The prevalence and impact of malnutrition in hospitalized adult patients in Mbagathi District Hospital, Nairobi – Kenya

by
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DECLARATION

I, the undersigned, hereby declare that the work contained in this thesis is my own work and that I have not previously in its entirety or in part submitted it at any university for a degree.

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ABSTRACT

Introduction: Malnutrition is a public health problem that is affecting both the developed and developing world, and in Africa, little focus has been placed on the presence of malnutrition in hospitalized adults in recent years. Its prevalence among hospitalized patients ranges between 30% and 76%. Malnutrition was first identified by Florence Nightingale in soldiers of war and was first reported by Charles Butterworth in 1974. Both persons identified malnutrition as a problem that was undiagnosed and overlooked in most settings. Most studies conducted in Africa have not highlighted the burden of adult malnutrition within the hospital setting, yet malnutrition is associated with negative treatment outcomes in affected patients. The aim of this study was to determine the prevalence of risk of malnutrition among hospitalized adult patients in Mbagathi District Hospital, a public hospital in Kenya.

Methods: Patients above 18 years old were screened for eligibility within 48 hours of their admission. The nutrition risk screening tool (NRS-2002) was used to identify the prevalence of risk of malnutrition in patients among the various disease categories at both admission and discharge. Patients were drawn from medical, surgical and gynaecological wards. Referral of malnourished patients for nutrition support was also investigated.

Results: The study included 384 adult patients, of which 55.2% (n=212) were female. Discharge information was obtained from 94 patients. The mean age on admission was 39.61 ±13.86 years, average BMI of 19.0 ±4.7 kg/m^2, mean nutritional risk score was 3.39 ±1.09 SD and the average length of hospital stay was 7.5 ±5.0 days. The prevalence of the risk of malnutrition was 81.9% on admission and 77.6% on discharge. The highest prevalence of malnutrition was among patients diagnosed with HIV/TB, followed by those with gastrointestinal tract and respiratory infections. Despite the malnutrition risks being high on admission, the number of referrals made for nutrition support was low at 33%.

Conclusion: The prevalence of risk of malnutrition is high among hospitalized adult patients. In most cases patients are not referred for nutrition support despite studies having shown its negative impact on treatment outcomes.

ABSTRAK

Die prevalensie en impak van wanvoeding in gehospitaliseerde volwasse pasiënte in Mbagathi Distrik Hospitaal, Nairobi – Kenya

Inleiding: Wanvoeding is 'n probleem van publieke gesondheid omvang wat beide ontwikkelde en ontwikkelende lande betrek. Min fokus word geplaas op die voorkoms van wanvoeding in gehospitaliseerde volwassenes in Afrika. Die prevalensie van risiko tot wanvoeding onder gehospitaliseerde pasiënte wissel tussen 30% en 76%. Florence Nightingale was die eerste persoon om wanvoeding te identifiseer onder oorlog soldate en dit is die eerste keer rapporteer deur Charles Butterworth in 1974. Beide hierdie persone het wanvoeding identifiseer as 'n probleem wat onderdiagnoseer is en oorgesien word in die meerderheid gevalle. Die meerderheid studies gedoen in Afrika het nie die las van volwasse wanvoeding in die hospitaal omgewing uitgelig nie. Tog word wanvoeding geassosieer met negatiewe uitkomste wat pasiënte affekteer. Die doel van hierdie studie was om die prevalensie van risiko tot wanvoeding onder gehospitaliseerde volwasse pasiënte in Mbagathi Distrik Hospitaal, 'n publieke hospitaal in Kenia, te identifiseer.

Metodes: Pasiënte ouer as 18 jaar waas gesif vir geskiktheid binne 48 uur na toelating. Die voeding siftingstoets (NRS-2002) was gebruik om die prevalensie van risiko tot wanvoeding in pasiënte (met verskillende siekte kategorieë) met toelating en ontslag te identifiseer. Pasiënte van mediese, chirurgiese en ginekologiesale is ingesluit. Verwysing van wangevoede pasiënte vir voedingsondersteuning is ook bepaal.

Resultate: 'n Totaal van 384 volwasse pasiënte, waarvan 55.2% (n=212) vroulik, is ingesluit. Ontslag inligting is verkry van 94 pasiënte. Die gemiddelde ouderdom met toelating was 39.61 ±13.86 jaar, gemiddelde liggaamsmassa indeks BMI was 19.0 ±4.7 kg/m^2, gemiddelde voedings risiko telling was 3.39 ±1.09 SD en die gemiddelde duurte van hospitaalverblyf was 7.5 ±5.0 dae. Die prevalensie van risiko tot wanvoeding was 81.9% met toelating en 77.6% met ontslag. Die hoogste prevalensie van risiko tot wanvoeding was onder pasiënte met HIV/TB, gevolg deur diegene met gastrointestinale siektes en respiratorieses infeksies. Al was die risiko vir

wanvoeding hoog met toelating, was die aantal verwysings vir voedingsondersteuning laag op 33%.

Gevolgtrekking: Die prevalensie van risiko tot wanvoeding is hoog onder gehospitaliseerde volwasse pasiënte. In baie gevalle word die pasiënte nie verwys vir voedingondersteuning nie, ten spyte van studies wat die negatiewe effek van wanvoeding op behandelingsuitkomste bewys het.

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CONTRIBUTIONS BY PRINCIPAL RESEARCHER AND FELLOW RESEARCHERS

The principal researcher, Esther Achar, together with Prof Renée Blaauw and Mrs Janicke Visser developed the protocol for this study. Data collection was done by the principal researcher and two fieldworkers, both qualified nutritionists. The data were captured by the principal researcher and analysed with the assistance of Prof Blaauw, Mrs Visser and Prof Nel from Stellenbosch University. Editing was done by Mrs Lydia Searle.

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LIST OF ABBREVIATIONS AND ACRONYMS

ADA	American Dietetic Association
AIDS	Acquired Immune Deficiency Syndrome
AMDT	American Malnutrition Diagnostic Tool
ANOVA	Analysis of Variance
A.S.P.E.N	American Society of Parenteral and Enteral Nutrition
BMI	body mass index
cm	centimetre
DRM	disease-related malnutrition
EN	enteral nutrition
ESPEN	European Society for Clinical Nutrition and Metabolism
GIT	gastrointestinal tract
HCWs	healthcare workers
HIV	Human Immunodeficiency Virus
ICU	intensive care unit
kg	kilogram
LOS	length of stay
MNA	Mini Nutritional Assessment
MST	Malnutrition Screening Tool
MUAC	mid-upper arm circumference
MUST	Malnutrition Universal Screening Tool
NPO	nil per oral
NRS	nutrition risk score

NRS-2002	Nutrition Risk Screening 2002
ONS	oral nutrition supplements
PN	parenteral nutrition
RCT	randomised controlled trial
SD	standard deviation
SGA	Subjective Global Assessment
SOPS	standard operating procedures
SNAQ	Short Nutritional Assessment Questionnaire
TB	tuberculosis

CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND INFORMATION

Malnutrition is a public health problem that is affecting both the developed and developing world and in recent years, in Africa, little focus has been placed on the presence of malnutrition in hospitalized adults. Most studies conducted in Africa have not highlighted the burden of adult malnutrition within the hospital setting and despite availability of nutrition assessment tools, missed opportunities still exist because most of these tools are not put to proper use and assessment is done only when deemed absolutely necessary.

Identification of malnutrition at admission is said to lead to proper intervention and therapy.(1,2) In Kenya however, malnutrition in some cases has gone unrecognised since baseline assessment on admission is not routinely performed, despite it's importance. The reason for this is partly negligence together with the lack of information indicating the nutritional status of hospitalized adult patients.(1,2) In many instances, malnutrition is overlooked, and no clear systems are in place to ensure that malnutrition among hospitalized adults is identified.(2)

Malnutrition can present as either over- or undernutrition, this study focuses on under nutrition.

1.2 PURPOSE OF STUDY

The purpose of the study was to assess the prevalence and the impact of adult malnutrition in medical, tuberculosis (TB) and surgical in-patients at the Mbagathi District Hospital in Kenya. In addition, the study aimed to help establish reliable care plans for undernourished, adult, hospitalized patients by compiling recommendations that institutions can review and adopt. Finally, the study suggested possible areas of future study and research.

1.3 PROBLEM STATEMENT

The problem statement is presented below:

Does early nutritional assessment and screening of adult hospitalized patients help detect early malnutrition, support improved nutritional care during hospitalization and influence nutritional status on discharge?

1.4 SIGNIFICANCE AND MOTIVATION

Malnutrition among hospitalized adults is a common problem in both developed and developing nations.(3) Identification of malnutrition can be considered the first step in the proper management and prevention of complications associated with malnutrition.(3) Structures put in place to ensure early detection and intervention during hospital stays can help reduce mortality cases associated with malnutrition and improve recovery outcomes. Within the Kenyan context, identification of malnutrition among adult hospitalized patients on admission is a significant challenge since no proper protocols are in place to facilitate screening for malnutrition.

In recent years, European countries have introduced several initiatives to improve nutritional care in adults and older populations and these initiatives involves routinely assessing nutritional risks in patients.(4,5) Despite this assessment being a good practice, it has not been fully adopted in other parts of the world. In Africa, gaps in documentation on routine adult malnutrition screening still exits. There is, therefore, a need to compare the impact of malnutrition and its early detection among different centres to generate workable strategies that reduce the negative impact of malnutrition and thus improve the quality of life. The present study on malnutrition and its impact is important since it provides baseline data to help determine the prevalence of malnutrition among adults admitted to Mbagathi District Hospital and encourages further research in this area since no data is currently available. Determining the prevalence of malnutrition in Mbagathi District Hospital may be used as a resource in contributing to policies developed which may help to establish workable ways of ensuring that the problem is identified early and treatment is provided. This strategy will address various stages of the condition and contribute to researchers recommendations which when coupled with other studies around the same area could be adopted for use by healthcare workers (HCWs) in selectpublic health facilities

in Kenya. Given the prevalence of malnutrition in health facilities, regular nutritional screening may be necessary in reducing the cases of malnutrition within the hospital setting.

Whereas there are numerous studies that have focused on malnutrition in adult hospitalized patients across the globe,(6) most hospitals in Kenya still grapple with the challenge of lack of clear guidelines for nutritional care during hospitalization. From this study, it could be seen that only the selected patients who are referred to the nutrition clinics would benefit from nutritional services. Having considerations for individual nutrient requirements and development of a comprehensive discharge nutritional care and education plan are vital in management of these patients.

Gaps in assessment and nutrition management of patients in the wards make it difficult to address adult malnutrition in the hospitalized patients. With the increasing number of cases of undiagnosed malnutrition among hospitalized patients, the burden in healthcare may be felt more as the causes are not identified. This study aimed to identify the gaps in assessment and nutrition management and to introduce measures and recommendations that could be employed to improve the outcome for patients, to reduce the length of hospital stay and to improve the treatment outcome in adult patients.

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

This was a baseline study conducted to determine the prevalence of risk of malnutrition among hospitalized adult patients in the Mbagathi District Hospital in Kenya and to discuss recommendations that are cost effective and practical to address the problem. There is currently very limited documentation on the prevalence of malnutrition among this population, making it difficult to determine the statistics of occurrence. This chapter elaborates on the definition of hospital malnutrition, the prevalence of malnutrition within the hospital and the Kenyan context, the history of malnutrition and its causes, identification and associated risks. Nutrition screening, assessment and interventions are also discussed and their importance in patient care is emphasised. The study provides a description of the various nutrition assessment tools that have been used in studies in the past and discusses the tool of choice for the study, the Nutrition Risk Screening 2002 (NRS-2002), and its development, validity, feasibility and use within the hospital setting. In addition, studies that have been reviewed are summarised to contribute to the Literature Review chapter of this paper.

