (47%)
Previous admissions	<i>n</i> =18 (22%)
Previous admissions for malnutrition	<i>n</i> = 8 (10%)
Kwashiorkor	<i>n</i> =32 (38%)
Marasmus	<i>n</i> =16 (17%)
Marasmic-Kwashiorkor	<i>n</i> =10 (12%)
Protein-energy malnutrition	<i>n</i> =4 (5%)
Failure to thrive	<i>n</i> =10 (12%)
Underweight	<i>n</i> = 4 (5%)
Malnourished	<i>n</i> =5 (6%)
Unclassified	<i>n</i> =2 (2.5%)
Oedema	<i>n</i> =40 (48%)
No Oedema	<i>n</i> = 25 (30%)

A total of 83 folders were reviewed in the study. Thirty-four (40.9%) folders were reviewed at Helderberg Hospital, 37 (44.6%) folders were at Eersteriver Hospital and 12 (14.5%) folders were reviewed at Stellenbosch Hospital. Forty seven percent of the sample was female and 53% were male; all with ages ranging from 2 months to 5 years. Six children were under 6 months of age.

Admission dates ranged from end of September 2009 to end of June 2011. Eighteen patients had records of previous admission to the same hospital. Eight of these previous admissions related to treatment for malnutrition.

According to the descriptions in the folders: 32 (38%) were classified Kwashiorkor, 16 (17%) Marasmus, 10 (12%) Marasmus-Kwashiorkor, 23 (28%) as “Other” while 2 patients were not classified. The miscellaneous group of classifications included 4 classified as having protein-energy malnutrition, 10 described as “Failure to thrive”, 4 as underweight and 5 as malnourished. The 2 patients with no classification of their nutritional state noted despite having weights below -3 z-score, also had no description of oedema thus the researcher could not assign a probable malnutrition classification. One patient was described as Kwashiorkor though the doctor noted the absence of oedema. Eight of the 23 patients with vague descriptions of their malnourished state could be further classified as marasmic based on the weight-for-age and absence of oedema while 2 patients of the 23 patients met criteria for kwashiorkor. The remaining 13 patients with the vague descriptions of their malnourished state did not have examination for oedema noted but their weight-for-age recorded in the folder plotted at below -3 z-score so it is assumed that these patients could further be classed as marasmic. Of the 11 HIV-infected patients: 6 were classified as marasmic while 5 were classified as kwashiorkor.

On evaluating the completeness of notes with respect to oedema: 40 (48%) patients had record of oedema, 25 (30%) patients had no oedema noted while in 18 (22%) patients there were no entries recording either presence or absence of oedema. In 73% of the patients with oedema, the severity of the oedema was not graded or described.

In regard to objective anthropometric measurements, only 52% of patients had weights formally plotted while only one patient had a recorded height. Mid-upper arm circumference was not measured in any patients. Two patients had a history of prematurity and weights were not adjusted for gestational age.

4.2 Co-morbidities on initial presentation

Table 2: Frequency of co-morbidities

	Co-Morbidity on presentation	Frequency	Percentage
Diarrhoea	Yes	42	51%
	No	41	49%
Pneumonia	Yes	27	33%
	No	56	67%
Tuberculosis	Yes	3	4%
	No	80	96%
Sepsis	Yes	4	5%
	No	79	95%
HIV	Yes	6	7%
	No	77	93%
Other Co-morbidities	Yes	13	15.7%
	No	70	84.3%

Table 2 outlines the frequency of co-morbidities in the sample. These include the presence of diarrhoea, pneumonia; one of which was measles pneumonia, TB, HIV and sepsis on initial presentation to hospital. The predominant illnesses were diarrhoea in 51% of cases and pneumonia in 33%. Four percent presented on TB treatment while 7% were HIV-positive. The proportion of patients with HIV relates to patients in whom the HIV status was known prior to admission to hospital and does not include the patients who were tested in hospital. The miscellaneous group of co-morbidities included rashes, fungal infections, seizures, jaundice, herpes stomatitis and meningitis.

4.3 Initial assessment of clinical condition

Table 3 outlines the clinical presentation of children per hospital as to recorded evidence of the presence of pallor, apathy, fever, hypothermia, acidosis, respiratory distress and dehydration. These signs are known to indicate severity and increased mortality risk of the patient (Lapidus *et al*, 2009).

Table 3: Clinical signs on presentation to hospital

Clinical sign	Stellenbosch (n=12)	Helderberg (n=34)	Eersteriver (n=37)	Total percentage (n=83)
Pallor	4	2	6	14%
Apathy	2	6	15	28%
Fever	1	5	3	11%
Hypothermia	0	0	0	0
Acidosis	0	4	1	6%
Respiratory distress	0	4	5	11%
Dehydration	2	9	22	40%

Even though 35% of all the patients did not have their hydration status noted on admission, 40% of patients in the sample were noted to be dehydrated which places dehydration as the most common clinical sign that was positively noted as illustrated in Table 3. This implies that 33 (61%) patients of the 54 patients, who did have their hydration status checked, were dehydrated which is a significant proportion.

Of the dehydrated patients, 3 were noted to be severely dehydrated and 4 were assessed as being shocked while in 8 patients the severity of dehydration was not described. Clinical signs of dehydration which would add validity to the diagnosis of dehydration were not always commented on.

Sunken eyes, skin turgor and capillary refill time were most commonly described with each sign recorded in 15% of the dehydrated patients while pulse volume and cold feet were only noted in 9 and 4 patients respectively. Five of the patients noted to be dehydrated had no clinical signs of dehydration described.

Not shown in Table 3 is data reflecting the absence of written records relating to examination of important clinical signs. In 61 (73%) patients there was no written record for evidence that pallor was examined for or excluded. There was no evidence that apathy and acidosis was examined for in 18 (22%) patients and for respiratory distress in 9 (11%) patients.

All patients had a recorded temperature on admission thus the reported absence of hypothermia at presentation is probably an accurate reflection.

Nine patients did not have haemoglobin checked on admission. No patients with a recorded Haemoglobin had a level of less than 4g/dl which is the level at which a blood transfusion is indicated (WHO, 1999). The lowest recorded Haemoglobin was 5.4g/dl. No patients received blood transfusions.

4.4 Diagnostic tests on admission

Initial investigations need to be done to identify electrolyte imbalance, hypoglycaemia, anaemia, infection including TB and HIV. This ensures that emergency therapy can be initiated to treat such conditions, some of which are reversible.

4.4.1 Testing for hypoglycaemia

Only 57.8% of patients had a blood glucose checked on admission. At Eersteriver hospital a blood glucose was checked on 89% of patients. This practice seems less routine at Helderberg and Stellenbosch with only 35% of patients and 25% of patients, respectively, having had their glucose level checked.

Of the patients who had glucose checks on admission, doctors noted the initial glucose reading in only 21(43%) of these patients. Two patients, both from Eersteriver, were reported to suffer from hypoglycaemia on admission.

There was failure to recognise this emergency in one patient. In the second patient, treatment was incorrect since 25% Dextrose was prescribed as compared to 10% Dextrose that is recommended (Walton & Allen, 2011).

4.4.2 Testing for electrolyte imbalance

Sixty-three (76%) of patients had electrolyte levels checked on admission. Of those where laboratory investigations were done: Sodium was checked in 93% and Potassium in 98%, as compared to Magnesium in 35% and Phosphate in 37%.

Of the patients that had electrolyte checks there was hypokalaemia in 29 (46%) patients, hyponatraemia in 17 (27%) patients, hypernatraemia in 5 (8%) patients, hypophosphatemia in 6 (10%) patients and hypomagnesemia in 2 (3%) patients. One patient had hyperkalaemia.

4.4.3 Tests to exclude infections

When evaluating investigations to exclude infection, there were only 12 patients that had a blood culture done at admission and only 14 patients had urine dipstick checks. No urine dipstick checks were done at Stellenbosch hospital. Of the urine dipsticks done, 10 were reported as abnormal but only 6 were sent for formal urine culture. Two urine cultures confirmed a urinary tract infection.

Fifty-four patients (65%) had a chest x-ray done on admission of which 29 (54%) of these patients had some inflammatory changes noted on the x-rays. Fourteen (26%) patients who had x-ray investigations did not have the result of the x-ray recorded in the notes. Helderberg hospital accounted for 50% of these missing entries.

4.5. Initial approach to prevent and treat complications of SAM

This section will present the results of the initial approaches employed upon admission to prevent and treat complications of SAM which include hypoglycaemia, hypothermia, fluid imbalance, electrolyte imbalance or infection.

4.5.1 Initial approach to preventing and treating hypoglycaemia

Prevention of hypoglycaemia (blood glucose $<3\text{mmol}$) requires routine testing of blood glucose on admission and then 4-hourly checks in the stabilisation phase, feeding within 30 minutes of presentation followed by prompt initiation of 2 to 3-hourly feeds throughout the day and night. Treatment of low blood glucose involves providing the patient with oral glucose if conscious or 5ml/kg of 10% Dextrose intravenously or via a nasogastric tube if the patient is unconscious. (WHO, 1999; Ashworth & Burgess, 2003)

Sixty-three percent of patients had no written orders relating to regular glucose monitoring. Of the patients in which there were written orders only 7% specified 4-hourly glucose monitoring.

The times of the first feed was recorded for 56 (68%) patients in the nursing notes. Table 4 shows the mean and median times for the first feeds as recorded for the 3 hospitals. Stellenbosch hospital shows a median of 4 hours (SD+- 8.67) to feeding. At Eersteriver Hospital the median was 4.50 hours (SD+- 19.90) while at Helderberg Hospital the median was 13.50 hours (SD+- 9.02). Two patients at Helderberg were instructed to not eat for the first 24 hours which could explain this finding. At Eersteriver Hospital the first recorded feed was after 48 hours in 6 patients. It is acknowledged that these statistics are derived from when nursing staff recorded the feed and are not necessarily a reflection of the actual first feed at the hospital which could explain why the results are skewed towards protracted periods.



Table 4: Time to treatment by hospital

Hospital		Time to 1st feed in hrs	No. of days on initial antibiotics	Time in hours to 1st dose antibiotics	No. of days in hospital
Stellenbosch					
(n=12)	Mean	8.00	2.67	4.63	6.92
	Median	4.00	2.00	4.00	6.50
	Std. Deviation	8.672	2.535	2.669	2.678
	Minimum	1	0	2	3
	Maximum	30	7	8	13
Helderberg					
(n=34)	Mean	13.67	5.68	15.91	11.94
	Median	13.50	5.50	4.50	11.50
	Std. Deviation	9.022	2.716	23.508	7.369
	Minimum	0	1	1	2
	Maximum	34	14	86	36
	Eersteriver				
(n=37)	Mean	12.97	4.27	10.61	9.19
	Median	4.50	4.00	3.00	8.00
	Std. Deviation	19.095	3.212	17.647	5.651
	Minimum	1	0	1	2
	Maximum	72	12	72	22

4.5.1.1 Feeding orders

Children are to be fed cautiously in the stabilisation phase. Starter milk formula F-75 is recommended. The volume of feeds is limited to 130ml per kilogram per day in children without oedema. In children with oedema the volume is limited to 100ml per kilogram per day (Ashworth & Burgess, 2003).

In 42 patients (48%) a feeding order was written but the timing of the feeds was not specified. Two- hourly and three-hourly feeds were given in 48 patients based on information derived from the nursing notes.

In 18 patients it could be deduced that they were receiving the correct volume of feeds based on available information of weight as well as the presence of oedema. Thirty-three patients received too small volumes of feeds according to the records while 8 patients received too much feeds. Most of this information was derived from the nursing records of feeds given rather than written orders by the doctors. The type of feeds prescribed or given were commercial formulations. Some written orders were “feed on demand”, “toddlers diet, no milk”, “ORS, porridge, tea”, while another stated “normal food and milk diet”. Eight patients had orders for milk feeds but did not specify the type while 3 were prescribed cow’s milk. Where the doctor did not write an order, the nurses seemed to use their own discretion relating to the type of feeds, brand of milk as well as the volumes of the feeds.

4.5.2 Initial approach to preventing and treating hypothermia

Children with SAM are at risk of hypothermia because of diminished muscle mass and fat stores. It is recommended that four-hourly temperature checks be done with a low-reading thermometer to detect hypothermia that is defined as an axillary temperature below 35 degrees Celsius (Ashworth & Burgess, 2003).

Only 4% of patients had a written order for 4-hourly temperature checks while 81% of patients had no written order for temperature monitoring. In 54 (65%) patients the doctors did note the initial temperature of the patient in the clinical notes.

4.5.3 Initial approach to preventing and treating fluid imbalance

Excessive fluids need to be avoided. Intravenous (IV) fluids should only be given to patients presenting with signs of shock. All other children with dehydration should be treated with oral rehydration solution (ORS). Rehydration should be done at a slower rate than usual (WHO, 2000, Ashworth & Burgess, 2003)

Table 5: No. of patients (per hospital) with hydration status checked on admission

		Dr noted Hydration @admission		Total	
		Yes	No		
Hospital	Stellenbosch	Count	4	8	12
		% of Total	33.3%	66.6%	100%
	Helderberg	Count	20	14	34
		% of Total	58.8%	41.2%	100%
	Eersteriver	Count	30	7	37
		% of Total	81.1%	18.9%	100%
Total		Count	54	29	83
		% of Total	65.1%	34.9%	100.0%

As shown in Table 5, only 54 (65%) patients had their hydration status noted by the admitting doctor with most of these patients being at Eersteriver hospital, where 30 (81%) of the 37 patients admitted had their hydration status noted.