2.2 HOSPITAL MALNUTRITION

2.2.1 History and definition of malnutrition

Disease-related malnutrition(DRM) has been identified as a common problem in hospitals in both developed and developing nations and is reported to affect the general health and treatment outcomes of affected individuals.(7,8) Disease-related malnutrition is characterised by a protein/energy depletion mainly resulting from too low an intake of nutrients relative to the individual's requirements. This causes varying degrees of over- or undernutrition with or without the presence of inflammation and leads to changes in body composition and function.(9,10,11,12,13) Malnutrition in adults defined as nutrient deficiencies resulting to a lower Body Mass Index(BMI) or a BMI above normal range, causes impairment of body functions

and an imbalance in protein, energy-yielding nutrients and other nutrients. Malnutrition is also seen as a consequence of deficient dietary intake, poor absorption, increased requirements or excess nutrient losses due to disease or a combination of all the above and thus is commonly seen in patients with both chronic and acute disease.(14,15,16,) It is recognised that malnourished patients are slower to recover from illness and experience more complications such as poor wound healing and altered immune function and, therefore, require a more comprehensive assessment.(9)

Historically, malnutrition was first identified in 1859 in soldiers of war who presented with wasting.(9,17) Florence Nightingale observed weight loss and deterioration of health among the hospitalized soldiers, and this was present despite food being available, leading to her writings of "starving amongst plenty of food".(17) The prevalence of malnutrition was, however, first reported by Charles Butterworth in 1974 in his article, 'The Skeleton in the Hospital Closet', in which he noted that little attention was paid to the essential role of good nutrition in the maintenance of health and particularly in the recovery from acute illness or injury.(17) Butterworth further noted that iatrogenic malnutrition, which he referred to as "physician induced"(p 4) malnutrition, was a significant determinant of outcome of illness in many patients.(17) As a result, Butterworth recognised the importance of good nutrition in wound healing and improved patient outcome.(17)

It has been noted that definitions for adult malnutrition syndromes suffer various limitations.(18) This has been directly attributed to reliance on diagnostic criteria that lack full validity, resulting in poor specificity and sensitivity in addition to poor intra-observer reliability resulting from conflicting definitions, thus causing misdiagnosis.(18) Malnutrition has been defined as disease related and non-disease related. For example, when inflammation is persistent, there is a decrease in lean body mass that is associated with functional impairment, and this is referred to as disease-related malnutrition.(19)

2.2.2 Causes of malnutrition

Malnutrition results from an imbalance between nutrient intake and nutrient needs.(13) Various factors determine its onset, severity and clinical outcomes. These include the differences between energy intake and energy expenditure, nutritional status and the energy reserves at the onset of malnutrition in addition to the extent of adaptation to the undernutrition and the possible incidence of stress (inflammation).(13)

Factors contributing to malnutrition include: (i) disease-related factors such as mechanical obstruction of the gastrointestinal tract (GIT) that may lead to reduced food intake, as a result of nausea, vomiting and discomfort induced by the passage of food; (ii) treatment-related factors, causing drug-related side effects, impaired nutrient absorption and increased catabolism among others; and (iii) social or psychological factors that involve anxiety, economic factors, the environment, purchasing power, etc.(13,16,20)

Other factors that can affect the occurrence of malnutrition include the duration, the severity and the type of illness in addition to specific organ dysfunction such as renal, hepatic, cardiac or pulmonary failure that may alter the normal metabolic processes,(21) which in turn, have an impact on nutrition.

2.2.2.1 Hospital procedures

Studies conducted have found evidence to suggest that hospitalized patients often receive less than optimal levels of nutritional care due to lack of awareness and training in hospital staff.(16) This factor is considered to be among the causes of worsened nutritional status relating to different medical procedures in which, for example, the patient is nil per oral (NPO) or is fasting over long periods prior to medical procedures. As reported by Butterworth in 1974 and cited by Corish and Kennedy,(8) routine hospital practices have also been attributed to certain adverse effects on the nutritional status of patients.

2.2.2.2 Inflammation

Inflammatory disease has been identified as an important contributor to malnutrition and is said to promote catabolism of skeletal muscle that is in part cytokine mediated.(21,22) Inflammatory pathways are said to cause anorexia, resulting in weight losses and muscle catabolism. The metabolic response determines the catabolic rate and the trajectory to onset of malnutrition.(18,22) All these lead to changes in body composition, reduced body function and ultimately, adverse outcomes.

Acute and chronic inflammation are considered key factors in the pathophysiology of disease or injury-associated malnutrition,(21) resulting in DRM that is characterised by an inflammatory response that includes anorexia and tissue breakdown mostly elicited by an underlying disease.(21,22) Serum albumin and prealbumin are among the nutrition assessment indicators that are usually affected by an inflammatory response.(21,22,23,24) Other factors such as depletion of body cell mass are said to result from reduced intake or assimilation of energy and/or protein(19) and are associated with increased risk of malnutrition. Factors such as advanced ageing may also contribute to the state of inflammation, and inactivity and bed rest can also accelerate muscle catabolism during DRM with inflammation.(20)

Understanding the importance of inflammation on nutritional status is paramount, and health professionals should be able to identify if the inflammation is mild, moderate or severe.(19,21) Inflammation has been seen to limit the effectiveness of nutrition interventions, and the associated malnutrition is said to compromise the clinical response to medical therapy.(19) In the absence of inflammation, nutrition therapy is said to be very effective in the treatment of malnutrition.(19,21)

2.2.2.3 Dietary patterns/influence

Dietary patterns have been reported to contribute to other forms of malnutrition, which can be related to a reduced intake of food due to lack of appetite or lack of interest and the refusal to eat, leading to the condition known as anorexia nervosa.(25) However, when proper nutrition

therapy is established, this condition can be corrected without significant complications since there is no presence of inflammation.(21,25)

2.2.2.4 Other factors

Inadequate knowledge among HCWs on the importance of the nutritional assessment of patients during hospitalization is a possible cause of undiagnosed malnutrition cases in institutions.(7,15,26) Knowledge gaps among patients and HCWs regarding patients' nutritional status may further worsen patients' conditions and contribute to delayed identification and interventions. Basic nutrition screening is also overlooked and is only conducted on request or when handling critically ill patients who are on specialised nutritional care. Routine assessment on admission and during hospital stay is not conducted and if done, only includes the basic measurements such as weight and height, which in most cases, only provides a description of the current situation and does not indicate any risk of future development of malnutrition. Poor nutrition screening can thus be seen as a contributor to the occurrence of malnutrition within the hospital. It is, therefore, important to ensure nutrition screening tools are available and their use is well understood by healthcare providers. Malnutrition in hospitals and the worsening of existing malnutrition among hospitalized patients can be prevented if identified early.(24)

2.2.3 Identifying malnutrition

The lack of nationally and internationally accepted thresholds and guidelines for anthropometric and biochemical variables to define nutritional status has contributed to studies using different methods to assess nutritional status and thus, the criteria used to define undernutrition vary greatly.(6) In addressing this challenge, the International Guideline Committee developed definitions for malnutrition syndromes in adults for use in the clinical setting.(18) This gave a different dimension on how to view malnutrition and its underlying causes in adult hospitalized patients. The European Society for Clinical Nutrition and Metabolism (ESPEN) highlights the different forms of malnutrition and demonstrates the difference between cachexia (extreme

muscle wasting and loss of subcutaneous tissue), sarcopenia (loss of muscle mass and function) and malnutrition. According to ESPEN, although these three terms are sometimes used interchangeably, cachexia is characterised by severe loss of body weight, fat and muscle and increased protein catabolism.(6) In this case, malnutrition is mostly influenced by inadequate consumption of nutrients and is associated with an inflammatory state of intermediary metabolism.(6,13,18)

Hospital malnutrition, which is of main interest, results from a variety of complex issues ranging from illness to inadequate food and nutrition and is normally observed as a vicious cycle. With the complexity and increased nutrient requirements of the affected patients, depletion of nutrients occurs, which causes an increase in nutrient demands.(25)

It is well established that nutrition screening using a validated simple tool is the first step towards identification of malnutrition and the subsequent nutritional intervention and care.(13) Identification of malnourished patients is paramount in helping prevent further deterioration of patients and affecting the outcome of treatment.(15)

Diagnosis of malnutrition can be divided into different categories depending on the degree and the primary cause. These categories can be starvation-related malnutrition caused by chronic starvation but presenting with no inflammation, chronic DRM with inflammation (either chronic, mild or moderate) and acute disease or injury-related malnutrition where inflammation is acute and severe.(8)

The figure below gives an aetiological approach for the identification of malnutrition syndrome in adults. This was developed in 2009 when the Academy of Nutrition and Dietetics (Academy) and the American Society of Parenteral and Enteral Nutrition (A.S.P.E.N.) recognised the need to standardise the approach for the diagnosis of malnutrition in adults.(27,28)

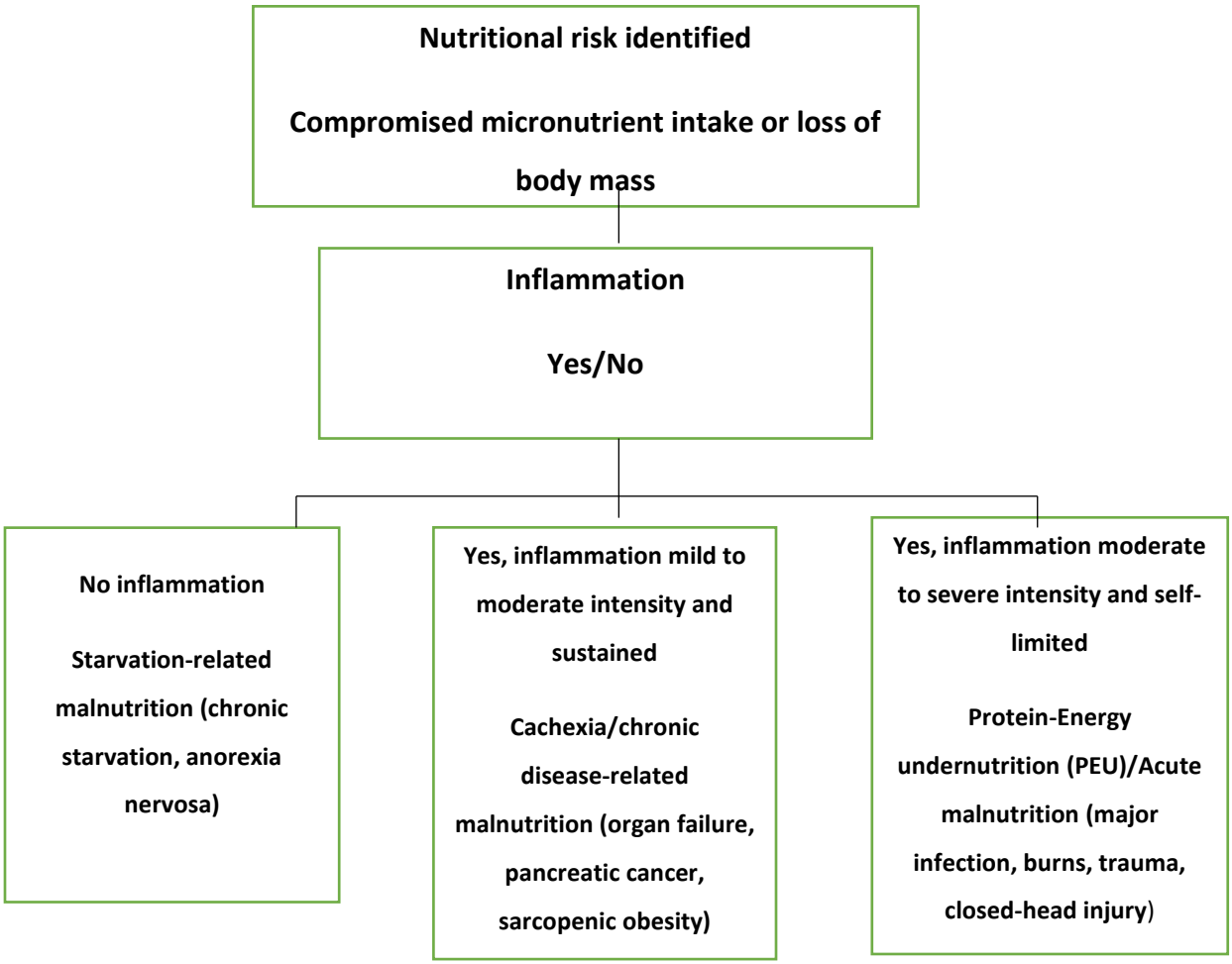

Figure 2.1: Aetiology approach to diagnosis of adult malnutrition syndromes(22,28)

This aetiological approach was endorsed by A.S.P.E.N and ESPEN, and the definitions were developed to describe adult malnutrition in the context of acute illness or injury, chronic diseases or conditions and starvation-related malnutrition.(28)

There have been emerging concerns on the relationship of the occurrence of malnutrition among the overweight/obese persons with disease, those with injury or having high-energy expenditure and poor-quality diets in both developed and developing countries.(19) Despite this concern, malnutrition is still a common problem in hospitalized adult patients, and there is very little

awareness among HCWs, resulting in poor identification and the under prescribing of timely nutrition therapy.(17,29)

2.2.4 Prevalence of hospital malnutrition

The prevalence of hospital malnutrition in developing countries ranges between 20% and 50% depending on the method used to identify the malnutrition, the patient characteristics and the co-existence of other disease processes.(8,15) Despite advancements in understanding the importance of proper nutritional care, malnutrition in hospitalized patients is reported to be extremely common due to poor recognition by healthcare providers.(7,15)

Various studies have been conducted to determine the prevalence of malnutrition in hospitals. In Latin America studies involving several hospitals indicated an overall prevalence of 50%, with a 47% prevalence reported among surgical patients and a prevalence of 39–73% among patients with arterial disease and patients exceeding a one-week stay in hospital.(6,13,16,30,31) Other studies demonstrate a very similar range. For example, a study conducted by McWhirter and Pennington and cited by Wyszynski, Perman and Crivelli(32) found that of 500 admissions to an acute-care hospital, 40% were malnourished at the point of entry and by the time of discharge from the hospital, 75% demonstrated a deterioration in nutritional status during hospitalization. Similar studies conducted in Brazil and Chile indicated a prevalence of 48.1% and 37% respectively.(32) It is said that malnutrition prevalence rates increase with age due to factors such as increased morbidity, loss of appetite, diminished physical function, oral health and cognitive decline.(33)

2.2.5 Overview of malnutrition in the Kenyan context

Malnutrition is a condition that is very common within the hospital setting and has been investigated globally in different centres.