Not included in Table 5 is the data that 34 (41%) patients received intravenous fluids. From the descriptions of the patients' level of dehydration in the notes: only 7 patients were assessed as severe dehydration (>10% dry) or shocked so only 9.6% of the sample should have received intravenous fluid therapy. Of the Helderberg patients, 12 (36%) patients received intravenous fluids while at Eersteriver Hosp 17 (46%) patients had intravenous fluids prescribed. At Stellenbosch Hospital 5(42%) patients received intravenous fluids. Of the 49 patients who were either suffering from diarrhoea or were noted to have dehydration, the calculation of fluid requirements was not clear in 24 (49%) of these patients.

4.5.4 Initial approach to preventing and treating electrolyte imbalance and micronutrient deficiencies.

WHO recommends extra potassium and magnesium supplementation to be given at doses of 3-4mmol/kg and 0.4-0.6 mmol/kg respectively. Salt intake needs to be restricted. Vitamin A, Zinc, Iron, Folic acid, copper and Selenium need to be prescribed. The treatment approach involves giving a multivitamin supplement from admission to ensure a daily intake of the micronutrients of up to twice the recommended daily allowance. Vitamin A supplementation is given orally with dosing according to age. Iron is not to be given during the stabilisation phase (WHO, 1999, Ashworth & Burgess, 2003).

Potassium supplementation was prescribed in 61% of patients, Magnesium was prescribed in 12% while phosphate was prescribed in 3.6% of patients. In one case, potassium supplementation was given though the patient was hyperkalaemic. Sixty-eight (82%) patients received multivitamin syrup, 61 (73%) received Folic acid, 62 (75%) received Zinc, 61 (73%) received Vitamin A and 47 (57%) patients were dewormed with Albendazole.

Iron was prescribed on day one in 6 (7%) patients. One patient had the iron stopped the next day by another clinician.

Sixty-one (73%) patients did not have iron prescribed at all. The remaining 16 patients received iron therapy after day 2 and mostly on discharge.

4.5.5 Initial approach to preventing and treating infection

WHO recommends broad-spectrum antibiotic therapy, such as Ampicillin and Gentamicin for at least for the first five to seven days, the duration depending on the response and nutritional status of the child (WHO, 2000; Ashworth & Burgess, 2003). If the child has any of the danger signs (hypoglycaemia, hypothermia, lethargy or appears severely ill) then intravenous antibiotics are advised (Bhan *et al*, 2003). The antibiotic regimens need to be adapted depending on local resistance patterns (Lazzerini & Tickell, 2011)

Seventy-one patients in the sample received antibiotics on day one of admission. A further 4 patients had antibiotics prescribed on day two. Thus a total of 90% of the sample received antibiotic therapy.

Twenty-nine patients were given antibiotics via the oral route, 40 patients received antibiotics intravenously while 6 patients received a combination of both. Thirty-two patients (39%) received IV Ampicillin, 22 (27%) received IV Gentamicin and 18 (22%) had IV Ceftriaxone prescribed. A further, 29 (35%) patients received oral Amoxicillin, 9 (11%) patients received Metronidazole, and 11 (13%) patients received other antibiotics such as Flucloxacillin, Co-trimoxazole, Acyclovir and Erythromycin. The average number of days on the first prescribed antibiotic spanned from 2 to 5 days per hospital. One patient at Eersteriver hospital was on antibiotics for 12 days despite not spiking a fever.

The average time to the first antibiotic dose is outlined above in Table 4. Stellenbosch hospital shows a median time of 4.00 hours (+-SD 2.69), Helderberg hospital 4.5 hours (+-SD 23.51) and Eersteriver hospital 3.00 hours (+-SD 17.65) to the time when the first dose of antibiotics was recorded to have been administered. The time is calculated from time when doctor examined the child.

4.6 Monitoring and management of complications

4.6.1 Hypoglycaemia in the ward

Fifty-eight (70%) patients did not have any glucose monitoring done in the ward. Of the 25 patients that did have glucose monitoring done, only 11 had 4-hourly glucose checks. The doctors only noted the glucose readings in the clinical notes in 5 cases. None of the patients were recorded to have received any feeds overnight. Doctors commented on the adequacy of feeds in only 9 patients.

Of the patients where glucose monitoring was done, 4 (2%) had hypoglycaemic readings recorded by the nurses. This complication occurred on days 2 to 6. In none of the cases of hypoglycaemia were there any records of actions taken to correct the hypoglycaemia nor did the doctors make mention of these episodes in the clinical notes.

4.6.2 Hypothermia in the ward

Only 3 patients had a record of 4-hourly temperature monitoring. In the other 80 patients, temperature was recorded every 5-8 hours during the day shift and temperature was not checked overnight after 20h00.

A total of 15 (18%) patients had temperature readings at the level of hypothermia. However, there was no record in the folders showing that the hypothermia was recognised or whether any immediate action was taken to remedy the complication.

4.6.3 Electrolyte imbalance in the ward

Twenty- nine (35%) patients did not have electrolyte checks done while in the wards. Of the 54 patients where electrolyte levels were monitored, 32 (59%) had abnormal results recorded. The frequency of the electrolyte imbalances recorded was: hyperkalaemia in 5 patients, hypokalaemia in 18 patients, hyponatraemia in 12 patients, hypernatraemia in 3 patients, hypomagnesemia in 2 patients, hypermagnesemia also in 2 patients, hypophosphataemia in 3 patients and hyperphosphataemia in 3 patients.

Twenty-two patients showed a recovery in electrolytes and 4 still had abnormal electrolytes recorded on repeat tests, while 7 patients never had electrolyte checks repeated despite showing previously deranged electrolyte levels.

4.6.4 Fluid imbalance in the ward

Fifty-three percent of patients were recorded as having diarrhoea in the ward. However, when evaluating the accuracy of fluid balance monitoring, hydration status was only noted in 37% of patients in the entire sample.

Perfusion states, respiratory rate and pulse rates are sensitive clinical signs relating to hydration but these were only noted in 10, 12 and 14 patients respectively.

Twenty-five patients had a record of being dehydrated in varying degrees in the wards. Twenty-six patients received intravenous fluids, 13 patients were given fluids via nasogastric tube and 26 patients received ORS at some point during the hospital admission. In 13 patients the hydration status worsened to dehydration in the ward while 1 patient was recorded as suffering from fluid overload.

4.6.5 Infection complications in the ward

A fever is defined as temperature above 37.5 degrees Celsius (WHO, 2000). Fifty-four percent of patients spiked a fever at least once during their admission to hospital. One patient at Eersteriver Hospital did not spike a fever at all or have any investigations done to screen for sepsis and yet received a prolonged 12 day course of antibiotics. In contrast, another patient at Eersteriver did spike a temperature but no antibiotics were prescribed nor were any investigations done to screen for sepsis during the admission.

Blood cultures were done in only 16 patients who spiked a fever. Of these blood cultures only 1 had a positive result, 3 had no growth while for 12 of the blood cultures a result was not recorded in the folder.

Urine culture was done for 10 patients with fever of which 4 patients had an organism cultured, 5 patients had no growth on urine culture and 1 patient did not have the urine culture result recorded.

A chest x-ray was done in 22 patients who developed a fever in the ward. Nineteen were reported as abnormal while 3 had no result noted.

Sources for the fever were attributed to pneumonia in 21 patients, sepsis in 8 patients, urinary tract infection in 7 patients, thrombophlebitis in 1 patient and minor illnesses in 6 patients. The miscellaneous illnesses included: measles in 2 patients, otitis media and upper respiratory tract infections. In 10 cases, a source for the fever was not identified.

Doctors changed antibiotic choice in 9 of the patients that spiked a fever in the ward.



4.7 Search for TB

TB was suspected in 84% of cases. TB was diagnosed and treatment initiated in 24% of suspected cases. When taking into account the patients that were already on TB treatment on admission to hospital a total of 28% of the total sample were on TB treatment.

Sixty-two (75%) patients had a Mantoux Tuberculin skin test done of which 11 were reactive and 37 non-reactive while no result was recorded in the folder for 14 patients. Gastric washings for TB culture were done in 58 patients. Four produced a positive culture, 37 were negative while 17 folders had no record of gastric washing results.

4.8 Determining HIV status

As shown in table 6, it is concerning that 20 patients did not have their HIV status checked. Stellenbosch hospital did no tests on admission in patients with unknown status and contributed to 45% of the patients not offered an HIV test at all. Eersteriver did the most tests on admission.

Table 6: HIV tests per hospital

		HIV test done				Total	
		During admission	Known status	Done according to mother	No test done		
Hospital	Stellenbosch	Count	0	3	0	9	12
		%	0.0%	25%	0.0%	75%	14.5%
Hospital	Helderberg	Count	14	8	7	5	34
		%	41.2%	23.5%	20.6%	14.7%	41.0%
Hospital	Eersteriver	Count	22	9	0	6	37
		%	59.6%	24.3%	0.0%	16.2%	44.6%
Total		Count	36	20	7	20	83
		% of Total	43.4%	24.1%	8.4%	24.1%	100.0%

In sample, 11 patients were HIV positive, 51 patients were HIV negative, in 1 folder the HIV status was not recorded although it was recorded that a test had been done. This indicates an HIV positivity rate of 18%.

4.9 Summary of overall implementation of WHO stabilisation phase.

The figures, that follow, graphically present frequency distributions for each of five key management actions for severe malnutrition during the stabilisation phase. It is a summary of the degree of adequacy to which each of the steps during the stabilisation phase of the WHO protocol were adhered to in each hospital. These graphs enable one to compare clinical practices between hospitals for each of the principles.

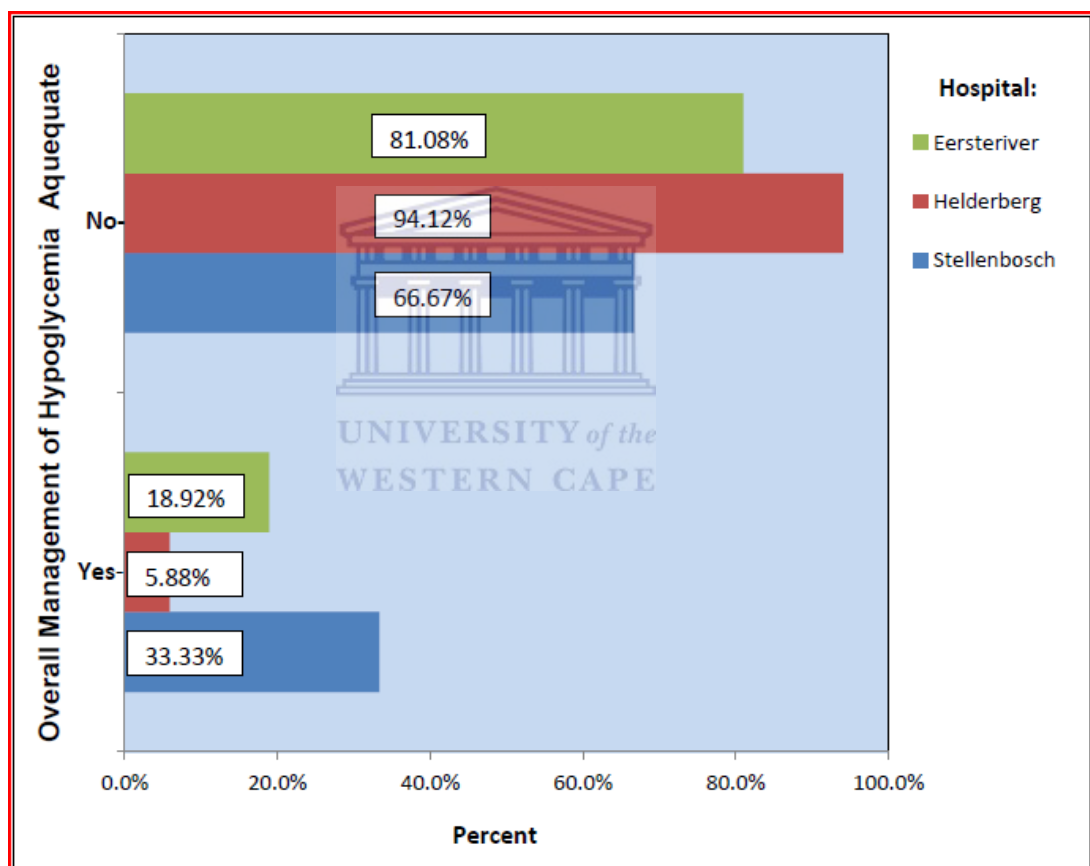


Figure 2: Overall management of Hypoglycaemia

Management of hypoglycaemia was generally poor across the three hospitals as shown in figure 2. Between 65% and 94% of severe malnutrition cases in the three hospitals did not receive adequate prevention and treatment for hypoglycaemia.