Within the Kenyan context, there is little research on malnutrition in adult hospitalized patients. Additional research would be valuable in generating adequate data and devising practical ways for the identification and management of malnutrition in order to improve care, service delivery and the overall wellbeing of patients.

There is currently no reported data on adult malnutrition in hospitals in Kenya. This makes it difficult to compare the prevalence of malnutrition with studies conducted worldwide.

About 50% of Kenyan households are reported to be food insecure due to poverty and inadequate food production. The resulting nutrition insecurity is exacerbated by the large burden of morbidity.(2) In the adult population, anecdotal evidence indicates significant rates of undernutrition, with the dry plains reporting over 20% among rural population groups.(2) Poverty and inadequate food production contribute to malnutrition both directly and indirectly. A study conducted among HIV-positive male patients in a hospital in Kericho, Kenya indicated that there was an increased risk of malnutrition among the HIV-positive clients in this region.(2) The overall prevalence of malnutrition reported in this population was 29.1%, which was in line with a similar study conducted in Ethiopia where the prevalence reported was 27.8%.(34)

In the Kenya Demographic and Health Survey (KDHS) 2008-2009, data from different studies were used to analyse the prevalence of over- and undernutrition among women of reproductive age in the country.(35) A nationally representative sample of 5 916 women was analysed, and the dependent variable for the women's nutritional status was the body mass index (BMI), with a BMI of <18.5 kg/m^2 being defined as undernourished and >24.9 kg/m^2 as overnourished. The burden of overnutrition was reported to be greater than undernutrition.(35) However, the data were not specific to general hospitalized patients and, therefore, could not provide a true representation of the actual nutritional status of the hospitalized adult population in Kenya.

Within the hospital setting, malnutrition can be identified and associated with a disease but is rarely identified as the underlying cause of the development or the worsening of the disease.(6,29) Critically investigating malnutrition in hospitalized adults could reveal unidentified issues affecting the adult population, especially in the Kenyan hospital settings.

In recent years, the approach of nutrition assessment, counselling and support (NACS)(36) has been adopted in Kenya as a model for the provision of nutrition services to patients at both the outpatient and the in-patient level. This has created an opportunity for increased case finding and identification of both under- and overnutrition. However, knowledge gaps still exist in this area, making it difficult to identify and treat malnutrition in adult hospitalized patients. In addition, the approach is biased towards HIV care.

Nutrition assessment according to this study is not a routine exercise conducted on admission, and despite having a basic knowledge or training in nutrition, many HCWs are still not able to identify malnutrition in its early stages or offer basic screening to patients on admission and during their hospital stay.(7) These are among the challenges causing malnutrition to go undiagnosed and untreated among the adult hospitalized patient population during their hospital stays.

2.2.6 Risks associated with malnutrition

The results of studies conducted worldwide demonstrate that malnutrition among adult hospitalized patients is an underlying factor for many outcomes, including treatment outcome. Nutrition is an important component of care and thus, it is essential that each patient has access to a basic nutrition service at any time in their hospital stay. The World Health Organization portrays malnutrition as the greatest single threat to the world's public health,(37) with the reported hospital prevalence reaching 50%.(37) Malnutrition and specific nutrient deficiencies are reported to be the leading causes of immune deficiency, which leads to infections and other diseases.(30,38-41)

Although results from various studies on nutritional care vary, addressing hospital malnutrition has the capacity to improve the quality of patient care and clinical outcomes and to reduce the cost.(40,41) Nutrition is a critical determinant of immune response, and malnutrition is reported to be the most common cause of immunodeficiency worldwide. Protein-energy malnutrition is associated with a significant impairment of cell-mediated immunity, phagocyte function, the

complement system, secretory immunoglobulin A antibody concentration and cytokine production.(42) Hence, deficiency in one or more nutrients can compromise the body's immune function.

2.2.7 Consequences of malnutrition on health

2.2.7.1 Impaired functional ability

Malnutrition is identified by certain changes in the weight and functionality of an individual.(8) The condition causes muscle weakness, fat loss, fatigue, reduced respiratory muscle and cardiac function and loss of body strength, resulting in weakened physiological functions and physical performance.(14,15,43,44)

Physically, an unintentional 15% weight loss causes a reduction in respiratory function and muscle strength, a 23% loss of body weight causes a 70% decrease in physical fitness, a 30% decrease in muscle strength and a 30% rise in depression. Psychologically, malnutrition causes fatigue and apathy, which delays recovery and results in increased time in convalescence,(14) thus leading to reduced body function.

2.2.7.2 Impaired immune response

The body's immune system is divided into two systems, innate and adaptive.(45) Both are important for normal survival and proper body function.

Various studies indicate that protein-energy malnutrition is more common among hospitalized adults, especially in the elderly. Malnutrition depresses antibody production, phagocytic cell levels and the T-cell mediation effect, thus affecting the T-lymphocyte mediated response and increasing susceptibility to infections.(42)

It is reported that changes in the metabolism of immune-suppressed patients (e.g. HIV-infected people) occur as a result of the response of the immune system to HIV infection.(2) In mounting

its acute phase response to infection, the body releases pro-oxidant cytokines and other reactive oxygen species. These cytokines produce several symptoms, including anorexia (causing lower intake of food) and fever (increasing energy requirements). If the infection is prolonged, muscle wasting occurs because muscle tissue is broken down to provide the amino acids for the synthesis of the immune protein and enzymes that are needed.(2) Therefore, a depressed immune system causes an increased risk of malnutrition and disease manifestation, reducing the body's ability to fight infection.(42)

Another factor associated with the increased risk of malnutrition in the hospitalized adult population is ageing, which is associated with a progressive deterioration of the immune system.(46) As the individual grows older, the innate system barriers become less resistant to invading pathogens, and this increases the risks of morbidity and mortality among the elderly population. When coupled with nutrient deficiency resulting from various factors such as reduced intake and uptake of nutrients, the conditions are worsened.(9)

2.2.7.3 Increased risk of DRM

Disease is a state in which the normal functions of the body are either partly or fully affected by the presence of a condition that alters normal body function, thus compromising immunity.(45) Various studies conducted among hospitalized patients have shown that malnutrition influences disease outcome, which can result in an increased length of stay (LOS) in the hospital, a negative treatment outcome and an increased chance of readmission among those affected.(2,15,42,45)

Generally, malnutrition has been associated with higher post-operative risks, with increased risks of contracting nosocomial infections and developing pressure ulcers being demonstrated among malnourished patients.(15) The scientific evidence indicates that poor nutrient status in HIV-infected individuals hinders their immune system and, therefore, renders the patients vulnerable to infections and further deterioration of their nutrient intake and utilization.(2,42)

The Figure 2.2 below demonstrates the vicious cycle of the development and the progression of disease-related malnutrition.

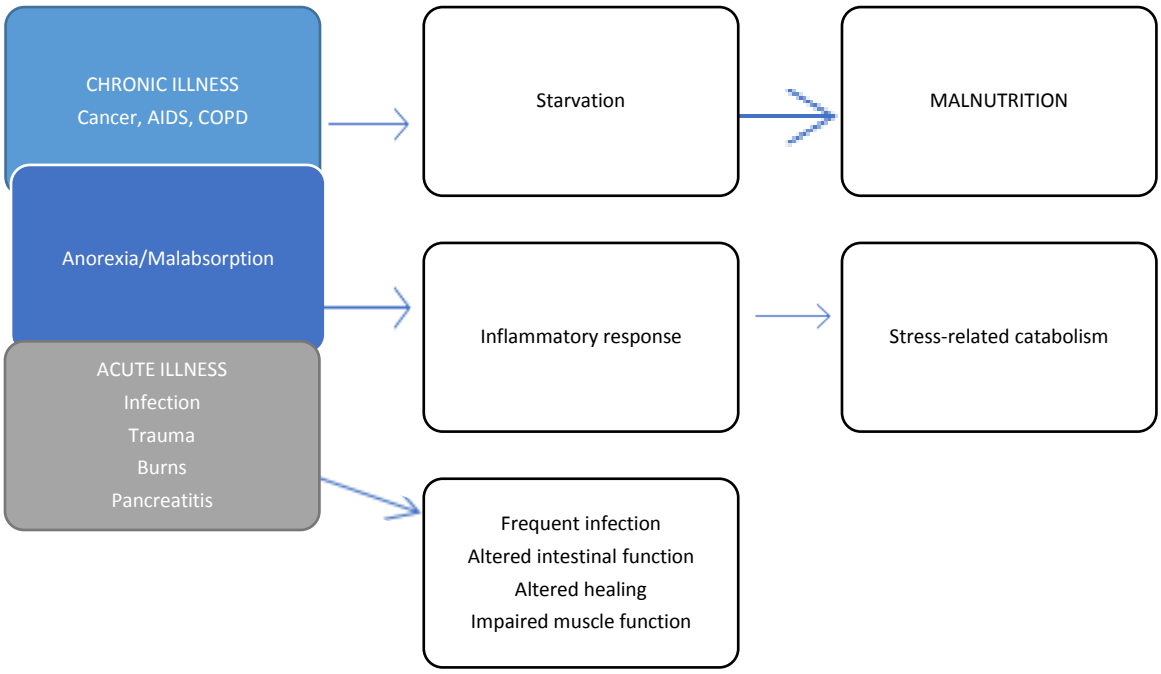

Figure 2.2: Vicious cycle of the development of malnutrition(18)

(COPD: chronic obstructive pulmonary disease)

2.2.7.4 Psychological impact

Nutrition is seen to play a vital role in mental health, and any deficiency resulting in malnutrition negatively affects the mental health of individuals.(48,49) Psychological distress is considered a sign of poor mental health.(47,48,)

In a study conducted by Ma, Poulin, Feldstain and Chasen, the researchers found that there is a positive relationship between malnutrition and psychological distress and that malnutrition is a predictor of psychological distress.(47) It has also been noted that conditions such as dysphagia could affect the self-esteem, socialisation and enjoyment of life of elderly populations.(47,48)

2.2.8 Malnutrition and disease outcome

The development of malnutrition is influenced by the existing nutrient reservoirs and in some cases the malnutrition is said to be dependent on the disease state.(16,49)

It is seen that increased strain on the body in the presence of illness depletes the body of nutrients and increases the demand to balance the energies lost during the illness.(49,50) In cases in which the increased energy needs are unmet, the body depletes the nutrient stores, and in the absence of a nutrition intervention, the individual is more predisposed to developing malnutrition.(49) For example, in HIV infection, energy requirements are increased through the increase in resting energy expenditure (12% higher), while reduced food intake, nutrient malabsorption, negative nitrogen balance and metabolic alterations exacerbate weight loss and wasting, thus perpetuating the cycle.(2)

One-third of patients in developing countries are reported to be malnourished/undernourished on admission to hospital and if untreated, the nutrition condition will worsen in a further two-thirds of patients during hospitalization.(16) It is stated that when malnutrition is undiagnosed, one-third of patients who are not malnourished on admission develop malnutrition during their stay in hospital,(6) and undernutrition in these patients is associated with impairment of various systems in the body.(16,49,50)

A retrospective study of 709 adult patients from 25 Brazilian hospitals reported that the incidence of complications in the malnourished was 27% (relative risk: 1.60) compared with 17% in the well-nourished patients.(51) Furthermore, mortality in the malnourished patients was 12.4% versus 4.7% in the well-nourished patients.(51) Similarly, a study involving 104 patients with acute stroke onset of <24 hours reported that malnourished patients were more likely to have higher stress reactions and to demonstrate increased frequency of infections and pressure ulcers than the appropriately nourished group,(52) thus indicating negative outcomes associated with malnutrition.