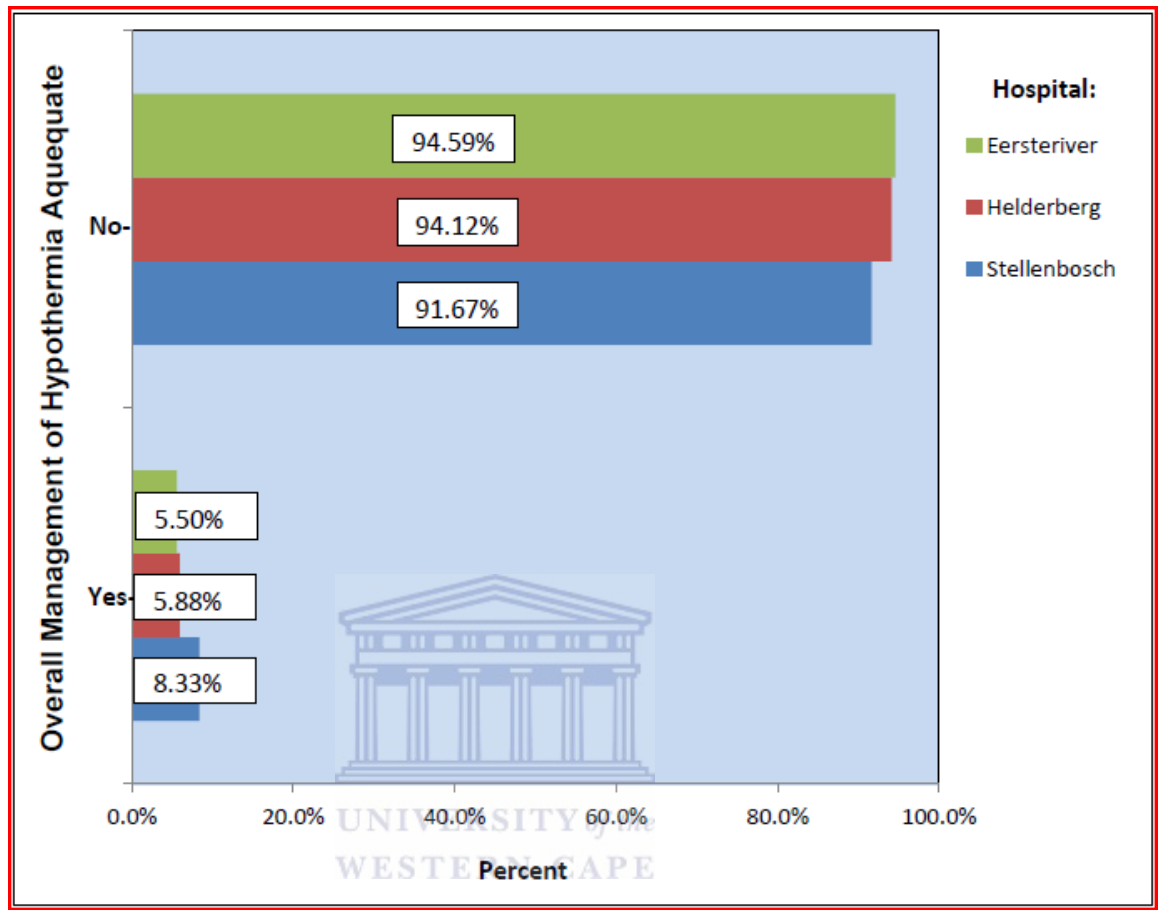


Figure 3: Overall management of Hypothermia

Figure 3 depicts that the management of hypothermia was generally poor across the three hospitals as more than 90% of the cases did not receive adequate treatment for this condition.

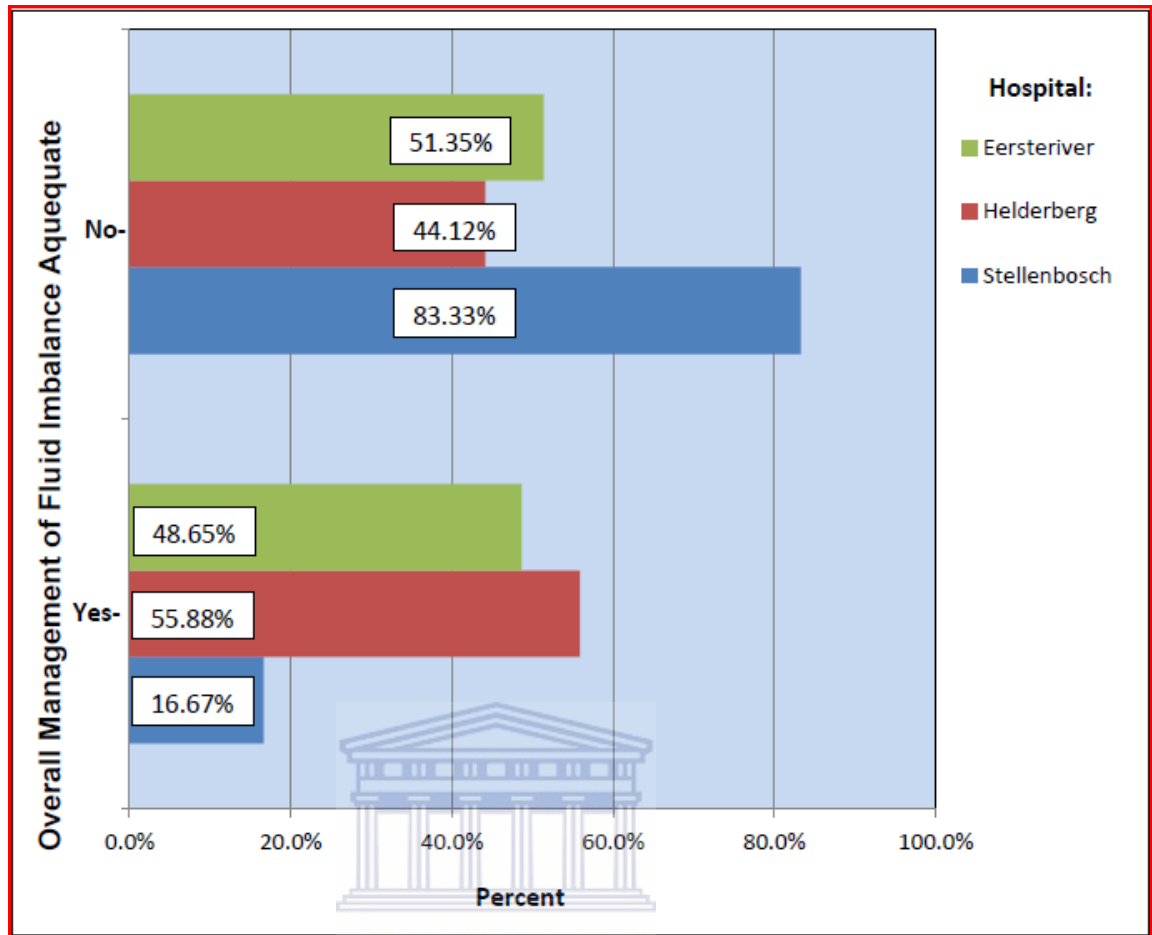
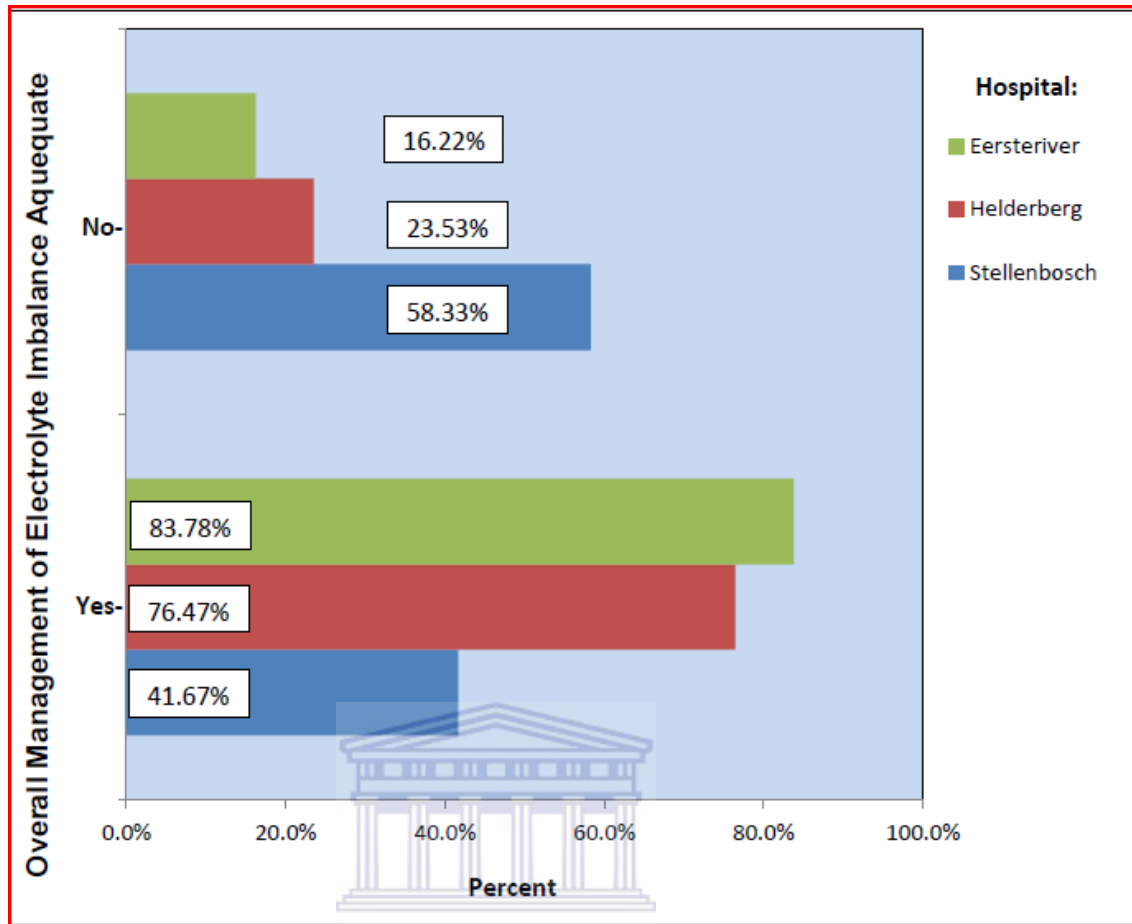


Figure 4: Overall management of Fluid balance

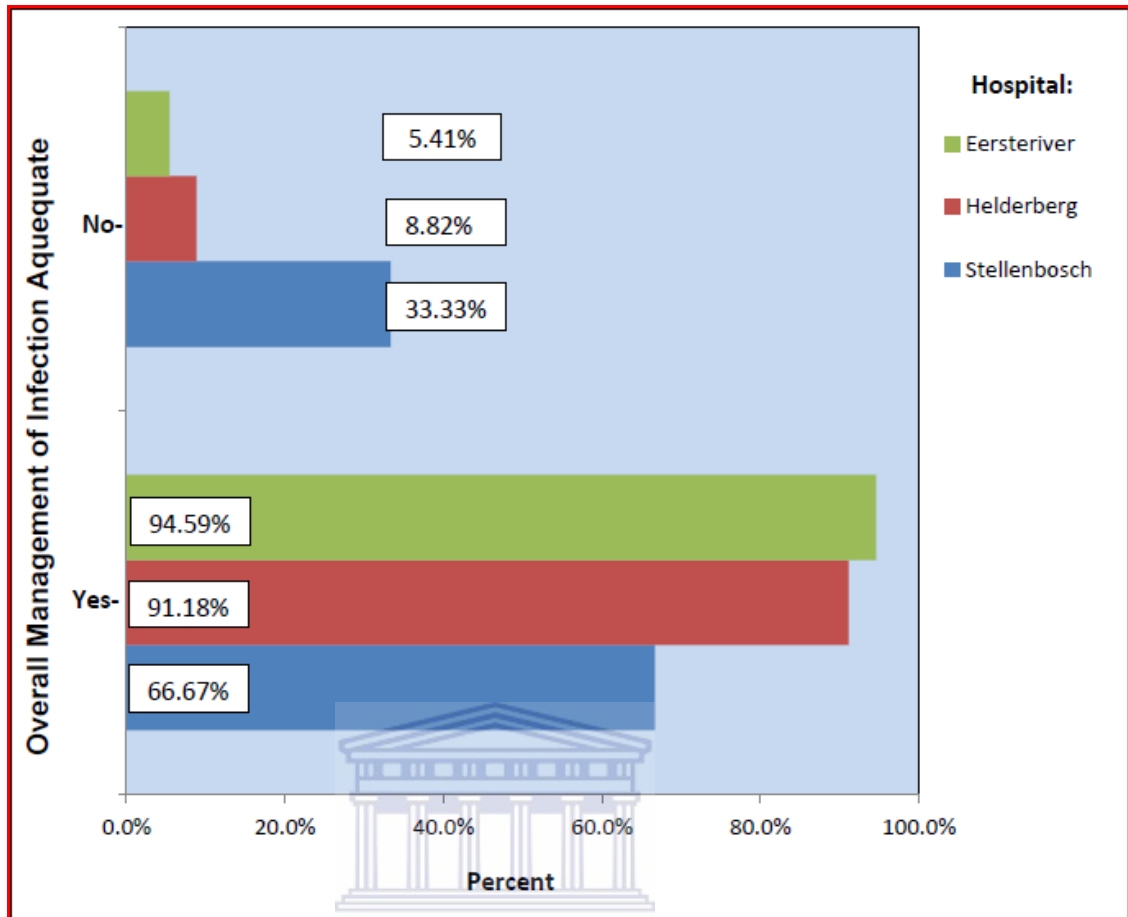
As shown in figure 4, Stellenbosch Hospital had the worst practices regarding the management of fluid imbalance compared to other two hospitals. For these two other hospitals, the proportion of cases who received adequate management of fluid imbalance was almost the same as that of the cases who received poor management.



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Figure 5: Overall management of Electrolyte imbalance

Compared to the other two hospitals, Stellenbosch hospital had the highest percentage of cases that were inadequately managed for electrolyte imbalance.



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Figure 6: Overall management of Infection

Generally, the management of infections was good in all the three hospitals although Stellenbosch did relatively poor compared to the other two hospitals.

4.10 Final outcome of admission

There were no deaths in this sample. Sixty-seven (81%) patients were discharged home. Sixteen (19%) patients were transferred to specialist hospitals. Some of the reasons for transfer included sepsis, shock, severe dehydration with acidosis, hypernatraemia, hyperkalaemia and respiratory distress. Fifty percent of the cases transferred were described as having kwashiorkor. Given that the sample consisted of a majority of kwashiorkor patients this could have resulted in a skewing of the results towards kwashiorkor patients being transferred. The possibility of misclassification of SAM cases in these folders precludes analysis to determine whether there is indeed a true statistical relationship between kwashiorkor and an increased probability of transfer.

Table 4 outlines the average length of stay for patients at each hospital. The average duration of stay in the hospital was higher for Helderberg hospital (Median= 11.50 days, +- SD 7.37) followed by Eesteriver hospital (Median 8.0 days, +- SD 5.65) then Stellenbosch Hospitals (Median = 6.50 days, +- SD 2.68). Reasons for discharge involved either resolution of the acute problem or availability of beds at care homes in the situation of social placements needed. Helderberg showed protracted length of hospital stay due to two cases retained for social reasons.

WHO guidelines advocate discharge once weight has been gained to between -2 z-score and -1 z-score (WHO, 2009). In none of the patients was the weight gain evaluated and noted on discharge.

It was not possible to do analytical analysis since non-probability sampling was done. Thus the current study cannot assess whether the severity of the patients' clinical condition and co-morbidities significantly impacted on the development of complications and clinical outcomes.

CHAPTER 5

5.0 DISCUSSION

5.1 Introduction

This study set out to assess the clinical practices of doctors in treating severely malnourished children admitted to three district level hospitals; Eersteriver Hospital, Helderberg Hospital and Stellenbosch Hospital, in Cape Town in the Western Cape. The results overall showed poor clinical management of children with SAM admitted to these hospitals.

South Africa is counted among the 24 countries that account for 80% of the worldwide burden of chronic undernutrition (Schubl, 2010). Schubl (2010) cited the National Food Consumption Survey from 1994 to 2005 which showed a slight decline in stunting from 23% to 18% nationally while the prevalence remained static at 12% in the Western Cape. Schubl (2010) also cited a draft report by the University of Western Cape (October 2009) outlining the nutritional status of children in the Western Cape. This unpublished report showed that the prevalence of wasting increased alarmingly from 1% to 11.5% in the Western Cape from 1994 to 2005. Schubl (2010) attributes poor health outcomes in South Africa, despite high expenditure and supportive policies, to a failure to build capacity to implement policies and lack of monitoring of implementation. Interventions to stem the alarming levels of the under-5 mortality rate require a comprehensive, integrated approach embodied in the primary health care approach (Sanders, Bradshaw & Ngongo, 2010). Sanders *et al* (2010) highlighted that there are differences between districts in South Africa as regards coverage of key interventions for maternal and child health. The authors stated that access to housing and sanitation, employment rates, ratio of paediatric specialists and quality of health interventions are much better in the Western Cape as compared to the Eastern Cape.

Although the Western Cape is better able to implement strategies to improve overall health outcomes, the increasing prevalence of SAM in the Western Cape places a burden on the few skilled staff and resources available.

This mismatch of the many patients requiring treatment and strained resources may contribute to poor management and high case fatality rates of children with SAM.

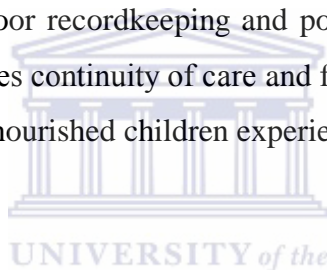
Given this bleak scenario, the Western Cape provincial nutrition directorate has put strategies in place in the Annual Performance plan 2011/12 as regards training of doctors to manage SAM at hospitals and so it is expected that doctors, irrespective of level of experience, should have basic knowledge of the WHO protocol.

The retrospective design of this study means that evaluation of staffing levels, training, available equipment or resources is not possible in order to see how these impacted on clinical management practices. Notwithstanding, the results obtained from the review of folders, the study demonstrates the existence of poor practices and a lack of understanding regarding the management of severe acute malnutrition. Issues relating to the initial assessment of the child's malnourished state, the identification of co-morbidities and accurate evaluation of the clinical condition and signs on admission and a "disregard" for the importance of accurate recordkeeping and monitoring of this extremely vulnerable group of children were uncovered. The concern is that if basic good clinical practice is lacking at the initial evaluation of the patient, it is likely that misclassification or missed diagnoses will impact negatively on adherence to the WHO guidelines for managing SAM.

The current study found that doctors at all the hospitals did not implement the WHO guidelines for the stabilisation phase adequately as regards monitoring, preventing and treating hypoglycaemia, hypothermia, fluid imbalance, electrolyte disturbances and micronutrient deficiencies or infections. The results reiterate the findings by Scholfield and Ashworth (1996) who stated that staff are unfamiliar with best practice which results in inappropriate treatment regimens such as incorrect rehydration procedures, missed infections and the failure to recognise the vulnerability to hypoglycaemia and hypothermia being common.

The poor and disadvantaged communities served by these district level hospitals are having to access health facilities that are overburdened and understaffed resulting in helpless individuals experiencing poor quality care. Parents struggle to reach facilities due to transport issues. They have to sometimes first save up money in order to pay for transport which results in delays in help being sought. Taking a child to a healthcare facility has a further negative economic impact since the carer needs to stay off work to care for the ill child. This scenario highlights the need to define acute cases and those at risk of malnutrition at every contact with a health worker and to act effectively and immediately as required so that the child is not lost to follow-up in the health care system.

If malnutrition or the clinical signs associated are missed then the child does not get placed on the path to recovery and the greater impact on the family continues in a downward spiral. Poor recordkeeping and poor initial documentation of the child's clinical state makes continuity of care and follow-up difficult. It seems that only a proportion of malnourished children experience good practice.



5.2 Hospital recordkeeping and tracing of malnutrition admissions

Only 83 folders were reviewed due to issues relating to accessing records at the institutions. Some of the recordkeeping problems related to hospitals not being able to trace admission registers. There is no computerised database available to enable one to draw records based on diagnoses.

An initial proportionate calculation meant that the majority of folders should have been reviewed at Helderberg hospital. Due to better recordkeeping and filing practices at Eersteriver Hospital, 44.6% of folders in the sample were reviewed there with 40.9 % at Helderberg and 14.5% at Stellenbosch.

Malnutrition was not always listed as the admission diagnosis in the registers. Bejon *et al* (2008) commented similarly that the direct causes for admission that were ultimately attributable to malnutrition as the underlying cause were infectious diseases, which were then recorded as the primary diagnoses by

clinicians. More folders were reviewed at Eersteriver Hospital because the ward register had a column for the diagnosis on admission and for the diagnosis on discharge. Severe malnutrition was found to be listed among the discharge diagnosis although not initially listed in the admission diagnosis.

Eersteriver Hospital also has a dietician who provides a follow-up clinic for malnourished patients so the dietician checks each admission for those patients who are malnourished or at risk of developing malnutrition. This simple practice highlights how an awareness of malnutrition as a disease entity nudges clinicians towards identification, rehabilitation and follow-up which could mitigate the problem of malnutrition.

It is likely that more cases of SAM could have been selected for review but were probably missed due to the combination of unreliable recordkeeping, probable misclassification and focus on the primary diagnosis with failure to recognise underlying malnutrition.

Twenty-two percent of patients in this study had a record of previous admission to the same hospital and 44% of these previous admissions were for malnutrition. This again demands interrogation whether malnutrition was not diagnosed previously or whether the risk factors for malnutrition were possibly not quantified on the previous admissions so as to ensure that the necessary steps could be taken to ensure future rehabilitation or prevention. The importance of checking the Road to Health card as part of growth monitoring by the health care worker is highlighted here.

The perspective relating to identification of children at risk of malnutrition was raised in a earlier study by Marino, Goddard & Workman (2006), following a one-day cross-sectional survey done at Red Cross Memorial Children's Hospital in Cape Town, which showed an increasing prevalence of malnutrition in the hospitalised patients at an unacceptably high 34%; which was comparable to studies in other developing countries. This previous study argued that malnutrition remains an unrecognised problem impacting on increased hospital stay and health costs.

The authors recommended that a nutrition risk screening tool be developed that identifies risk factors for malnutrition, assesses the nutritional status of all children on hospitalisation and serves as a guide towards planning appropriate nutrition care plan interventions for discharge in order to avoid missed diagnoses and relapse of patients (Marino *et al*, 2006).

5.3 Classification of malnutrition on admission

In the current study, anthropometric measurements were poorly performed overall. Only 52% of patients had weight-for-age formally plotted on a chart even though 100% had a weight recorded. Only one patient had height measured and no patients had a mid-upper arm circumference checked. Maitland *et al* (2006) also showed that anthropometric measurements were done poorly where results showed only 35% of weights recorded in a previous study.

Due to missing height data in the current study, weight-for-height measurements could not be checked to assist in differentiating patients in the sample suffering from wasting versus stunting. This means there could have been misclassification of cases since only weight-for-age measurement was used and no MUAC was available to verify information in folders.

Review of the clinical notes also revealed that clinicians on occasion would not calculate the age of the child accurately which meant that the weight would be incorrectly plotted. This has immediate implications for the accurate identification of malnutrition and further impacts on the accuracy of feed volumes, fluid requirements and even medication dosing since these all include weight in the calculation of these.

The bigger proportion of patients was described as Kwashiorkor (38%) while 17% were described as Marasmus. This finding differs from previous studies in Kenya and Bangladesh where 58% and 66%, respectively of those study samples were found to be Marasmus (Nzioki *et al*, 2009; Hossain *et al*, 2009).

This difference in findings may be due to differences in community profiles, risk factors for malnutrition, sampling differences as well as issues with classification and case definitions.

In the current study, 28% of the patients were not formally described by the clinician according to the classification of SAM and were instead described in general terms as “failure to thrive” and “protein-energy malnutrition” when the anthropometric measurement of weight-for-age placed the patient at below -3z-score.

The introduction of misclassification bias in the current study is an acknowledged limitation of a retrospective study design. The identification of cases in the sample relied on the completeness and accuracy of the medical records. There is no certainty that case definitions were correctly applied by the clinicians thus results may be skewed.

The case definitions of malnutrition in the current study could be verified in 78% of the patients since these patients’ notes contained a description of oedema. It is worrying that one patient was classed as Kwashiorkor by the clinician though an absence of oedema was noted. The remaining 22% patients of the sample, having a vague description of under-nutrition, also lacked any reference to oedema meaning the researcher could not assess if these cases might have met the criteria for SAM.

The retrospective design of the current study meant the researcher was unable to check if the non-entry relating to oedema means that the doctor did examine for oedema and only recorded oedema as a positive finding or whether a non-entry meant no examination for oedema at all. This all implies that the proportions of Marasmus and Kwashiorkor in the current study could be different if these children had been thoroughly assessed and evaluated as advocated by the WHO growth standards (WHO, 2009).

The problem of misclassification and incorrect diagnosis is concerning given that the case definition of malnutrition is pivotal in identifying the vulnerable malnourished child in order to initiate treatment as per the WHO protocol.

When patients are classified incorrectly; some could get discharged prematurely while other patients get admitted and treated for SAM when they do not have the condition and this could place them at unnecessary risk of hospital-acquired infections (Walton & Allen, 2011).