Reduced nutrient intake is also a factor that is attributed to increasing the risk of malnutrition.(14) This is mainly due to illness-induced poor appetite and gastrointestinal

disorders resulting from the patient's inability to chew or swallow, which increases the risks of undernutrition for the hospitalized patient.(14) Normally, disease causes strain on the body system, and this can result in patients who were identified as well nourished on admission developing malnutrition during their hospital stay or during the course of the disease.(16,50,52)

Malnutrition in patients with acute conditions or advanced disease may at times be inevitable, and screening of the patients on admission or during hospital stay may reveal details that when properly managed could prevent the conditions from worsening.(8,46) It can be said that hospital malnutrition results from a complex relationship between disease, food and nutrition and consists of both over- and undernutrition.(15,53,54) Malnutrition is also reported to be common in patients with severe congestive heart failure and is associated with increased right atrial pressure and tricuspid regurgitation.(15) In addition, malnutrition has been identified among orthopaedic patients. In their review on the prognostic impact of DRM, Norman et al. found the recovery time among women suffering from fractured neck of the femur to be increased.(15) Malnutrition is also associated with poor prognosis in patients with chronic obstructive pulmonary disease.(16)

Other studies have shown LOS to be markedly prolonged in undernourished adult patients who received no intake orally after major gastrointestinal surgery. The studies also demonstrated a prolonged LOS even in malnourished patients without peri-operative complications compared with well-nourished patients suffering from other ailments.(16,51,52,55)

Proper nutritional care, management and reporting may not be well monitored or implemented in hospitals. Nutritional screening may play a role in reducing the risks of malnutrition in these hospitalized patients and also lead to early detection and interventions, ultimately reducing cases of mortality due to malnutrition-related complications and minimising LOS and cases of recurrence.(25,55,56,57,58,59)

2.3 NUTRITION SCREENING, ASSESSMENT, DIAGNOSIS AND INTERVENTION PROCESSES

Nutrition screening, assessment, diagnosis and intervention are key processes in patient management and comprise a cycle that cannot be overlooked in patient care because each component contributes to the effective management of patients identified with malnutrition.

The incorporation of nutrition screening and comprehensive assessments is recognised as imperative in the development of standards of quality care in the hospital setting.(2,32,46) The definition of nutrition screening and nutrition assessment according to the American Dietetic Association (ADA) and cited by Pathirana et al.is as follows: Nutrition screening is a process of identifying characteristics known to be associated with malnutrition risk, and nutrition assessment is a diagnostic tool used to determine if a patient is currently malnourished.(14) Many nutrition screening and assessment tools are available to identify the risk of malnutrition, to diagnose the condition and to guide the nutritional care and intervention process.(46)

Improved understanding of how malnourished patients are identified and assessed in the hospital setting ensures that the needs of both the patients and the clinicians who treat them are adequately addressed.(5)

2.3.1 Nutrition screening

The goal of nutrition screening is to identify patients who are malnourished or to identify patients who are at an increased risk of developing malnutrition and subsequently to intervene.(5) The screening process entails a set of questions that identifies a patient's nutritional risk status. In cases where patients are indicated to be at risk, nutrition assessment is conducted. This assessment is performed by medical personnel using a recognised protocol and considers the present nutritional status of the patient together with the patient's status a month or two before admission or assessment.(16) Aspects of predictive validity, content validity, reliability and practicability are key factors to consider when deciding which tool to use.(25,26) The screening process should be a simple and rapid process that can be carried out by busy nursing and medical

personnel without much complication and should be sensitive enough to detect all or nearly all patients at nutritional risk.(25,26)

Nutrition screening determines the chance of a positive outcome related to nutrition and supports the appropriate nutrition intervention plans and their influence on the treatment.(46,59,60) Screening is the first step in the management of malnutrition and needs to be structured well to ensure that all risk factors are well captured and the correct scores are determined. The NRS-2002 has been recommended as one of the screening tools for use In the hospital setting, adult patients are screened and a score of ≥3 qualifies the patient for a nutrition plan.(25,55) For identifying patients at nutritional risk, it is important that hospitals and healthcare organisations have a policy and a specific set of protocols in place that lead to appropriate nutritional care plans.(60)

2.3.1.1 Nutrition screening procedure

For nutrition screening to be effective, it must be easy to use by existing staff; it must be simple and inexpensive and be initiated early in the hospital stay.(7,10)

In 1996, the Joint Commission, a not-for-profit organisation in the United States(29) mandated that nutrition screening be performed within 24 hours of hospital admission. Cases in which at-risk patients were identified at the screening were recommended for referral to a registered dietitian for further management. Periodic re-screening was also recommended at regular intervals for patients not identified as 'at risk' on admission and referrals made should any risk be identified.(5,29)

2.3.2 Nutrition assessment

Nutrition assessment is a process that involves the collection of timely and appropriate patient information. As defined by the ADA, it is a comprehensive approach to identifying malnutrition using nutrition indicators such as, medical history, physical examination, anthropometric

measurements and laboratory data to determine if a patient is currently malnourished.(2,14,16,60) It is recommended that nutrition assessment is performed on all patients at risk of malnutrition since the assessment provides the basis for diagnosis and nutrition treatment in a clinical setting.(19,61) Nutrition assessment involves the evaluation of objective and subjective data to determine an individual's nutritional status or growth patterns and is seen as a critical step in improving and maintaining nutritional status.(10,62)

The goal of nutrition assessment is to identify patients who have developed or are at risk of developing protein-energy or nutrient disorders in order to quantify their risk of progressing to malnutrition-related medical complications and to monitor the adequacy of nutritional therapy.(16) This is seen as the first step in the treatment of malnutrition.(16)

Various techniques are used in clinical assessment.

- *Anthropometric data:* This information comprises the current nutritional status as it presents on initial contact with the patient.(19,25,26) Information from the anthropometric assessment may include weight, height, BMI, waist circumference and mid-upper arm circumference (MUAC).
- *Biochemical data (laboratory examinations):* This information is an important component that indicates organ function. It includes the determination of levels of factors in the body such as blood protein, albumin and potassium and reveals biochemical changes.
- *Dietary data:* This information is gained by taking dietary recalls to determine the approximate quantities taken and the adequacy of the diet. This can involve a 24-hour recall or a one-month history.(26,62)

Therefore, nutrition assessment can be employed to identify medical conditions that affect nutritional status, to detect dietary habits that affect improved health, to inform nutrition messages and counselling and to help establish a good, individual, nutritional care plan.(62)

2.3.3 Nutritional diagnosis

Nutritional diagnosis involves the identification of the problem, the possible causes and the contributing risk factors.(10,63) The Academy and A.S.P.E.N. recommend the use of a standardised set of diagnostic characteristics to diagnose and to document adult malnutrition in routine clinical practice.(28) The European Society for Parenteral and Enteral Nutrition (ESPEN) and A.S.P.E.N recommend the adoption of an aetiology-based approach in the diagnosis of adult malnutrition in clinical settings.(28) The latter approach focuses on three main aetiologies, starvation-related malnutrition (in most cases, this is an acute form of protein-energy malnutrition), chronic disease-related malnutrition (occurs over a long period of time and correction is difficult) and acute disease or injury-related malnutrition (can result from inability of the body to utilise nutrients appropriately due to the presence of a disease that alters normal body function).(28)

A diagnostic nomenclature that incorporates a current understanding of the role of the inflammatory response on the incidence, progression and resolution of malnutrition is proposed by ESPEN and A.S.P.E.N.(19,28,64) This approach has been used in various centres.

Current approaches to the diagnosis of malnutrition vary widely, specifically in regard to the diagnostic criteria used, and there is generally poor specificity, sensitivity and inter-observer reliability among the current protocols in use.(28) The lack of an acceptable diagnostic approach can cause confusion and misdiagnosis of malnutrition.(28) It is important to identify patients who are at increased risk of malnutrition on admission such as the elderly and frequently monitor them to be able to implement measures that adequately take care of their increased demands.(28)

It can be deduced that a single factor cannot be used to conclude a diagnosis. It is, therefore, necessary to use two or more indicators such as insufficient energy intake, weight loss, subcutaneous fat loss, loss of muscle mass, fluid accumulation and diminished functional status. These can help to distinguish between severe and non-severe malnutrition.(28)

Indicators used for diagnosis vary and should be routinely assessed on admission and continuously monitored during the hospital stay.(28) The A.S.P.E.N recommends any two of the following indicators can be used to make a diagnosis.

- Dietary/energy intake

Recent food intake is compared with estimated requirements, and this is a primary criterion in defining nutrition and presence or prevalence of malnutrition.(28) This is based on any changes in dietary habits and intake.

- Anthropometric measurements

Weight and height measurements can be used to determine the BMI of individuals. Calculations of reported weight loss over time against the baseline weight can be used to determine the prevalence of malnutrition.(26,28) Other important measures may include Waist Circumference(WC) and Mid-Upper Arm Circumference(MUAC).

- Clinical assessment

Clinical assessments are conducted using different techniques. A physical examination can reveal the characteristics of clinical indicators of malnutrition such as weight loss, fluid retention, loss of body fat, loss of subcutaneous fat (e.g. orbital, triceps, fat overlying the ribs) and muscle fat, which is characterised by wasting around the temples, clavicles, shoulders and thighs.(26,28) Generalised or localised fluid accumulation evident on examination (extremities, vulvar/scrotal oedema or ascites) is also evaluated. Generalised fluid retention (oedema) may be observed as weight gain; however, this could be an indication of actual weight loss or onset of malnutrition.(28)

- Biochemical analysis

Indicators of inflammation can include elevated C-reactive protein, white blood cell count and blood glucose levels, and these may aid in the determination of an aetiological-based diagnosis of malnutrition.(28,51)

- Functional ability

Reduced hand grip and muscle strength are predictors of malnutrition.(44) These can be used to determine a patient's reduced physical function as a predictor of onset of malnutrition.(43,44)

Thus, the patient's chief complaint, the symptoms and the medical, nutritional and psychosocial histories should be carefully reviewed. A physical examination should be conducted and the laboratory markers for inflammation, the anthropometric parameters, food intake and the functional status should be determined. Such determinations should be performed by relevant members of the healthcare team when making the initial diagnosis, determining and implementing a plan of care, monitoring progress and adjusting the plan of care to facilitate the patient's attainment and maintenance of optimal, achievable nutrition health.(28)

2.4 NUTRITION SCREENING AND ASSESSMENT TOOLS

Nutrition screening and assessment tools are intended for identifying patients at nutritional risk quickly, for obtaining additional details on the nutrition status of the individual and for identifying patients who are at an increased risk of developing malnutrition.(33) Various screening tools have been developed over the past years to facilitate easy screening, to determine patients' nutritional status and to predict poor clinical outcomes related to malnutrition.(4) These screening tools have been used in various studies to identify, diagnose and classify malnutrition, with different tools giving varying results based on the population.(4) Some of the commonly used tools include Subjective Global Assessment (SGA), Malnutrition Screening Tool (MST), Malnutrition Universal Screening Tool (MUST), Nutrition Risk Screening (NRS-2002), Mini Nutrition Assessment-Short Form (MNA-SF) and Short Nutrition Assessment Questionnaire (SNAQ). The first malnutrition screening tool to be developed and used was the SGA in 1982. Since then, many other tools for assessment have been established.(33)

The MST has been in use for some years and is used to identify patients at increased nutritional risk.(65) The tool has components that closely relate to the MUST, which according to Pathirana et al. and Guigoz was developed to detect both undernutrition and obesity in adults.(13,61)

According to Kondrup et al.2003 the NRS-2002 has been recommended as the preferred tool for identifying hospitalized adults at increased risk of malnutrition while according to Guigoz,(61), the MNA-SF was developed to identify malnutrition in the elderly. The MUST, the NRS-2002 and the MNA-SF have been endorsed as tools that can be used for screening in elderly populations.(4,61) Another tool used is the four-item SNAQ that was designed to identify malnutrition in hospitalized patients. It has limitations since it does not capture BMI. Detsky et al. report that the SGA is considered the best for detecting patients with established malnutrition.(66)

2.4.1 Components of a nutrition screening tool

For nutrition screening to be effective, standardised tools that are not homogeneous but are applicable to various types of populations and provide accurate results without bias must be employed.(37,60) The screening tools discussed here are designed to detect protein and energy undernutrition and to determine if the undernutrition is likely to develop or to worsen with the current status of the patient.(46,54,65)

As highlighted by ESPEN, screening tools must assess the four main components that inform further management.(60)

1. *Current condition:* This includes determining the weight, height, BMI and MUAC (in critically ill patients) and indicates the nutritional status of the patient at contact or at present.
2. *Stability of the patient's condition:* This is determined by identifying any recent involuntary weight losses that could indicate the onset of undernutrition and that may have been missed at the initial anthropometric assessment.
3. *Chances of the condition worsening:* This is determined by detecting any changes in dietary intake that could possibly affect the patient's condition further.