Further issues relating to poor note keeping by the clinicians is shown by the fact that 45% of the patients with oedema did not have grading or severity of the oedema specified. This speaks to clinicians disregarding the importance of documenting the patient's condition in detail in the notes to enable all in the team of health carers to be able to assess the patients' progress accurately during admission.

5.4 Co-morbidities in the sample

Patients present to hospital for admission for various acute conditions rather than for malnutrition. The predominant illnesses on presentation to hospital in the current study were: diarrhoea (51%), pneumonia (33%), septicaemia 5%, TB on treatment (4%) and HIV (7%). This finding supports the association between diarrhoea and pneumonia with malnutrition (Khanum, Ashworth & Huttly, 1994). The finding in the current study of diarrhoea and pneumonia as the predominant co-morbidity is comparable to previous studies in Colombia and Kenya (Sunguya *et al*, 2006; Bernal *et al*, 2008; Nzioki *et al* 2009).

Pneumonia carries a significantly increased mortality risk when combined with SAM and needs to be detected early and managed appropriately to ensure good outcomes (Chisti *et al*, 2009). As regards the practice of performing a chest x-ray to exclude possible underlying TB or pneumonia (Ashworth & Burgess, 2003), only 65% of the patients had an x-ray done on admission. Twenty-six percent of the patients that did have x-rays done did not have the results recorded in the folders. This implies a lack of adequate radiological investigation in 52% of the sample and could mean that respiratory infections could have been underdiagnosed in some of the patients at admission.

It is however noted that the optimal diagnosis of pneumonia does still rely on a combination of history, clinical signs and chest x-ray (Chisti *et al*, 2009).

The current study further evaluated co-morbidities diagnosed in the ward and the results showed a further 7% of patients were diagnosed with sepsis and 11% more of patients were noted to have pneumonia. This suggests possible misdiagnosis at admission or the acquisition of as well as the vulnerability to hospital-acquired infections.

5.5 Evaluation of clinical signs on admission

A thorough initial systemic examination of a child presenting to a hospital with SAM is needed to detect co-morbidities as well as danger signs that require emergency management and so decrease the malnourished child's risk of mortality. The poor physical state of children with malnutrition means that clinical signs are often distorted and difficult to assess which increases the risk of clinicians missing signs of complications, such as severe dehydration and infection, which are potentially treatable (Bhan *et al*, 2003).

The presence of any of the danger signs on admission: shock, dehydration, respiratory distress, anaemia, apathy, hypothermia, hypoglycaemia and refusal to eat, indicate the need for increased vigilance and intensive management (Maitland *et al*, 2006; Lapidus *et al*, 2009). Results in the current study reveal that danger signs were recorded in low proportions overall except for dehydration which was noted in 40% of the patients. The lack of identification of hypothermia on admission correlates with findings in studies that found hypothermia is rare on presentation since all patients had a temperature reading recorded at presentation to hospital (Maitland *et al*, 2006).

The finding of the high proportion of dehydration in the current study correlates with the fact that dehydration is difficult to assess in SAM because of the lack of subcutaneous fat giving the impression of persistently decreased skin turgor which

results in the over-diagnosis of dehydration (Walton & Allen, 2011). Only 4 patients were assessed as shocked on admission.

The poor documentation of clinical signs of dehydration means that the accuracy of the evaluation of hydration status could not be objectively verified in the current study. It is possible that the diagnosis of dehydration could be incorrect or could have been missed in the patients in which no attention was given to the hydration status at all since only 65% of patients had hydration status noted on admission.

Eersteriver Hospital accounts for the most clinical signs recorded. This could be a reflection of better note-keeping by the doctors, over-diagnosis of certain signs, oversampling of records from Eersteriver Hospital or possibly that Eersteriver Hospital has a more ill population presenting to the hospital.

The Western Cape Provincial health department's tiered hospital referral system recommends that uncomplicated SAM should be treated at a district level hospital while complicated SAM; those with anorexia, pneumonia, fever, dehydration and apathy, should be referred to level two and specialist hospitals. This means the primary care clinics can bypass the district hospitals and refer the severely ill malnourished child directly to the tertiary hospital. This could explain why the sample did not show a high proportion of children who were extremely ill and presenting with danger signs.

Again noted in the current study is the large proportion of patients in whom danger signs were not noted. In 73% of patients no mention was made of pallor, while apathy and acidosis were equally not noted in 22% of patients. This again highlights that the clinicians are possibly not writing their findings even if the findings are negative or that they might not be assessing these signs because they lack training and understanding as to the significant mortality risk that these signs carry in this paediatric sub-population. This is especially a concern since studies consistently find that pallor and shock are significant predictors of death (De Maayer & Saloojee, 2011).

Thorough clinical examination and accurate documentation thereof is important to ensure that correct steps in algorithms are initiated. If clinical best practice is not adhered to it could result in unnecessary morbidity and mortality.

5.6 Treatment and prevention of complications

Results of the current study revealed that the WHO protocol step 5, for prevention and treatment of infection, had the highest frequency of implementation overall through the routine prescription of broad spectrum antibiotics in all patients admitted to hospital with SAM as recommended by the WHO guidelines (WHO, 1999; Ashworth & Burgess, 2003). Eersteriver and Helderberg hospitals started antibiotics in over 94% and 91% of cases, respectively. Stellenbosch adequately managed infections in only 66% of cases. The findings correlate with previous studies done in the Eastern Cape, South Africa and in Kenya where treatment of infections was found to be implemented in 90% of cases (Karaolis *et al*, 2007; Nzioki *et al*, 2009).

In the current study, the second best implemented step was at Eersteriver and Helderberg hospitals for the management of electrolyte imbalance with 84% and 76% implementation respectively. This is step 4 of the WHO protocol that recommends electrolyte levels to be checked and that electrolytes be supplemented routinely (WHO, 1999; Ashworth & Burgess, 2003). Stellenbosch performed poorly with 58% of cases not having electrolytes checked or supplemented. These results differ to a previous study by Nzioki *et al* (2009) which showed modest implementation of fluid balance practices (55%) and correction of electrolyte imbalance (45%). The current study found that hypoglycaemia prevention and feeding practices (Steps 1&7), hypothermia prevention (Step 2) and correction of fluid imbalances (Step 3) were poorly managed at all three institutions in major proportions.

5.6.1 Prevention and treatment of hypoglycaemia (Step 1)

Hypoglycaemia can have dire consequences if not diagnosed thus the WHO protocol recommends regular 4-hourly monitoring of blood glucose levels as well regular feeds to maintain energy stores (WHO,1999). Hypoglycaemia 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). Efficient management of this first step is crucial and has been shown to be effective in reducing case fatality rates (Wilkinson *et al*, 1996).

Documentation of the glucose levels by the doctors as well as orders for glucose monitoring was very poor in the current study. Only 59% of patients in the current study had blood glucose checked on admission and only 30% had monitoring once transferred to the wards. This questions if there were patients that might have had hypoglycaemic episodes that had gone undiagnosed. Furthermore, it is concerning that 5 cases of hypoglycaemia were not noted by the staff and the one case that was noted was incorrectly treated.

These results show a lack of awareness, by the doctors and nurses, of the high risk for hypoglycaemia in severely malnourished since hypoglycaemia was also found to be common in most other studies (Ahmed *et al*, 1999; Deen *et al*, 2003, Puoane *et al*, 2001).

5.6.1.1 Cautious feeding (Step 7)

Two to three hourly feeds are important in the prevention and treatment of hypoglycaemia. WHO recommends in step 7 that attention be given to the specified composition of energy-rich, low protein, low solute milk formulas and that the volumes be restricted initially and increased incrementally after 2 to 3 days (WHO, 1999, Ashworth & Burgess, 2003).

Review of feeding practices in the current study shows that little attention to detail is given to this step. Feeding orders were not well documented. When orders were written, the frequency of feeds was not clearly defined while the type and volume of feeds were incorrect in a large proportion of the patients. A study in South Africa showed similar findings of poor knowledge of health workers relating to feeding practices since regular milk formulas and soft diets was prescribed simultaneously for some children (Mogomotsi, 2008).

Early initiation of feeds and regular feeds is pivotal to hypoglycaemia prevention in SAM. The current study shows prolonged times to initiation of feeds. The first record of feeding was only detailed by nurses once the patient arrived in the ward.

Given the long waits and the unavailability of feeds in busy hospital emergency centres, these children are at risk of deterioration in their condition while waiting to be examined or transferred to the wards. It is possible that some children ate or were breastfed but that the times of the feeds were not recorded accurately. This still raises the concern that the importance of early initiation of feeding is poorly understood and especially since gauging the child's ability to feed is part of the initial assessment of the malnourished child and gives an indication of the severity of the child's condition (Maitland *et al*, 2006; Lapidus *et al*, 2009).

Doctors in the current study did not comment on the adequacy of feeds recorded nor were the feeds adjusted as the patients progressed to the rehabilitation phase. This correlates with a previous study in which Karaolis *et al* (2007) stated that doctors were generally not involved in decisions concerning feeding. This previous study also found that children were given incorrect foods or that insufficient intake went unnoticed since carers were responsible for dispensing feeds and were unsupervised while doing so.

Lack of knowledge by the staff means that they are less empowered to communicate effectively with parents to educate the parents as to feeding practices. The outcome is ultimately a negative impact on the physical condition of the malnourished child.

5.6.2 Prevention and treatment of hypothermia (Step 2)

Despite the WHO recommendation that temperature monitoring be done 4-hourly throughout a 24-hour day (WHO, 1999), the current study showed poor practices by doctors in specifying 4-hourly temperature checks in the written orders and highlights possible paucity in doctors' knowledge of temperature monitoring and prevention steps. Temperature monitoring was left to be done according to the nursing routine where temperature checks are done three times on a dayshift and once during the night. No temperature monitoring for 12 hours at night means that

cases of hypothermia could have been missed. Doctors did not note the temperature readings resulting in the 15 cases of hypothermia in the ward not being treated actively.

A previous South African study reported similar findings of poor identification and treatment of hypothermia, with temperatures not being checked routinely and sometimes records even being contrived (Karaolis *et al*, 2007). Such practices are not acceptable since some studies showed that preventing hypothermia is an easily implementable step (Ashworth *et al*, 2004; Deen *et al*, 2003).

5.6.3 Prevention and treatment of fluid imbalance (Step 3)

The WHO guidelines recommend that children with SAM presenting with dehydration be rehydrated more slowly than usual and that intravenous fluids be reserved for patients presenting in hypovolaemic shock and that these children be monitored closely for overhydration (WHO, 1999).

In the current study, 33 patients were assessed as being dehydrated and yet 34 patients (41%) received intravenous fluids. The obvious incorrect prescription of intravenous fluids in the current study indicates poor knowledge of step 3 in the protocol by clinicians at the hospitals reviewed. Several studies have indicated a high case fatality rate due to infusion of fluids in children who are not severely dehydrated (Ashworth *et al*, 2004, Bachou *et al*, 2006). Case-fatality rates linked to patients receiving intravenous fluids and blood transfusions were shown to be reduced after the implementation of the WHO protocol in previous studies and demonstrated that severely malnourished children need extremely precise protocol management to ensure survival (Bachou *et al*, 2008). A study in Uganda found excessive use of intravenous fluids and blood transfusions at proportions of 27% and 18% respectively, before implementation of the WHO guidelines, which were reduced to 9% and 3.5% respectively, after implementation of the protocol (Bachou *et al*, 2008).

According to details in the folders reviewed in the current study, only 7 patients, who suffered from shock, qualified for intravenous fluid replacement.

This corroborates the finding that a large proportion of patients assessed with dehydration should not have received intravenous fluids and specifically not the one child who was not even assessed as dehydrated. The adequacy of the fluid volumes could not be thoroughly interrogated since fluid calculations were not always clear nor was the severity of the dehydration always outlined in the notes.

It is worrying that 53% of patients in the current study were noted to have diarrhoea but that the hydration status was noted in the daily notes in only 37% of cases. The poor practice of not checking or recording the hydration status routinely could be a factor that contributed to 13 patients developing dehydration and one patient being overhydrated while in the wards. The recording of clinical signs of perfusion, pulse rate and respiratory rates, which give warning that overhydration may be developing, was poor. The patient that suffered overhydration was one that initially was not assessed as being dehydrated but still received intravenous fluids. That more patients in the current study did not suffer fluid overload is fortunate and possibly due to incorrect fluid calculations where too little fluid was prescribed. However, this vital step was not implemented correctly in a large proportion of the sample. This confirms an unacceptably low level of fluid monitoring revealed in the current study.

A study by Nzioki *et al* (2009) suggested that factors resulting in the poor management of dehydration could be due to lack of knowledge about the dangers of overhydration and also shortages of nursing staff. Some studies raised related concerns regarding the mismanagement of dehydration in SAM by observing that doctors' prescriptions of intravenous rehydration were unclear, nursing record of fluid input was poor and that monitoring of pulse and respiration rates to avoid fluid overload was never done (Karaolis *et al*, 2007). A frequently overlooked perspective is that the carers are often made responsible for giving oral rehydration but without guidance about volume and frequency and that carers

often failed to report ongoing fluid losses and so children in danger of dehydration are rarely identified as a result (Karaolis *et al*, 2007).

5.6.3.1 Blood transfusion practices

Unnecessary blood transfusions place children at risk of fluid overload as well. No patients in the current study received a blood transfusion as none qualified according to the WHO protocol recommendation in step 3 that only patients with a haemoglobin reading of less than 4g/dl be transfused (WHO, 1999).

Eleven percent of patients did not have haemoglobin checked at all while 73% did not have pallor mentioned. Eight of the nine patients that did not have a haemoglobin checked, also lacked any entries relating to pallor while one patient was described as having pallor but had no haemoglobin checked. This highlights that clinicians are not cross-checking their examination findings with laboratory tests so patients in need of treatment interventions could be missed; even if this proportion is small.

5.6.4 Prevention and treatment of electrolyte imbalance (Step 4)

A previous study found that electrolyte imbalance, and especially hypokalaemia, to be among the common causes of death in severely malnourished children (Ashworth *et al*, 2004). All severely malnourished children have potassium, magnesium and phosphate deficiencies that adversely affect a number of metabolic functions hence the routine supplementation of these electrolytes is recommended (Ashworth & Burgess, 2003).

In the current study, hypokalaemia and hyponatraemia were the two most common imbalances on admission and in the ward. Not all patients had laboratory investigations to exclude electrolyte derangements. Heikens (2007) states that where electrolyte monitoring and blood gas monitoring is possible, the assessment and treatment of metabolic changes will promote a more favourable outcome in these patients. This statement is substantiated in the current study because, of the

patients that did have electrolytes checked in the wards, abnormal results still persisted that could have been remedied.

The current study showed supplementation with potassium and magnesium in two-thirds and 12% of the sample, respectively. This is not acceptable since potassium should be routinely prescribed as some studies found supplementing with potassium and magnesium to be easily implementable (Deen *et al*, 2003; Ashworth *et al*, 2004). Some studies found potassium was available in the hospitals but it was not prescribed by doctors or that doctors made errors in calculating doses (Karaolis *et al*, 2007).

A concern is that the one patient had hyperkalaemia and still received potassium supplementation and that the potassium level was not rechecked before this individual patient was discharged. It is also concerning that doctors did not recheck electrolytes on 13% of patients with proven derangements or that derangements were not proven to be corrected by the time patients were discharged especially when imbalances were shown to persist.

Given that not all patients had electrolytes checked and that only two-thirds received supplementation, it is notable that more patients did not suffer more complications. All the hospitals have easy access to laboratory services so this cannot be a factor that prevents doctors from implementing step 4 to manage electrolyte imbalances.

5.6.5 Prevention and treatment of infections (step 5)

Since children with SAM do not exhibit the usual signs of infection, a high index of suspicion of a bacteraemia needs to be maintained. WHO protocol recommends investigations be done to screen for sepsis if resources are available and that all children with SAM admitted to hospital be given broad-spectrum antibiotics with minimal time delay (WHO, 1999).

Studies show that pneumonia, bacteraemia and urinary tract infections have a high prevalence in children with SAM (Chisti *et al*, 2009). The small proportion of patients in the current study that had septic screening done in the form of chest x-

rays, urine dipsticks and blood cultures, implies that more infections could have gone undiagnosed.

Clinicians in the current study seem to not make full use of all the resources at their disposal given that all three district hospitals have access to x-rays and laboratory investigations to diagnose infections effectively.

Ninety percent of patients in the current study received some form of antibiotic though not all received WHO recommended antibiotic combination. Twenty-seven percent of patients received the recommended combination of IV Ampicillin and Gentamicin, another 22% got broad-spectrum antibiotic cover with IV Ceftriaxone while 30% of patients received oral Amoxicillin. A previous study similarly reported that 90% of children received antibiotics routinely though only half received the WHO recommended combinations due to no supplies or prescribing patterns of doctors (Karaolis *et al*, 2007). This previous study ascribed the incorrect prescriptions to inexperience and lack of training of the doctors. The current study shows that there appears to be poor correlation, by the clinicians, between patients' clinical picture, the use of investigations and administration of antibiotics. The reason for this is one patient in the current study without any fever that was kept on antibiotics for an extended period while there was another patient who had a fever but did not receive any antibiotics and neither was the source of the fever investigated.

In the current study, the protracted time periods shown to when patients received the first dose of antibiotic speaks again to the need for improved communication between doctors and nurses as regards the orders and the need to change nursing routines that do not take into consideration the fact that children with SAM need special attention and that delays in initiation of treatment need to be minimised. Mogomotsi (2008) also alluded to health workers not strictly adhering to antibiotic regimens and dosing schedules which ultimately compromises effectiveness of the treatment.

A previous study in Nairobi advocated that a blood culture should be included in the initial septic screening of severely malnourished children, irrespective of the

presence of fever, given that nearly a third of the patients in this previous study were found to have bacteraemia (Noorani *et al*, 2005).

Given that only 11% of patients in the current study were diagnosed with sepsis, it again raises the concern that a proportion of cases of bacteraemia especially since only a third of patients spiking a temperature had a blood culture done to exclude bacteraemia.

Another concern is the practice where a proportion of patients did have investigations ordered but no results of the investigations were followed up or recorded in the notes meaning that infections could go undiagnosed and untreated.

5.6.5.1 Diagnosing and treating Tuberculosis

Tuberculosis ranks high with other infections in adding to mortality rates in children in South Africa and is fuelling the malnutrition epidemic (Sanders *et al*, 2010). Thus it would be good practice for clinicians to have a high index of suspicion for TB co-infection in children presenting to hospital with SAM. In the current study 84% of the sample was investigated for TB.

A total of 28% of the sample was diagnosed to have TB with 24% of the patients being diagnosed with TB during the hospital admission. The practice of not following up or recording results of investigations, in the current study, was also noticeable in TB investigations. In some cases, written records of the Mantoux skin test and gastric washings results were missing in the folder. There was no evidence in the folders that the patients were discharged with referral to local TB clinics for follow-up of results.

A previous South African study found that TB was frequently suspected but seldom proven with Mantoux skin tests or microbiologically (De Maayer & Saloojee, 2011). The authors of this previous study acknowledged the challenge in diagnosing TB in malnourished and HIV positive children since the skin tests are falsely negative resulting in heavy reliance on clinical experience and chest x-rays resulting in a significant proportion of patients started on empirical TB treatment.

The authors argue that this overzealous treatment of TB is justifiable given the enormous TB epidemic in South Africa and that the true incidence of TB in this sub-population of children is unclear (De Maayer & Saloojee, 2011).

5.6.5.2 Diagnosing HIV infections

Children with SAM who are HIV-infected have a higher associated mortality risk since these children present in worse clinical condition (Kessler *et al*, 2000; Chinkhumba *et al*, 2008; De Maayer & Saloojee, 2011). Sanders *et al* (2010) cited a Statistics South Africa report for 2009 that showed that the vast majority of children with severe malnutrition who died in South Africa were also HIV infected.

In the current study, the 6 patients that were known to be HIV-infected plus the additional 5 patients were diagnosed with HIV during their hospital stay gives a total of 13% of patients that were HIV positive. It is concerning that one patient had a HIV test where the result was not recorded and that 24% of the patients were not offered any HIV testing which creates opportunity for missed diagnosis and treatment. It is unacceptable that the health system should fail the patients in this way especially since highly active antiretroviral therapy (HAART) is available. A possible missed diagnosis of HIV, as an underlying secondary cause for malnutrition which can be stabilised, will result in a poor outcome for a patient. Early diagnosis of HIV and initiation of HAART serve as preventative measures against development of malnutrition and reducing mortality in these children (Chinkhumba *et al*, 2008; Heikens, 2007).

The issue of poor diagnostic practices surrounding HIV in children was raised in a previous South African study where results showed that half of the HIV positive children only got their HIV status diagnosed on admission to hospital for SAM (De Maayer & Saloojee, 2011). The authors found that since HIV infected children are more likely to suffer from Marasmus than Kwashiorkor this results in marasmic children having a worse early prognosis in high HIV prevalent settings.

A previous study in the Western Cape found an HIV prevalence of 18% and the authors commented that HIV infection may be contributing to the continued high incidence of malnutrition recorded and increases the demand for hospital based treatment since these HIV-infected patients present in poor clinical conditions (Marino *et al*, 2006). The authors emphasised that issues surrounding food security and poverty and HIV treatment need to be addressed to tackle the bigger problem of malnutrition.

5.6.6 Correction of micronutrient deficiencies (Step 6)

Step 6 of the WHO protocol recommends that micronutrient deficiencies of Vitamin A, zinc, copper, folic acid and multivitamins be corrected in order to aid tissue repair and restore immunity. Iron is to be given in the rehabilitation phase (Ashworth & Burgess, 2003).

Multivitamin syrup was prescribed in 82% while micronutrients were prescribed in just over 70%. The researcher's personal observation is that the prescription of zinc and Vitamin A may be linked to the treatment of diarrhoea as well as Vitamin A and measles local health campaigns during the time period of the admissions rather than specifically linked to the WHO protocol.

Doctors lacked insight into the prescription of iron supplementation and especially the possible negative impact that early prescription of iron would have on the 7% that had received iron immediately on admission. Seventy-three percent of the sample was not given iron on discharge. These findings are comparable with findings of a previous study in North -West province South Africa, where some children were given iron in the stabilisation phase while no children received iron in the rehabilitation phase which emphasises the lack of knowledge of the importance of the need for iron therapy to aid growth during recovery (Mogomotsi, 2008).

5.7 Final outcome at the end of initial hospital stay

For children admitted with weight-for-height measuring below -3 z-score, as defined by the WHO standards, a discharge measurement at -2 z-score and at -1 z-score corresponds on average to a weight gain of 9% and 19% respectively (WHO, 2009). For children with oedema, the same discharge criterion should be applied using the weight after oedema has disappeared as the baseline. However, for children who have a weight-for-height above -3 z-score or a MUAC above 115 mm once they are free from oedema then a discharge two weeks after the disappearance of oedema is usually sufficient to prevent relapse. The evidence for these discharge criteria is based on the association shown that children with weight-for-height above -2 and below -1 z-score have a lower mortality risk than those below -3 z-score (WHO, 2009).

In the current study, most of the patients (81%) were discharged home or into care homes. The length of stay was excessive in some patients due to children waiting for social placements rather than solely slow resolution of clinical issues.

It is concerning that children in the current study were discharged based on resolution of the acute problem rather than based on weight gain measurements or even the child's ability to eat. There was not regular weight monitoring done in the majority of the children. Children were discharged without having met the WHO growth standards guidelines and some were even discharged having shown no weight gain or having lost weight. This is a real injustice to an already vulnerable child resulting from doctors and staff not appreciating the holistic approach needed to manage the child with SAM as outlined by the WHO guidelines. A study by Mogomotsi (2008) found that almost all children admitted at a Mafikeng Hospital, for treatment of SAM, were readmissions who had been discharged with very low weights. The author states that reasons patients are relapsing may be due to the fact that children were discharged while they were not yet fully recovered.

Reasons for premature discharge may be poor understanding of the WHO criteria for discharge or shortage of beds causing doctors to discharge as soon as a patient's acute problems are stabilised (Mogomotsi, 2008). The author highlighted that there is need for rehabilitation centres where these children could be referred to until they reach a satisfactory weight gain to decrease the length of stay at acute hospitals and so alleviate the bed pressure at district hospitals.

In the current study, 16% of patients were transferred to the referral specialist hospital. The main reason for referral was deterioration in a child's condition. Some of the diagnoses on transfer were the identified complications associated with SAM. These included sepsis, dehydration and electrolyte imbalance. This poses the question whether proper implementation of the WHO Ten steps could have possibly mitigated the need to transfer those children given that some of the complications would have been treated and avoided if proper management was initiated at admission.

The final outcome of the children transferred to specialist care was not part of this study. However, considering the poor clinical condition of the children, as described in the folders, it is possible that some of the children could have died at the specialist hospital. A future follow-up study would be useful to track the clinical outcomes of children at a specialist hospital after having been transferred from a district hospital and whether appropriate initial management of the children could have been improved to prevent the transfer.

In the current study, the majority of patients requiring transfer were classified as Kwashiorkor. Due to limitations in the sampling methods, as well as the possibility of misclassification bias, this finding might be due to chance. Some studies do show that children with Kwashiorkor do present with more severe clinical conditions and have higher associated mortality rates than malnourished children without oedema which might warrant their transfer (Sunguya *et al*, 2006).

5.8 Factors impeding best practice

The reasons and rate of referral to a specialist hospital would be influenced not only by the clinical severity of the patients' condition but the experience and confidence level of the consulting clinician together with the availability of resources at a specific district hospital. The retrospective design of the current study precludes the chance to evaluate these factors. The retrospective design also means that the current study cannot elaborate on the training of the individual doctors. However, the fact that treatment practices were poor across all three hospitals brings into question which factors would impact significantly on doctors not adhering to best practice.