4. *Chances of the disease accelerating and deterioration of the nutritional status of the patient:* This can be determined by considering the dietary intake and any increased nutrient demands due to the disease.

It is also important that screening tools are linked to specified protocols for action (e.g. referral of patients screened to be at risk to an expert for more detailed assessment and care plans).(60)

Assessment tools have different limitations, and most have been developed for the screening of a specific target population.(4) Despite there being no universally accepted tool,(4,60) it is recommended that in nutrition assessment, all tools should be practical, easy to perform, non-invasive, well tolerated, inexpensive and applicable in addition to showing appropriate sensitivity and specificity and yielding immediate results.(13)

Three different assessment tools have been discussed in this paper; however the tool of choice in this study was the NRS-2002, which is discussed in detail below.

2.4.2 Subjective Global Assessment Tool

The SGA identifies patients at risk of complications by clinically assessing changes in intake of food and changes in body composition and function.(67) This tool categorises various parameters as historical, symptomatic and physical. It identifies malnourished clients as those at increased risk of medical conditions and those who will presumably benefit from nutritional intervention.(67,68) In addition, the SGA considers bedside clinical assessment, functional test of malnutrition and measurement of body composition.

The SGA also determines if nutrient assimilation has been restricted due to reduced food intake or malabsorption and considers the effects of malnutrition on organ function, body composition and whether or not the disease process influences nutrient requirements.(68)

The historical SGA components focus on five main areas.(68)

1. *Percentage of body weight loss in the past six months:* This is characterised as mild = <5%; moderate = 5–10%; and severe = >10%.
2. *Dietary intake:* This is either normal or abnormal and is characterised by changes in intake and determination if the current diet is nutritionally adequate.
3. *Presence of persistent gastrointestinal problems:* Problems include anorexia, nausea, vomiting, diarrhoea and abdominal pains that occur almost daily for at least two weeks.
4. *Patient functional capacity:* This is defined as bed ridden, suboptimal or full capacity.
5. *Patient's metabolic demand and underlying disease state.*

The physical component of the SGA investigates normal, mild, moderate and severe alterations. It considers loss of subcutaneous fat through examination of the triceps region and lower ribs and muscle wasting through examination of the temporal areas, deltoids and quadriceps. Oedema around the ankle areas is also identified, and the results of both the historical and physical examinations are used to classify patients as well nourished, moderately undernourished or severely malnourished.(66,67,68)

2.4.3 American Malnutrition Diagnostic Tool

The Academy and A.S.P.E.N. recognised the need to standardise the diagnosis of malnutrition and adopted patient-specific definitions based on aetiologies that included social and environmental circumstances and chronic and acute illness.(27)

The Academy and A.S.P.E.N. propose aetiological-based definitions that consider time and degree of inflammatory response in categorising an illness or injury as acute versus chronic(27,69) using the American Malnutrition Diagnostic Tool (AMDT). The organisations recommend that any two of the following six characteristics, provided they are established as present, can be used to identify malnutrition: insufficient energy intake, weight loss, loss of muscle mass, loss of subcutaneous fat, localised or generalised fluid accumulation (may

sometimes mask weight loss) and diminished functional status (as measured by hand-grip strength).(27,69)

However, this tool is not discussed further since it was not used in the study.

2.4.4 Nutrition Risk Screening Tool

The NRS-2002 is designed to detect the presence of undernutrition and the risk of developing undernutrition within a hospital setting. The tool was designed by Kondrup et al. and the ESPEN working group in 2002 and measures four aspects to generate a nutrition risk score (NRS) that include anthropometry (BMI), recent weight loss, recent nutrient-intake changes, age and subjective assessment of disease severity (based on increased nutritional requirements and/or metabolic stress).(14,26,59,65,70) The NRS also evaluates the degree of malnutrition risk. A score of ≥3 indicates that the patient is at risk of malnutrition, and a patient with a score of <3 is classified as not at risk.(65)

This tool also contains nutritional components of the screening tool known as MUST. The NRS-2002 has four pre-screening questions and is intended to cover all categories of adult hospitalized patients.(55,59) The tool is divided into two sections. The first section is the initial screening, and any question answered as 'Yes' qualifies the patient to progress to the second section, which is the final screening. The details of the NRS-2002 are discussed in Chapter Three: Methodology.

2.4.5 Validity and reliability of the Nutrition Risk Screening Tool

The predictive validity of an assessment tool is deemed important since the result obtained is what determines the type of intervention that is implemented to obtain a positive health outcome.(59) This was documented in a retrospective analysis of 128 randomised control trials (RCTs) of nutritional support that showed that RCTs with patients meeting the risk criteria had a higher chance of a positive clinical outcome from nutritional support than those who did not

meet the criteria.(55) In addition, the screening tool must have a high degree of content validity and demonstrate inclusion of all the components of the problem that it is designed to solve.

The NRS-2002 was employed by nurses and dietitians in a two-year implementation study in three hospitals (a local, a regional and a university hospital) in Denmark. Results indicated that staff and investigators seldom disagreed about a patient's risk status.(59)

An assessment tool must demonstrate high reliability with little inter-observer variation. It must be rapid, simple and practical and must achieve the purpose for which it is meant. The reliability of the NRS-2002 was validated by an inter-observer variation between a nurse, a dietitian and a physician with a result of k=0.67, meaning there was no significant difference between the three sets of results. Its practicability was shown by the finding that 99% of 750 newly admitted patients could be screened.(59) The incidence of at-risk patients was about 20%.(59)

In addition, an assessment tool must have the relevant information to ensure that the objectives are met.(60) The NRS-2002 has been used in various analyses to determine the risk of malnutrition in various population settings, and its predictive validity evidence has been documented.

2.4.5.1 Validity of nutrition screening and assessment

Predictive validity of nutrition screening is of great importance in that the individual identified to be at risk by the method is likely to obtain a health benefit from the intervention arising from the results of the screening.(60,65)

2.4.5.2 Limitations on nutrition screening, assessment and diagnostic tools

Various nutrition-risk screening tools are used for the identification of malnutrition. Sound knowledge regarding their use and the interpretation of results is an important component in assessment, diagnosis and management.(60) However, most nutrition-risk screening tools have

been reported not to appreciate the role of the inflammatory response on the acute phase proteins that are often used as primary indicators of nutrition status,(29) and this makes identification of inflammation in at-risk patients difficult.

Most of the tools are developed specifically for special populations and may not be applicable to the general population or populations with unspecified conditions.(46) For example, the MST is valid in the acute-care setting as confirmed in a randomised controlled trial. However, this tool does not provide an avenue for screening patients who are unable to communicate.(46) This indicates the need to combine more than one tool in an assessment in order to be able to determine all the variables of interest.

Other identified limiting factors include an understanding of how the tools are used and their interpretation. Specific tools can be used to determine specific cases, and in settings where tools are unavailable, diagnosis is a major issue of concern.(14)

2.5 MOTIVATION AND CONCLUSION OF THE CHAPTER

Malnutrition remains a common problem despite the increasing evidence of its impact on both clinical and economic outcomes.(15)

Nutrition-risk assessment among hospitalized adult patients has not been comprehensively conducted in the past, especially on the African continent. No clear data exist on assessments done or interventions made in Kenya, yet malnutrition in hospitalized adult patients is evidenced in various studies as a problem of significant concern. Malnutrition is seen to affect the wellbeing of individuals, to increase the risk of developing disease, to hinder recovery and to affect the functional ability of those with the condition. Despite these factors, malnutrition still goes unrecognised in most hospital settings. Since there are no publications on adult malnutrition in hospitalized patients in Kenya, this study investigates the prevalence and the outcome of malnutrition in adult patients together with the importance of early identification and intervention.(15)

The lack of nutrition policies and protocols to guide nutrition screening and assessment is a gap that is still experienced in some public health facilities, hence increases the gap between early identification and the subsequent nutrition management.

CHAPTER THREE: METHODOLOGY

3.1 BRIEF OVERVIEW OF THE STUDY

Malnutrition and its outcomes in hospitalized adult patients in Kenya was an important field to investigate since not many studies that target this population have been conducted in this area.

All patients above 18 years of age admitted to the medical, surgical and TB wards of Mbagathi District Hospital were screened for eligibility for inclusion in the study. Once consent had been obtained from the patients, their information was gathered. Nutritional screening was conducted on all adult patients included in the study within 48 hours of admission and on discharge which were recorded in the admission and discharge forms respectively. For patients who had a longer stay, screening was repeated on Day 21 and information captured in the discharge form, which had been developed for the study.

Two Nutritionists assisted the principle investigator in the data collection. Clear roles and responsibilities were stated, and standard operating procedures (SOPS) were developed and adapted for use during the study period.

The NRS-2002 was the tool of choice for the data collection of the study. The NRS-2002 was adopted because of its simplicity and because most HCWs were familiar and comfortable in engaging with it. Apart from being easy to understand and easy to determine the information needed, the NRS-2002 is a tool that has been recommended in other studies for nutrition risk assessment within the hospital setting.(59)

3.2 METHODS

3.2.1 Research question

What is the prevalence of the risk of malnutrition and its consequences among hospitalized adults in Kenya?

3.2.2 Objectives of the study

The objectives of the study are as follows:

Objective 1: To assess the prevalence of the risk of malnutrition in adult patients on admission

Objective 2: To compare the risk of malnutrition per different disease category on admission

Objective 3: To assess the risk of malnutrition in adult hospitalized in-patients between admission and discharge from hospital

Objective 4: To determine the percentage of at-risk patients referred for specialised nutritional support

3.2.3 Null hypotheses

Ho: There is no difference in the prevalence of risk of malnutrition between admission and discharge.

Ho: There is no difference in the prevalence of risk for malnutrition within different disease categories.

Ho: There is no association between nutritional status on admission and development of malnutrition prior to discharge.

Ho: There is no association between malnourished patients and referrals for nutrition support.

3.2.4 Conceptual framework

This was developed to help address the study objectives.

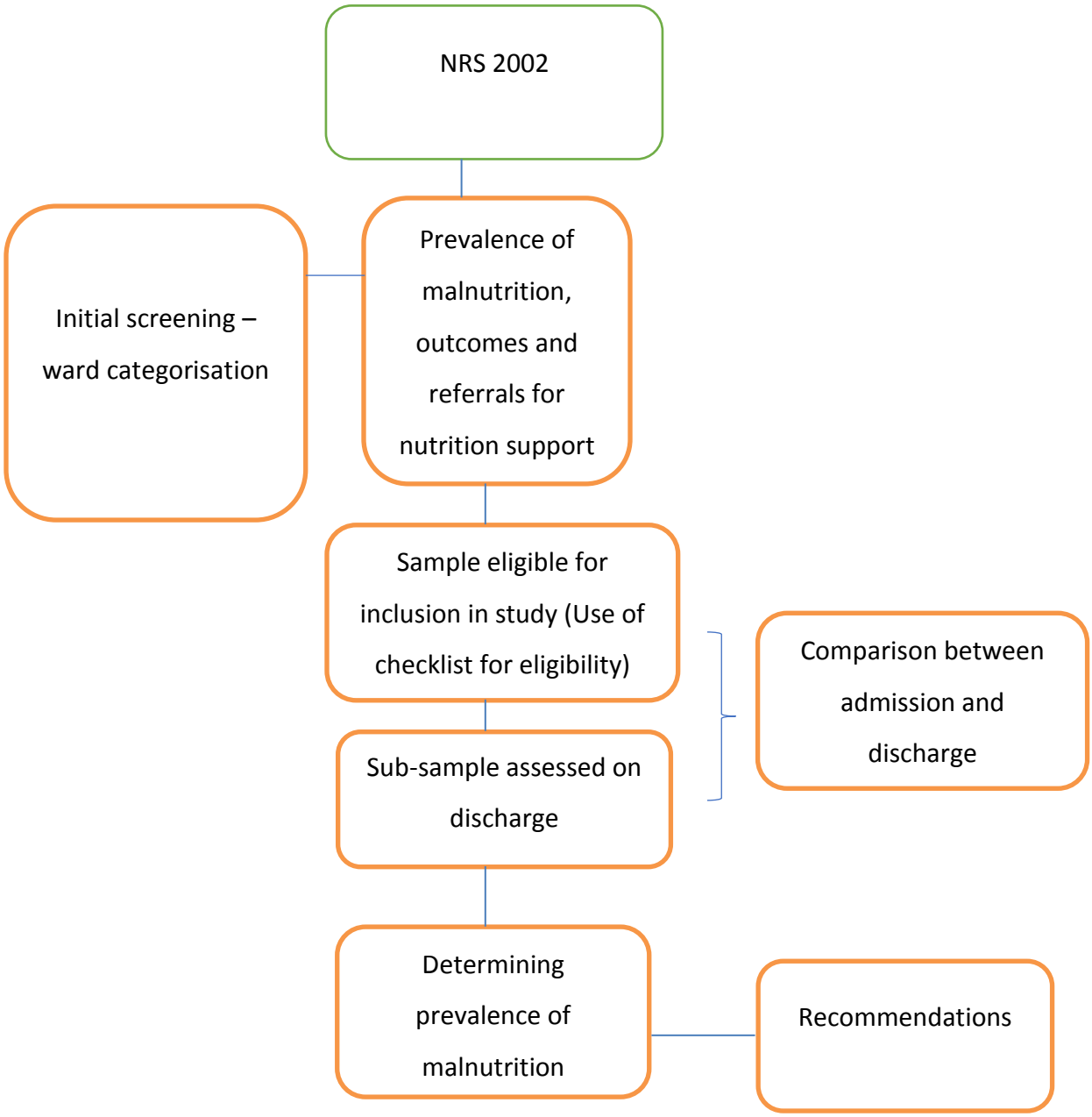

Figure 3.1: Conceptual framework for the study

3.3 STUDY PLAN

3.3.1 Study type

Although part of a larger multicentre study conducted in six different centres, this paper reports on the Mbagathi District Hospital in Kenya. The Mbagathi District Hospital is a sub-county referral hospital that serves people from most counties neighbouring Nairobi, including Nairobi County. The hospital is situated in Nairobi, Kenya adjacent to the Kenyatta National Hospital, which also serves as a learning centre. Previously, the Mbagathi District hospital was known to specialise in HIV and TB treatment and care, but now deals with all types of medical cases. It comprises different out-patient and in-patient departments, with an in-patient bed capacity of 200.

This study is a descriptive, observational, cross-sectional study with an analytical component that compares various variables, which include nutritional status and risks among hospitalized adult patients and different disease categories among this group. The study describes the baseline nutritional status of the participants to justify the descriptive component of the study. The study qualifies as an observational study since no intervention was implemented on diagnosis of malnutrition.

3.4 STUDY POPULATION

3.4.1 Sampling frame

The study was conducted at Mbagathi District Hospital and included all male and female adult patients who were admitted to the medical, surgical and TB wards in the hospital. The patients were assessed for eligibility within 48 hours of admission.

3.4.2 Sample size

The sample size calculation was based on the primary aim and sought to determine the proportion of patients with a risk of malnutrition with a precision of 8% and a 95% confidence

interval. A total of 400 participants were to be included, which would have yielded a power value of 90%. This calculation set the precision at 0.05 to give a 95% confidence interval and anticipated proportion 0.50 (n=p(1-p)z2/d2), where p was the anticipated population, d was the precision required (0.05) and z was the cut-off of normal distribution (1.96).

This was calculated from a published table (71):

N=p (1-p)z2/ d2,

0.50(1-0.50)3.8416/0.0025,

n=384.16

Nearest whole number is 384.

3.4.3 Sample strategy

An interval selection was used to select eligible patients in the various wards. However, due to low admissions in some wards, all patients admitted in these cases were screened for eligibility into the study. Since this study was used to determine prevalence of risk, a non-random selection of patients was justified. A total of 500 adult patients above 18 years of age were screened for eligibility; however, only 384 patients were included in the study. Patients were selected for the study over a period of six months.

3.4.4 Inclusion and exclusion criteria

3.4.4.1 Inclusion criteria

- Informed consent granted
- Over the age of 18 years

- Conscious

3.4.4.2 Exclusion criteria

- Pregnant or lactating
- Psychiatric patient
- Eating disorder
- In ICU, critically ill patient, burn patient or patient on ventilation support
- Renal disease
- Paediatric patient (younger than 18 years)
- Day-care patient

3.5 METHODS OF DATA COLLECTION

Data collection was conducted by the researcher and 2 research assistants. Both research assistants were staff members, trained nutritionists and were registered with the Kenya Nutritionists and Dieticians Institute. Interviews were conducted in both English and Swahili and in instances where there was a language barrier, an interpreter was used. In most cases, this was the caregiver. Standard operating procedures were developed and used to help the researcher and the 2 assistants obtain relevant information for the study. A training was done before a pilot study was conducted, which was to ensure all uniformity of information and data collection procedure. Data was collected on admission, discharge and post-discharge (which was done telephonically). The latter information was needed for the overarching project and will not be reported on in this study. The first researcher would seek for consent from the patients, after which the other two researchers would follow to conduct the interview and assessment. All three researchers moved together to cover the various wards, which was mainly done after the hospital ward rounds. Follow-up of patient on discharge was coordinated by the principle researcher.

The research tool box contained the following:

- Form 1(Appendix A): Participant screening selection; used to determine eligibility for inclusion to the study.
- Form 2(Appendix B): Participant contact details. This was put to use during patient follow-up interview
- Form 3(Appendix C): Informed consent (in both English and Swahili); used to acquire permission from the patients to allow the researcher to collect information from the patient.
- Form 4(Appendix D): Admission data collection; used to collect patients details within 48 hours on admission
- Form 5(Appendix E): Discharge data collection; used for information collection after and during hospital stay
- Form 6(Appendix F): Follow-up form; which was used to collect information 3 months post-discharge.
- Appendix G: Participant checklist; which contained the details of all participants screened to be included in the study.
- One-page pictorial example of a food plate; used as a guide to help patient to visually provide details on food portions consumed
- Portable weighing scale; used to determine the patient weight at the bed side
- Portable stadiometer: used to determine height where patient was mobile
- Flexible, non-stretch measuring tape: used to determine height where patient was immobile
- Clipboards; used for holding writing material
- Copy of research protocol. This was shown to the departmental heads before the team could start the data collection process initially.

3.5.1 Participant screening

A checklist was developed for ease of selection of participants, which included the inclusion and exclusion criteria.

To identify the patients who were eligible for inclusion in the study, the research team examined the ward admission book to access relevant patient information such as date of admission, age, primary diagnosis and bed number.

The researcher and the assistants explained the study in brief to the patients who were to be included in the study. Thereafter, each patient voluntarily signed the consent form, a copy of which was left with the patient. A unique identifier was written on the consent form retained by the researcher, and all the documents were kept by the researcher. The screening forms were also retained by the researcher and were considered confidential.

3.5.2 Admission and discharge data collection

Separate data collection forms were administered by the interviewer to help collect demographic, dietary, medical, anthropometric and clinical information from the patient. These forms were administered at different intervals.

Admission data collection form

The admission form was designed to gather details such as the patient's gender, age, admission ward, diagnosis on admission, dietary intake and history, anthropometry and clinical information. This information was collected at the patient's bedside within 48 hours of patient admission.

Discharge data collection form

This form was developed to determine the patient's hospital treatment and malnutrition-related outcomes. The form was only completed if the patient LOS exceeded seven days. It included details that indicated the patient's disease state on discharge, dietary intake, anthropometry and clinical information in addition to complications that had occurred during hospitalisation and were still present on discharge.

This form was administered on hospital discharge or Day 21 for those with a longer hospital stay.

The interviewers made ward rounds each weekday to ensure that no patient was overlooked or discharged before information could be obtained from them. However, discharge information on patients released during the weekends was not recorded.

3.5.3 Research instruments

3.5.3.1 Data collection form

A structured data collection form was used to record the following patient information. It took approximately 30 minutes to correctly and completely fill in the form with the patient details. The data collection form details are discussed below:

Demographic data

These data comprised date of admission and discharge, age, gender, referral to dietician/nutritionist, home address and telephone number. Contact telephone numbers were kept separately and used to contact the patient for the three-month post-discharge part of the study.

Anthropometric data

The anthropometric measurements were takenusing standard measuring techniques. Weight and height were determined in kilograms and metres respectively. A bathroom scale was used to determine the weight, which was recorded to the nearest 0.1 kg. The weighing scale was calibrated to zero before any measurement was taken. The scale was placed near the patient's bed on a flat surface, and the patient was requested to wear minimal clothing to ensure accuracy of weight measurement. A portable stadiometer was placed next to a wall to determine the patient's height. The patient was asked to stand next to the wall with legs straight and knees together. A measuring stick was then lowered down to press against the patient's hair, and the reading was made at eye level. The height measurement was recorded to the nearest 0.1 cm. These measurements were used to calculate the BMI. Changes in body weight per month for the

three months prior to their admission were also determined through interviewing the patients.(72)

Clinical data

Oedema was assessed around the orbital, ankle and sacral areas.(26,73,74) Weight was corrected according to the table below to determine the actual weight.

Table 3.1: Body weight adaptations according to degree of oedema (74,75)

Degree of oedema	**Correction factor**
Mild	Actual Body weight minus 1 kg
Moderate	Actual body weight minus 5 kg
Severe	Actual body weight minus 10 kg

Dietary intake

Information on changes in feeding patterns before admission and during hospital stay was gathered. This was determined for a period of one to two weeks prior to admission and during the hospital stay. A pictorial food plate example was shown to the patients to help guide the choices. This was interpreted as an intake of less than 75% (¾ plate) to indicate a moderate reduction in usual food intake and an intake of less than 50% (½ plate) to indicate a severe reduction.(72,76)

Medical information

This was obtained from the patient's medical files to determine the primary diagnosis made after admission and the development of any complications during the hospital stay. The presence of

any gastrointestinal disorders was also noted since such disorders are also determinants associated with risk of malnutrition.

3.5.4 Research instrument: NRS-2002 Screening Tool

The instrument of choice in determining the risk of malnutrition in this research was the NRS-2002.(9,59) Using this tool, data were collected and recorded on both admission and discharge to ensure uniformity. The field workers were trained on the use of the tool prior to the study.

The NRS-2002 developed by ESPEN has been recommended for hospital nutrition screening in various studies in Europe and other parts of the world. Not only is this tool able to indicate the current nutritional status, but it also provides details of the patient's nutritional status before admission and indicates patients at increased risk of malnutrition. The NRS-2002 mainly considers the BMI, unintentional weight loss, changes in food intake and severity of the disease, which were important components of the assessment.(59,75,76) The NRS-2002 comprises two screenings, the initial screening and the final screening. The initial screening considers BMI, weight reduction, food intake and severity of illness. If the answer 'Yes' is given to any question in the initial screening, it qualifies the assessment for the final and second screening. The second screening considers the presence of impairment of nutritional status and severity of disease, and a score of >3 qualifies one to be considered at increased nutritional risk. For patients above 70 years of age, an adjustment of one is added to the total score.(38) Table 3.2 below indicates the components of the NRS-2002.

Table 3.2: Nutrition risk assessment – NRS-2002(59)

Section 1: Initial screening			
1	Is the BMI <20.5?	Yes	No
2	Has the patient lost weight within the last three months?		
3	Has the patient had a reduced dietary intake in the last week?		
4	Is the patient severely ill? (e.g. in intensive therapy)		
***Yes*:** If the answer is 'Yes' to any question, the second (final) screening is performed. ***No*:** If the answer is 'No' to all questions, the patient is re-screened at weekly intervals. If the patient is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.			

Section 2: Final screening			
Impaired nutritional status		Severity of disease (≈increase in requirements)	
Absent: Score 0	Normal nutritional status	Absent Score 0	Normal nutritional requirements
Mild: Score 1		Mild: Score 1	
Moderate: Score 2		Moderate: Score 2	
Severe: Score 3		Severe: Score 3	
Score		Score	Total score
Age: If ≥70 years, add 1 to total score = age-adjusted total score			
Score ≥3: The patient is nutritionally at risk and a nutritional care plan must be initiated.			