Some studies found that such factors could include staff shortages, patient case loads, training and experience, lack of senior supervision and access to investigations (Puoane *et al*, 2004; Ashworth *et al*, 2004, Karaolis *et al*, 2007). Karaolis *et al* (2007) when evaluating constraints to implementation of WHO guidelines in hospitals in the Eastern Cape concluded some factors to be rapid staff turnover, doctors' poor knowledge, nurses' inattentiveness, poor communication among staff as well as between nurses and carers. Future prospective studies at the hospitals reviewed in the current study would be useful to determine if similar factors are present.

That the sample in the current study did not have deaths represented or children with more severe clinical conditions needing transfer might be due to the current Western Cape provincial three-tiered hospital system that recommends that complicated cases of SAM to be referred to specialist units. This referral process favours a better outcome for the patient who reaches an institution with adequate infrastructure and experienced staff to initiate appropriate management without minimal delay. This does imply that the junior staff at district level therefore do not get much exposure to treating SAM because of existing specialist support in the greater Cape Town area.

This, however, reiterates that the training of doctors needs to provide a solid foundation for when these same doctors are deployed to more rural settings in South Africa where they will be the first point of call for treatment of these severely ill children without any senior or specialist supervision.



CHAPTER 6

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

This study has revealed poor management of severe malnutrition in all three district hospitals. The extent to which the WHO Ten Steps were implemented was of a poor standard overall. A review of folders revealed that doctors and nurses have poor understanding of malnutrition as a disease entity and lack knowledge of the importance of adhering to the framework of best practices that the WHO guidelines provide in order to minimise the morbidity and mortality suffered by the child admitted with severe acute malnutrition.

The results showed poor practices by the clinicians that need to be remedied. The documentation in the folders by the clinicians was not thorough regarding the initial identification of malnutrition nor was the assessment and description of the clinical condition of patients. This implies that the prompt to initiate the treatment protocol for severe malnutrition is absent which means that the guidelines are consequently not followed, resulting in poor monitoring and incomplete treatment interventions and failure to act when complications arise.

The clinicians focussed on the acute problems and do not regard malnutrition as the main disease entity. Future studies should be done to assess whether factors such as lack of resources, lack of training or experience, staffing numbers and staff motivation play a role in the poor implementation of the WHO protocol in treating children admitted to hospital with malnutrition.

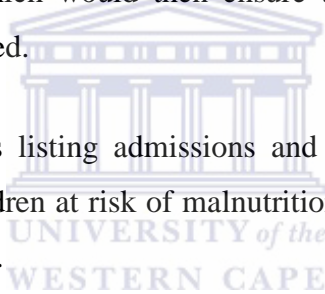
The call for continuous auditing of clinical practices still remains to assess adequate dissemination of knowledge and effectiveness of implementation of the WHO Ten Steps protocol in treating severe acute malnutrition.

6.2 Recommendations

- Provincial nutritional directorate should energetically disseminate of guidelines on treating malnutrition to all hospitals.
- Provincial nutritional directorate should continuously monitor and evaluate the implementation of the guidelines and monitor related case – fatality rates at hospitals.
- Emphasise training on treatment of severe malnutrition in undergraduate curricula of doctors and nurses.
- Annual provincial wide refresher training courses to be offered. Consideration should given to having an annual campaign/ drive as with other health programmes.
- Continuous professional development sessions (formal and informal) at hospitals.
- Distribution of posters and educational materials outlining the “Ten Steps”.
- Distribution of educational materials for mothers explaining in-hospital care.
- Clinical staff to do regular clinical audits at hospital and provide feedback sessions.
- Strengthen growth monitoring programme for early identification of children malnourished or at risk thereof through training of community health workers to be able to identify severe malnutrition by anthropometric assessment which includes the use of MUAC tapes and improved growth

monitoring at health facilities by doctors routinely checking the growth chart of every child presenting to hospital.

- Development of standardised stationery for malnourished children which would contain graphs and guides on correct case definitions, identification of danger signs and which prompts doctors toward proper investigations and treatment interventions.
- Standardised stationery to record monitoring and nursing records in the malnourished child which prompt nurses when to feed children and the monitoring and treatment of glucose, temperature and signs of overhydration which would then ensure the changes to the usual ward routine are initiated.
- Hospital registers listing admissions and readmissions of malnourished children and children at risk of malnutrition and steps taken for follow-up and rehabilitation.



CHAPTER 7

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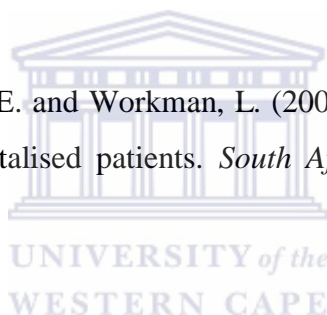
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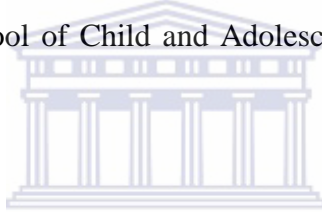
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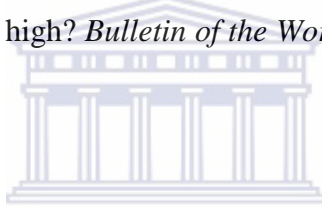
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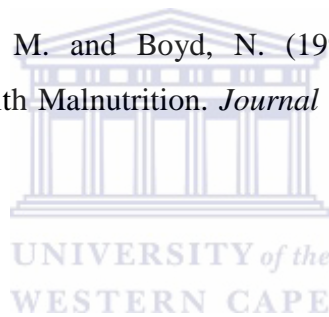
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APPENDIX 1: INFORMATION SHEET



UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa

Tel: +27 21-959, Fax: 27 21-959

INFORMATION SHEET

Dear Medical Superintendent

Thank you for your willingness to be informed about the research study and your institution's potential involvement as outlined below. I, Dr. Adele Anthony, am conducting this research study for a mini-thesis as a partial requirement for the Masters in Public Health degree at the University of Western Cape. The study will assess hospital management of children with severe malnutrition at your institution, Stellenbosch Hospital, as well as Helderberg and Eersteriver Hospitals.

Project Title

Assessment of clinical management in children admitted with severe acute malnutrition in three District hospitals, in the Western Cape, South Africa.

Purpose of study

Malnutrition is recognised globally as one of the biggest contributors to childhood illness and mortality. Worldwide research have shown that persistently high case-fatality rates in severe acute malnutrition are likely due to faulty case management and weaknesses in health systems. The proposed research, through a retrospective folder review, aims to assess the complication rates for children with severe acute malnutrition admitted to Stellenbosch, Eersteriver and Helderberg Hospitals .

The study aims to evaluate how these rates relate to clinical management practices and compare these practices to standards advocated by the World Health Organisation (WHO) recommendations for management of severe acute malnutrition.

The Western Cape Provincial Nutrition Directorate is proposing a protocol, in line with the Annual Performance Plan for Western Cape for 2011/2012, to implement the WHO 10 Steps within the Western Cape so as to improve inpatient care of severely malnourished children. Careful planning is needed to implement these steps. Hilary Goeiman, deputy director for Integrated Nutrition Programme (INP), in the directorate for Comprehensive Health Programmes, Western Cape, identified the need to obtain accurate baseline statistics specifically in the four substructures of the Western Cape Province Metropole. This study will provide a situational analysis of the current practices in the district hospitals.

Description of study and your involvement

The proposed study is a retrospective folder review of the clinical management and complication rates of children admitted with severe acute malnutrition to Stellenbosch, Eersteriver and Helderberg Hospitals. You are kindly requested to allow access to the clinical records in the registry of children discharged from Stellenbosch Hospital following treatment for severe acute malnutrition.

Selection of folders will start from the folders of children admitted 01 December 2009 to December 2010. The total amount of folders required will be 32. Folders of admissions earlier than December 2009 will be accessed if this number is not realised in the yearly timeframe. Only the principal investigator and one research assistant will be involved in recording the data onto data sheets. This process is expected to take 3-5 days, with minimal interference in the daily routine of the registry.

Confidentiality

We will do our best to ensure that confidentiality of all information obtained from the clinical records is upheld. The privacy of the patients' clinical information is preserved through use of coding.

No information identifying the patient or attending medical staff will be on the research record. The principal investigator will keep a control list of names, folder numbers and codes on a password-protected computer database separate from the research data. All information collected will only be used by the principal investigator, one research assistant, thesis supervisor and statistician. No folders or copies of these will be removed from the hospital premises. If we write a report or article about this research project, the identity of patients and hospital staff will not be revealed at any point.

Risks

There are no known risks associated with participating in this research project. There will be no costs incurred to you or your institution for participating on the study. The dignity, privacy and reputation of the patients, hospital staff and your institution as a whole will be upheld at all time through the maintaining of confidentiality of the clinical information.

Benefits

This research is not designed to impact directly on the patients whose clinical records are being accessed but the results may help Dr. Anthony and the Province's Integrated Nutritional Program, learn more about current management practices and contribute to improvement of care of malnourished children by promoting the implementation of severe acute malnutrition management guidelines and strengthen the evidence base advocating the wider implementation of the WHO guidelines and training of medical staff. This will benefit children admitted with severe acute malnutrition in the future.

Payments

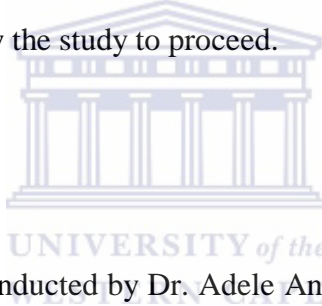
There will be no payment or incentives for participating in the study.

Voluntary Participation and Withdrawal

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

Informed Consent

Signed consent to allow access the clinical records of the hospital is required before research commences. The consent form accompanies this information sheet. The consent form can be reviewed and signed by you following your decision whether to allow the study to proceed.



Questions

This research is being conducted by Dr. Adele Anthony, student in the Masters in Public Health at the School of Public Health at the University of the Western Cape.

If you have any queries about the research study, more information may be obtained from Dr. Adele Anthony.

Contact details

Cell phone: 072 111 2655

Email: adeleanthony@gmail.com

Telephone: 021 982 3150 (h)/ 021 370 3700 (w)

Fax: 021 372 5158

You may also contact the student thesis supervisor, Prof. Thandi Puoane

Contact details: 0827075881/ 021 788 7209 **Email:** tpuoane@uwc.ac.za.

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

Head of Department:

Dean of the Faculty of Community and Health Sciences:

University of the Western Cape

Private Bag X17

Bellville 7535



This research has been approved by the University of the Western Cape's Senate Research Committee and Ethics Committee.

If you agree to the study to be undertaken at your hospital please sign the attached consent form.

Thanking you.

Dr. Adele Anthony

APPENDIX 2: CONSENT FORM



UNIVERSITY OF THE WESTERN CAPE

*Private Bag X 17, Bellville 7535, South Africa
Tel: +27 21-959, Fax: 27 21-959*

CONSENT FORM

I,....., Medical Superintendent ofHospital, have been approached to approve the undertaking of the research study “**Assessment of clinical management of severely malnourished children admitted to three selected district hospitals in the Western Cape, South Africa.**”, by Dr. Adele Anthony, Masters in Public Health student at University of Western Cape.

The study, in terms of the nature, scope, purpose, anticipated benefits and disadvantages of the proposed research project, has been described to me on an information sheet in language that I understand.

I understand that my agreement to participate is given freely and voluntarily, without undue influence or perverse incentives. My questions about the study have been answered. The procedures to be used to ensure confidentiality have been explained to me and I fully understand them.

I understand that I may withdraw from the study without giving a reason at any time and this will not negatively affect me in any way.

I, hereby, give my permission for this study to proceed.

Participant's name.....

Participant's signature.....

Date.....

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

Study Coordinator's Name: Dr. Adele Anthony

Student number 2827222

University of the Western Cape, School of Public Health

Private Bag X17, Belville 7535

Telephone: (021) 982 3150 (H)

(021) 370 3700(w)

Cell: 072 111 2655

Fax: (021)372 5158

Email: adeleanthony@gmail.com

I am accountable to Prof. Thandi Puoane, my supervisor.

Her contact details are 0827075881/ 021 788 7209. Or email:
tpuoane@uwc.ac.za.