Score <3: Weekly rescreening of the patient. If the patient for example is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.

3.5.5 Training of field staff

Staff was trained for one day, and all staff who were involved in the study were included. The criterion for qualifying as a data collector was being a staff member with a basic knowledge of nutrition and preferably qualified with a recognised certification. The field staff involved in the study met the requirement. The staff selected included nutrition volunteers at the facility since they were familiar with the study environment. Training materials were provided for them, and practical sessions were conducted to help in standardisation and their understanding of the tool. The SOPs that were developed earlier were provided during the training, and the staff signed a contract of agreement with the principle investigator. This contract acted as a guide for the field work procedures and indicated the expected conduct during execution of the work. During the training, the field staff were also informed of the research objectives and content, and their roles in the research study were clearly stated.

3.5.6 Pilot study

The pilot study was conducted at the Mbagathi District Hospital on a total of 10 eligible patients who were randomly selected from the medical, surgical and TB wards. The objective was to test the methods and data collection tools in addition to the adequacy of human resources in preparation for the actual data collection. No corrections were necessary to the tools after the pilot study and the data was excluded from the database of the main study.

3.6 DATA COLLECTION

Data were collected by both the principle investigator and the research assistants. Clear instructions were given to limit difficulties. Spot checks were also done to ensure correct procedures were followed.

3.6.1 Data quality

Data quality was an important component of this study. Reliable data needed to be harvested and analysed to be able to determine the outcomes of the study and to achieve the study objectives. To ensure that the correct information was recorded, double data entry to compare the data entered was carried out daily at the end of the data collection by two separate data clerks. In addition, counter checking was done by the principle investigator. Each form was checked before entry into the system to ensure that only correct information was keyed in. In cases where the information was unclear, reference was made and where possible, the patient was re-examined again.

Both weight and height measurements were verified on randomly selected patients after the first measurements had been taken. This was to ensure that there were no errors in the measurements. Most of the measurements tallied or demonstrated little difference. In the few cases that showed a significant difference, a third measurement was collected and an average weight calculated.

Before any new measurement was taken, the researcher ensured the weighing scale reading was at zero. After every 50 patients, the scale was rechecked to ensure its accuracy.

3.7 DATA CAPTURING

Data entry was done manually into an Excel spreadsheet. Collected data was entered every evening. A second person repeated the entries to ensure accuracy. All variables were included in

the data log and information keyed in as required. Both ordinal and nominal data were determined and entered as numbers and letters respectively.

3.8 DATA ANALYSIS AND STATISTICS

Microsoft Excel was used to capture the data, and the data analysis software system, Statistica version 13.2 (StatSoft Inc. www.statsoft.com) was used to analyse the data. The analysis was done with the assistance of a statistician assigned by the university.

Descriptive data

These data comprised the profiles of the adult hospitalized patients who were involved in the study. The information presented basic characteristics that included gender, age, height, weight, ward category and diagnosis category. Information in this section provided a general understanding about the population under study. The information was presented as ranges, means and standard deviation.

Comparative analysis

The following inferential tests were performed.

Analysis of variance (ANOVA) was used to determine the relationships between continuous and nominal variables such as the relationship between those identified to be at risk of malnutrition and those referred for nutrition support.

Exact tests were used where the expected cell frequencies were <5.

When comparing one continuous and one binary variable, if the continuous variable was normally distributed, the Student's T-test and Levene's test were used. If it was not normally distributed, the Mann-Whitney U test was employed.

A 5% significance level was used throughout the hypothesis testing, while a 95% confidence interval described unknown parameters.

Specific analysis

- Anthropometric measurements

The weight and height of the patient were used to determine the BMI, which was calculated as: BMI = weight (kg) / Height (m^2). A BMI of <18.5 kg/m^2 indicated under nutrition, 18.6–24.9 kg/m^2 represented a normal value, and >25 kg/m^2 indicated overnutrition.(56)

The usual weight of the patient was also recorded and weight loss calculated using the formula, weight loss = usual weight - current weight.

- Nutrition Risk Assessment (NSR-2002)

The NRS-2002 tool was completed for all eligible patients on admission and during discharge. The tool consisted of two sections. In Section 1, a positive answer qualified the patient to be evaluated in Section 2. Section 2 had four categories comprising both nutritional impairment and disease severity. Age was also considered, and a final score of ≥3 was interpreted as at risk of undernutrition.(56,58,59)

3.9 ETHICS

The research was approved by the Stellenbosch University Health Research Ethics Committee (N14/06/061), Kenyatta National and Hospital Ethics Committee (P711/12/2014) and the Mbagathi District Hospital Ethics Committee. After all the approvals were obtained, a research permit was issued by the National Council of Science and Technology (NACOSTI/P/15/0442/5859).

Standard operating procedures (SOPs) were developed, and these guided the research. The SOPs were developed centrally since the study was part of a multicentre study and they were to be used in the different study centres. Using the already developed SOPs, the researchercustomised them for the Mbagathi District Hospital.

3.10 INFORMED CONSENT

All patient information and consent forms were available in both English and Swahili since these were the most common languages among the participants.

Only participants who agreed to sign a consent document were included in the study. Each participant signed two informed consent forms; one was left with the participant and the other was retained by the researcher. The consent document contained a brief overview of the study. Complete understanding of this by the participant was required before signing consent.

The patient's name, telephone number (or contact number of the caregiver) and other identification details were not included in the forms but instead were entered into a different spreadsheet. This was important for the post-discharge follow-up, which was done telephonically.

All participants were given a unique number, which indicated the hospital research code first (E-00). Data were captured using these numbers, and no identification of persons was possible based on this system.

Collected information and data were only made accessible to the researcher for confidentiality purposes.

3.11 CONFIDENTIALITY

Patients' confidentiality was maintained, and no information was shared.

3.11.1 Medical records

All patient information, including information obtained from the medical files, was kept confidential. No personal information was made public. All participants remained anonymous.

3.11.2 Patient contact sheet

This form indicated the contact details of the patients who agreed to participate in the study. The information was collected from each patient at the bedside after consent had been received. The details were recorded separately for each specific patient and entered into Excel against the unique identifier. The unique patient number was used throughout the different forms. This contact information was especially useful for the post-discharge follow-up.

3.11.3 Obtaining anthropometric information

This was carried out by the bedside. Curtains were drawn to ensure privacy for the patient when taking the anthropometric measurements. Where this was not possible, the triage room next to the nurses' station was used.

3.12 STORAGE AND DATA HANDLING

All forms will be stored in labelled files by the principal researcher for the next five years. Forms displaying details of patients' personal information such as names were destroyed since they were not needed anymore.

3.13 CONFLICT OF INTEREST

A grant was received from the Harry Crossley Foundation, Stellenbosch University. The researcher had no conflict of interest to declare.

3.14 BENEFITS AND RISKS

Benefits: There were no direct benefits for the participants in this study. However, the study established certain baseline data on adult malnutrition and revealed additional areas for future research in Kenya. The study will also enable the researcher to obtain a master's degree.

Being an observational study, the study recommendations for improved patient service delivery will ultimately benefit the patients.

Incentives: Participation was purely voluntary; no incentives were given as motivation.

Risks: Onepossible risk anticipated was the contact between the researcher/research assistants and the patients demonstrating communicable diseases such as TB, especially multi-drug-resistant Tuberculosis (MDR-TB). To address this risk, the researcher and assistants wore masks.

3.15 TIME SCHEDULE

The pilot study was conducted in July 2015. Data collection began two weeks later (July) and continued until January 2016. Data were, therefore, collected within six months.

3.16 REPORT

The results of this study will be published in a peer-reviewed journal and will be available online via SUNScholar at Stellenbosch University. A presentation will be made to deliver the results to the Mbagathi District Hospital. A hard and a soft copy of the thesis will also be submitted to the hospital to meet the terms of the agreement reached during the ethics approval. Since the study adds to the research conducted in Kenya, a soft copy and two hard copies will be given to the National Commission for Science, Technology and Innovation (NACOSTI) in order to meet the requirements for research in the country.

3.17 DEVIATIONS

Minor deviations were made from the original protocol:

- In certain wards, all patients were screened for eligibility and not sampled as stated previously in the protocol since the numbers were very few.
- Some patients had very short stays in hospital; this resulted in deviations from the protocol since convenience sampling was preferred for this study over random sampling.

CHAPTER FOUR: RESULTS

4.1 INTRODUCTION

Chapter Four contains the analysis of the research data collected and seeks to address the four main objectives of the study. The chapter investigates the prevalence of the risk of malnutrition on admission to address Objective 1 and compares the nutritional risks against disease categories to address Objective 2. Changes in nutritional status between admission and discharge are explored to address Objective 3, and the percentages of patients referred for nutrition support are determined for Objective 4.

4.2 STUDY POPULATION

On admission, a total of 500 patients were screened for study eligibility. Of these, 116 patients did not meet the entry criteria and were excluded, leaving a sample of 384 participants for the study. A total of 94 patients were interviewed upon their exit from hospital. Their discharge information was captured since their LOS exceeded seven days. A further 85 patients were reported as having been discharged early (before discharge information could be captured), 197 were discharged over the weekends or discharged against medical advice, 3 patients were discharged to other hospitals and 5 patients were reported to have died. The selection process is summarised below in Figure 4.1.

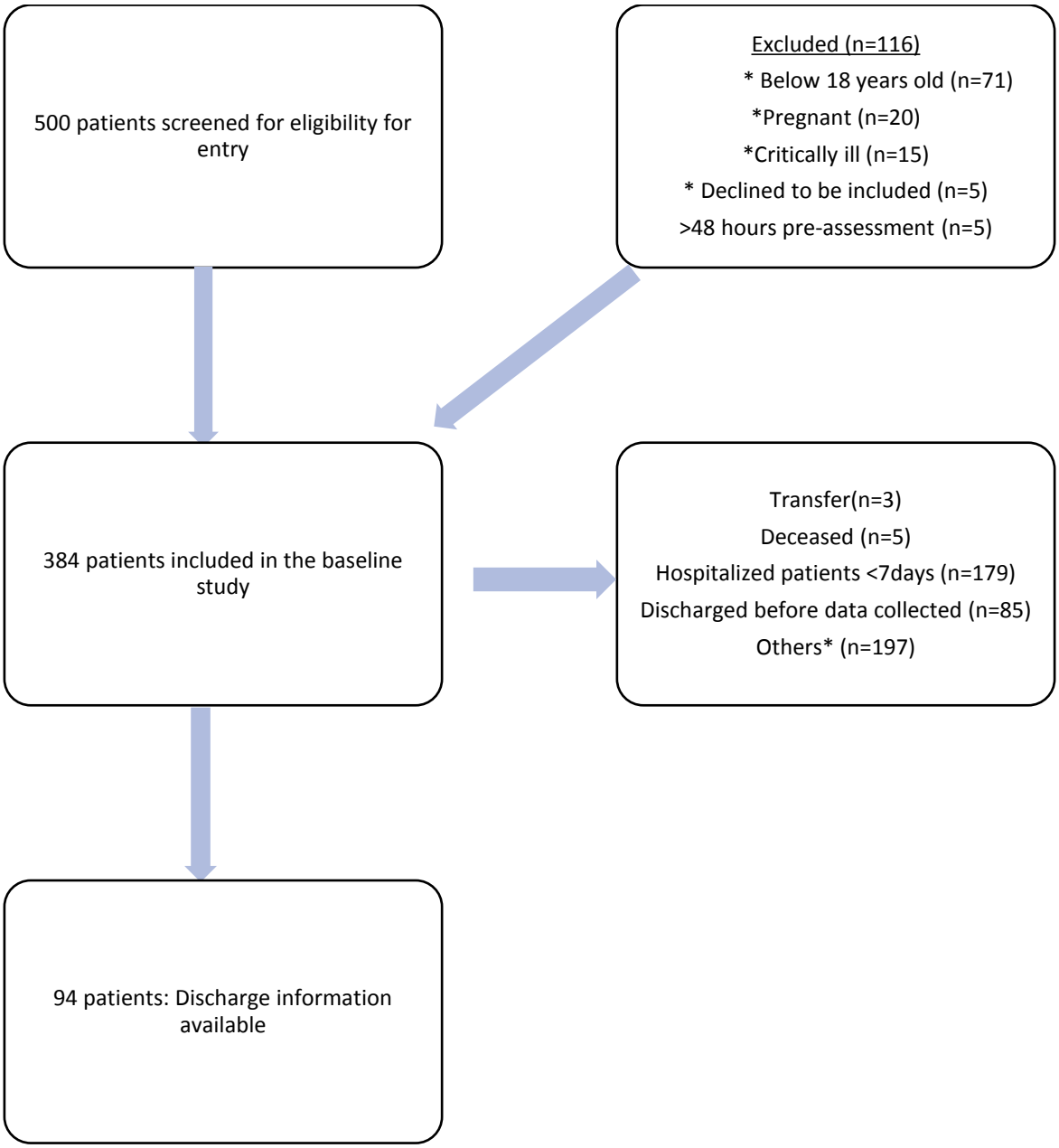

Figure 4.1: Screening and inclusion process

*Others: Discharged on the weekend or discharged against medical advice

4.3 ADMISSION DATA

4.3.1 Patient demographic profile

The majority of the study sample comprising 384 patients (55.2%, n=212) were females, and 44.8% (n=172) were male. The mean age of the patients was 39.7 ±13.8 years (range: 19−73 years).