APPENDIX 3: DATA COLLECTION TOOL

Demographic Information		Comments
Hospital name		
Research number		
Age		
Gender		
Date of admission		
Previous admissions Y/N		
Previous admissions related to malnutrition Y /N/n/a		
Score out of 5 in exposure to all 5 adequate mx criteria		
On Admission		
Weight (kg)/not recorded		
Height/ length (cm)/ not recorded		
MUAC(cm)/ not recorded		
Classification of Malnutrition: Marasmus(1), Marasmic-Kwash (2), Kwashiokhor (3), other (underweight, FTT, PEM)(4), not described (5)		
Oedema (Y/N/ not noted)		
Severity of oedema: 1+(1), 2+(2), 3+(3), 4+(4) not noted (5), Not applicable (6)		
Comorbidity: Diarrhoea=1, Pneumonia=2, TB=3, HIV=4, Sepsis=5, Other (6, specify), Nil on admission (7)		
Weight plotted on growth chart Y/N		
Height plotted on growth chart Y/N		
If no oedema: Weight plotting below -3z scores or 60% of expected weight Y/N/n/a		
If Oedema : weight plotting between 60-80% of expected weight for age? Y/N/n/a		
Clinical signs on admission		
Pallor Y/N/ not noted		
Apathy Y/N/ not noted		
Fever, T> 38.5 degrees celcius Y/N		
Hypothermia T< 35 (Axillary)(if rectal < 35.5) Y/N		
Acidotic Y/N/ not checked or noted		
Respiratory distress Y/N/ not noted		
Dehydrated Y/N/ not noted		
Severity of dehydration: 5%=1, 5-10%=2, 10%=3, shocked= 4, not applicable (5)/ not specified(6)		

(Data collection tool continued)

Management		
Were electrolytes checked Y/N		
Which electrolytes: Na(1), K(2), Mg(3), PO4 (4)		
Were any abnormal Y/N/n/a		
If yes : Which were abnormal: Low Na (1), High Na (2), Low K (3), High K (4), Low Mg (5), High Mg (6), Low PO4(7), High PO4 (7), Not applicable(8)		
Was blood glucose checked on admission Y/N/ No record found		
Was the blood glucose normal Y/N		
Actual reading of blood glucose		
Was blood culture done on admission Y/N		
Results of blood culture		
Was urine dipstix done on admission Y/N		
If urine dipstix done :normal (1), abnormal(2)		
If abnormal:Was urine culture done ? Y/N		
Results of urine culture		
Was CXR done on admission Y/N		
CXR appearance: normal(1), abnormal (2), not recorded(3)		



(Data collection tool continued)

Adequate Management Criteria		
Hospital Name		
Research number		
Hypothermia		
Did the dr note temperature recorded on admission Y/N		
Did Doctor order temperature to be checked 4hrly? Y/N		
If no : what hrly order was given/ no instruction given.		
Was Temp < 35 Axillary, (35.5 (Rectal) Y/N		
Did the doctor note the temp in notes 4hrly ? Y/N		
Did the dr note if temp went Hypothermic? Y/N/ N/A		
Fluid Balance		
Was hydration status noted on admission? Y/N		
Was pt assessed as dehydrated on admission Y/N/ not noted		
If Yes; Signs of dehydration outlined: Sunken eyes(1), sunken fontanelle(2), decreased skin turgor(3), dry mouth(4), no tears(5), cool feet(6), poor pulses(7), CFT<3S(8)		
Severity of dehydration noted: 5%=1, 5-10%=2, 10%=3, shocked= 4, not outlined (5)		
If Dehydrated:		
IV Fluids administered Y/N/ n/a		
IV Fluids indicated Y/N/ n/a/not clear		
How many mls/kg given: 5-10ml/kg/hr or 70-100 ml/kg/12hrs		
? Appropriate amount? Y/N		
If no : Was the amt too little=1, too much=2		
Was the amount of fluid clearly calculated /prescribed by the doctor Y/N		

Hypoglycaemia		
Was glc checked on admission Y/N		
Hypoglycaemia on admission. Glc<4 mmol Y/N		
What was the initial glc / no record		
Did the dr note the visidex in notes? Y/N		
If hypoglyc: Treated with 10% Glc orally if awake , if indicated? Y/N/ NA		
If unconcious via NGT Y/N/NA		
Was the initial time of feeding recorded Y/N		
How many minutes or hrs after admissions were feeds started/ recorded for first time?		
Did the dr prescribe Glc checks 4hrly Y/N		
If no: what was the order if any?/ no request		
Did the dr initially prescribe feeds every 2hrs Y/N		
If no: what was the order if any?/ no request		
What feed was prescribed initially?		
What volume of feed was prescribed?		
Was appropriate volume of 130ml/kg/d (or 100ml/kg/d if oedematous) Y/N		
Electrolyte Imbalances		
Were K=1, Mg=2, PO4=3, Other=4 given		
Were electrolytes checked Y/N		
Was Potassium HypoK (1) /HyperK (2)/Normal (3)/ not checked (4)		
If Potassium was abn: was appropriate therapy done to correct Y/N/ n/a		
Was Sodium HypoNa (1)/HyperNa (2)/Normal (3)/ not checked (4)		
If Sodium was abn: was appropriate therapy done to correct Y/N/ n/a		
Was Mg HypoMg (1)/ HyperMg (2)/Normal (3)/Not checked (4)		
If Mg was abn: was appropriate therapy done to correct Y/N/ n/a		
Was PO4 Hypophos (1)/ Hyperphos (2)/Normal (3)/not checked (4)		
If PO4 was abn: was appropriate therapy done to correct Y/N/ n/a		
Infection		
Were antibiotics prescribed on admission? Y/N		
Oral or IV : O=1. IV=2, Both=3		
Type of antibiotic: Ampicillin=1, Gentamycin=2, Ceftriaxone=3, Metronidazole=4, Other=5(name the abx)		
When was the first dose given?		
For how long were initial prescribed antibiotics administered?		
How many had been prescribed: MVT=1, Folic acid=2, Zinc=3, Trace elements=4, Vitamin A=5, Albendazole=6		
Was FeSO4 prescribed on admission? Y/N		
On what day after admission was FeSO4 prescribed?/ never		

(Data collection tool continued)

Part II: Outcomes and complications		
Demographic information		
Hospital name		
Research number		
Age		
Gender		
Hypoglycaemia		
Was there episode (s) of hypoglycemia/ Y/N		
If yes: Number of days to complication		
Was appropriate therapy done to correct hypoglycemia if present? Y/N		
Were 4hrly glc checks done? Y/N		
When were Glc checks stopped?		
Did the doctors record the glc reading in notes Y/N		
Were 2-3 hrly feeds done Y/N/ time not recorded		
Did drs record adequate feeds? Y/N		
Anaemia		
Hb<5g/dl on admission Y/N		
What was the Hb?		
Received blood transfusion Y/N		
What was the Hb at time of transfusion		
When was Transfusion done?		
If received transfusion: were there complications		
Day to complication after blood transfusion		
Infection		
Fever Y/N		
No. of days to complication/ n/a		
Type of infection : Pneumonia=1, Sepsis=2, UTI=3, Thrombophlebitis=4		
Was TB suspected Y/N		
Was TB diagnosed Y/N		
Was TB treatment started Y/N		
Was blood culture done for each event of fever? Y/N		
When was blood culture done?		
Growth on blood culture Y/N/not recorded		
On what day was result available?		
Organism on blood culture recorded?		
Sensitivity on blood culture recorded?		
Antibiotics changed accordingly? Y/N/na		
On which day was abx changed?		
To which abx was it changed?		

Was urine culture done Y/N		
When was urine culture done		
Growth on urine culture Y/N/N.A/ not recorded		
On what day was result available?		
Organism on urine culture recorded?		
Sensitivity on urine culture recorded? Y/N		
Antibiotics changed accordingly? Y/N/na		
On which day was abx changed?		
To which abx was it changed?		
Was CXR done Y/N		
Result of CXR: Normal=1, Abnormal=2		
Was Mantoux done Y/N		
Result of Mantoux: Reactive=1, Nonreactive=2, Unknown=3		
Gastric washing done Y/N		
Gastric washing result Pos=1, Neg=2, not recorded=3, N/A=4		
HIV test done during admission (1)/HIV status known (2)/ HIV status acc to mother (3)/ no test done (4)		
HIV result Pos (1), Neg (2), Not recorded (3)/ status not known (4)		
Hypothermia		
Was temp checked 4hrly?		
If not how often?		
No. Of days to complication		
Was hypothermia present on temp chart? Y/N		
Did the doctor note the various episodes of hypothermia in the notes Y/N		
If hypothermia present was treatment action recorded Y/N		
Was the temp checked half hourly when hypothermic until more than 36 degrees Y/N		
Electrolyte imbalances		
Was there a K Imbalance Y/N		
Was the K Hypo=1, Hyper=2		
No, of days to complication		
Corrected Y/N/ not rechecked		
What action was taken		
No. of days to correct complication		
Was there a Na Imbalance Y/N		
Was the Na Hypo=1, Hyper=2		
No, of days to complication		
Corrected Y/N/ not rechecked		
Action taken to correct		
No. of days to correct complication		
Was there a Mg Imbalance Y/N		
Was the Mg Hypo=1, Hyper=2		
No, of days to complication		
Corrected Y/N/ not rechecked		
Action taken to correct		
No. of days to correct complication		
Was there a PO4 Imbalance Y/N		
Was the PO4 Hypo=1, Hyper=2		
No, of days to complication		
Corrected Y/N/ not rechecked		
Action taken to correct		
No. of days to correct complication		

Dehydration		
Presence of diarrhoea Y/N		
No. of days to dehydration / on admission		
If Yes; Signs of dehydration outlined: Sunken eyes(1), sunken fontanelle(2), decreased skin turgor(3), dry mouth(4), no tears(5), cool feet(6), poor pulses(7), CFT<3S(8)		
How long before dehydration was resolved according to drs notes		
Loose stool / losses recorded? Y/N/n.a		
ORS given after each stool Y/N/n/a		
Severity of dehydration:<5%=1, 5- 10%=2,,10%=3, Shocked=4		
Input and output recorded Y/N		
Hydration status noted on each examination		
Were signs of dehydration recorded Y/N		
Perfusion status noted on each examination Y/N		
Was pulse rate noted on each examination Y/N		
Was respiratory rate noted on each examination Y/N		
Type of fluids prescribed Half Darrow's=1, N/Saline=2, 5% Dextrose=3, Other=4(specify)		
How many mls/kg given: 5-10ml/kg/hr or 70-100 ml/kg/12hrs		
Type of fluids IV=1, NGT=2, Oral=3		
No. Of days to complication in fluid status		
Overhydration=1 or dehydration=2		
Cardiac Failure Y/N		
cause : Anaemia=1, Blood transfusion=2, IV fluids=3		
No. of days to complication		
Outcome		
No. of days to death		
Is death attributable to comorbidity or complication i.e was there an immediate completion on day of death?		
No. of days to discharge		
Lost to follow-up Y/N/NA; Absconded=1, Transfer out=2		
Reason for transfer out		
Wt on Discharge/ transfer out		

APPENDIX 4: ETHICS COMMITTEE LETTER OF APPROVAL

**OFFICE OF THE DEAN
DEPARTMENT OF RESEARCH
DEVELOPMENT**

Private Bag X17, Bellville 7535
South Africa
Telegraph: UNIBELL
Telephone: +27 21 959-2948/2949
Fax: +27 21 959-3170
Website: www.uwc.ac.za

2 November 2010

To Whom It May Concern

I hereby certify that the Senate Research Committee of the University of the Western Cape has approved the methodology and the ethics of the following research project by:
Dr A Anthony (School of Public Health)

Research Project: Assessment of clinical practices of medical doctors with children admitted with severe acute malnutrition in three hospitals in the Western Cape, South Africa

Registration no: 10/9/17


Peter Syster
Manager, Research Development Office
University of the Western Cape



**UNIVERSITY of the
WESTERN CAPE**

A place of quality, a place to grow, from hope to action through knowledge

APPENDIX 5: DEPARTMENT OF HEALTH LETTER OF APPROVAL



DEPARTMENT of HEALTH

Provincial Government of the Western Cape

COMPONENT

healthres@pgwc.gov.za
tel: +27 21 483 9976; fax: +27 21 483 9895
1st Floor, Deneys Reitz House, 8 Riebeeck Street, Cape Town, 8001
www.capegateway.gov.za

REFERENCE: RP 146/2010

ENQUIRIES: Dr N Peer

19 Kannabos Crescent
Vredeloof,
Brackenfell,
7560

For attention: Dr. Adele Anthony

Fax: (021) 372 5158

Re: Assessment of clinical practices of medical doctors managing children admitted with severe acute malnutrition in three District hospitals, in the Western Cape, South Africa.

Thank you for submitting your proposal to undertake the above-mentioned study. We are pleased to inform you that the department has granted you approval for your research. Please contact the following people to assist you with access to the facilities:

Helderberg Hospital	Dr E Erasmus	(021) 850 4704
Eersteriver Hospital	Dr Tim Visser	(021) 902 8001
Stellenbosch Hospital	Dr Richard Davids	(021) 8870310 Ext 267

Kindly ensure that the following are adhered to:

1. Arrangements can be made with managers, providing that normal activities at requested facilities are not interrupted.
2. Researchers, in accessing provincial health facilities, are expressing consent to provide the department with an electronic copy of the final report within six months of completion of research. This can be submitted to the provincial Research Co-ordinator (healthres@pgwc.gov.za).
3. The reference number above should be quoted in all future correspondence.

We look forward to hearing from you.

Yours sincerely

DR J CUPIDO

DEPUTY-DIRECTOR GENERAL

DISTRICT HEALTH SERVICES AND PROGRAMMES

DATE: 14-01-2011

**CC: DR G PEREZ
DR L PHILLIPS**

**DIRECTOR: EASTERN/KHAYELITSHA
DIRECTOR: CAPE WINELANDS DISTRICT**

The Afrikaans or Xhosa version of this document is available on request.

page 1 of 1