Patients who participated in the study represented four major ward categories, General Medicine, Surgery, Oncology and Gynaecology. The majority of the participants in the study were admitted to the general medical wards (95.5%, n=367). Of the remainder, 2.8% (n=11) were admitted to the surgical ward and 1.04% (n=4) to the oncology ward. Only 0.26% (n=1) was admitted to the gynaecology ward.

4.3.2 Specific diagnostic categories on admission

The most common condition reported as the primary disease was HIV/TB, affecting 45.3% (n=174) of those admitted. This was followed by gastroenterological conditions (14.8%, n=57) and neurological and respiratory conditions, which affected 8.0% (n=31) of patients in both categories. In addition, some patients were admitted with haematological disorders (7%) and endocrine-related diseases (6%). Figure 4.2 below indicates the distribution of the primary disease diagnoses.

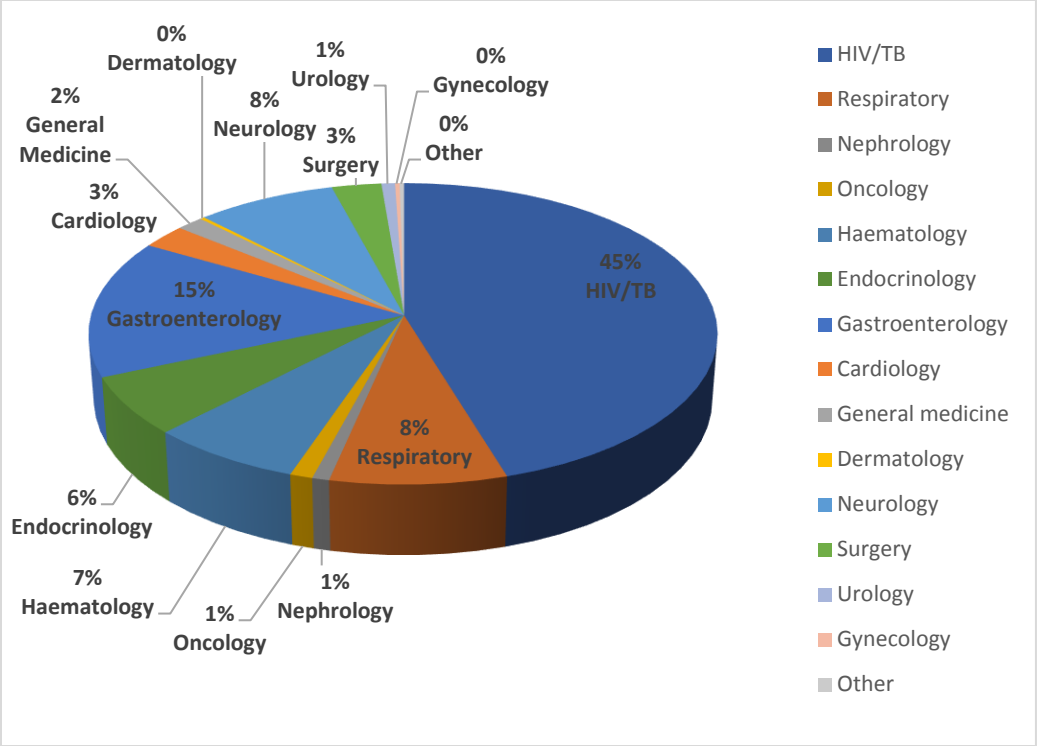

Figure 4.2: Percentage primary diagnosis on admission

4.3.3 Gastrointestinal tract complicationson admission

On admission, patients were asked about the presence and frequency of gastrointestinal tract (GIT) side effects. Information was obtained for the presence of nausea, vomiting, diarrhoea, anorexia and constipation over a period of one to two weeks prior to admission. Most patients did not experience any side effects except for anorexia (66%, n=253), which was experienced almost daily for two weeks at the time of admission. Figure 4.3 presents a summary of the GIT side effects recorded on admission.

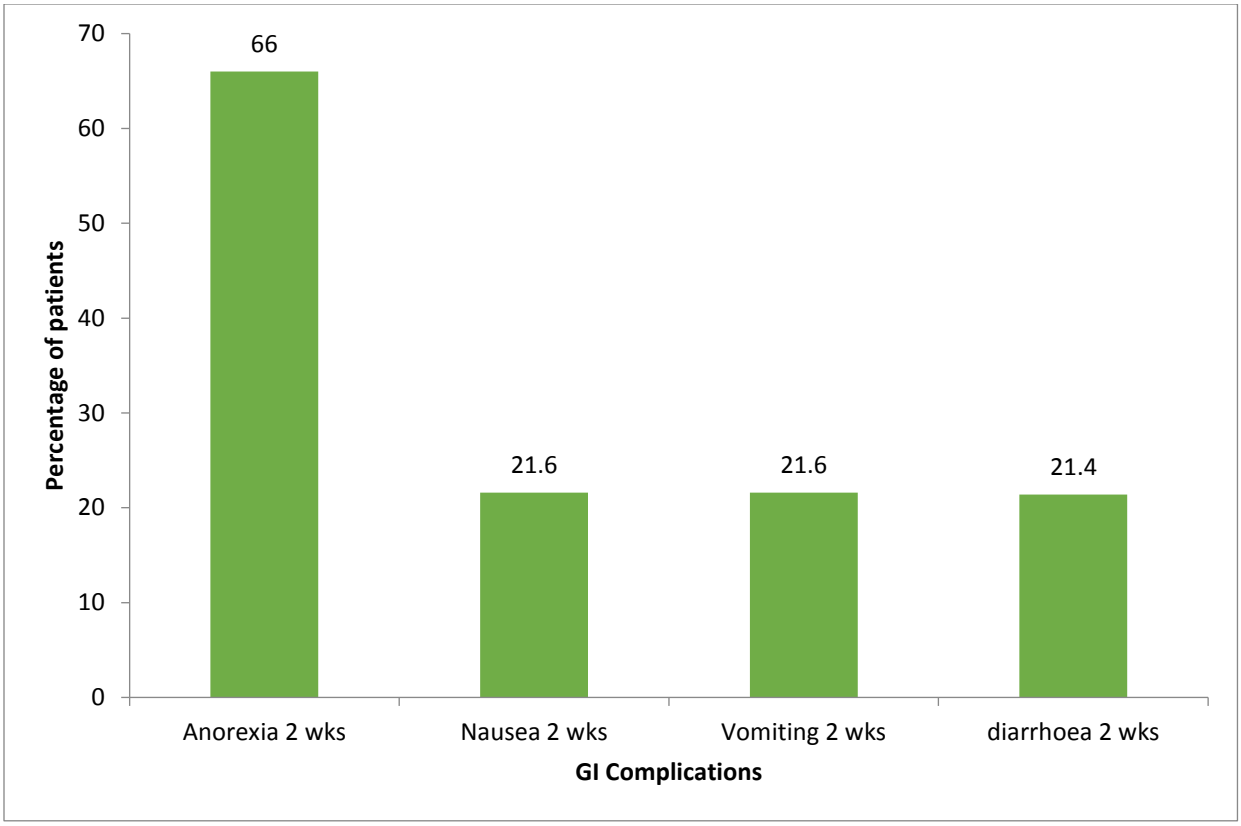

Figure 4.3: Percentage occurrence of gastrointestinal complicationson admission

GI: Gastrointestinal; wks: weeks

2 wks: Refers to symptoms experienced two weeks prior to admission to hospital

4.3.4 Dietary intake on admission

Patients were asked to provide information regarding dietary intake one week prior to admission. Almost one-third (30.2%, n=116) of the patients reported a one-quarter reduction in their normal intake, 24.7% (n=95) reported to have decreased their intake by one-half, 14.8% (n=57) reported a decrease of three-quarters, 6.3% (n=24) were completely unable to feed, and 23.9% (n=92) of the patients reported no change in food intake (Figure 4.4).

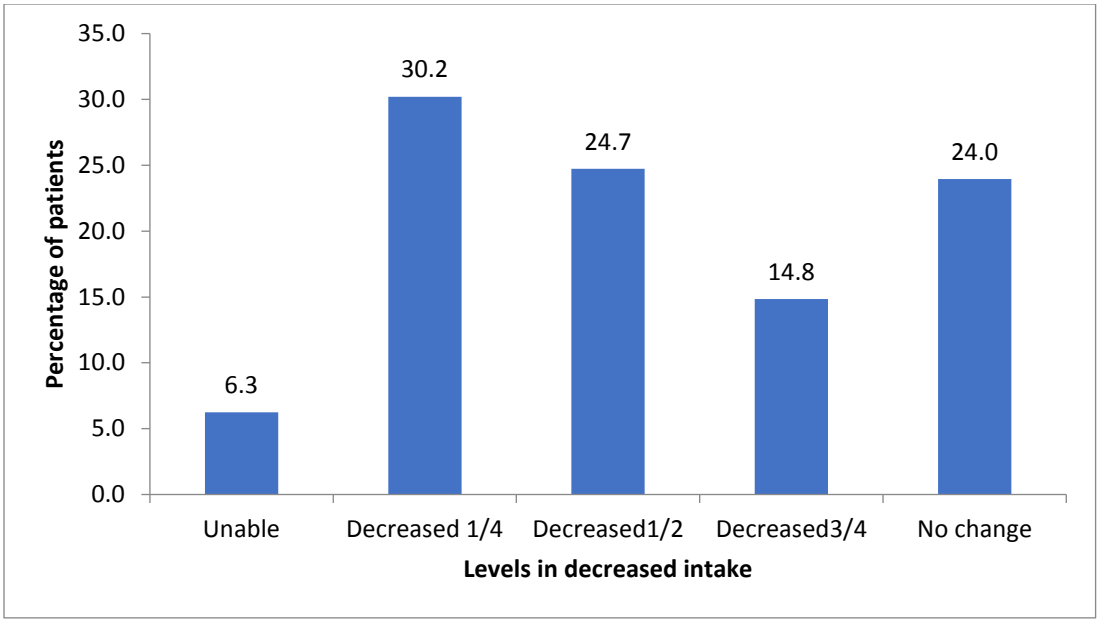

Figure 4.4: Percentage change in dietary intake

Unable: Not able to take in food; No change: No change in food intake, 2 weeks prior to admission

4.3.5 Anthropometric data

4.3.5.1 Height and weight on admission

Weight and height measurements for all patients were taken either through measurement or estimation in kilograms and centimetres respectively. In cases where the patients were unable to stand, the knee length was used to determine the height of the patient and estimated BMI used to determine the estimated or Ideal body weight.The average weight of all the participants on admission was 53.1 ±12.7 kg. The mean height of all patients was 165.7 ±8.0 cm (range: 144.1−190.0 cm). Gender specific details are included in Table 4.1.

Table 4.1: Anthropometric measurements on admission

Measurement	n	Mean	SD	Minimum	Maximum
Weight (kg)	383	53.1	12.7	30	92.2
Weight corrected for oedema (kg)	384	52.2	12.9	20	92.2
Weight corrected for oedema – females (kg)	211	50.4	14.0	20	92.2
Weight corrected for oedema – males (kg)	173	54.4	11.2	30	90.0
Height (cm)	384	165.7	8.0	144.1	190.0
Height – females (cm)	211	162.5	7.3	144.1	190.0
Height – males (cm)	173	169.6	7.0	154.0	189.0
BMI (kg/m^2)	384	19.1	4.94	8.2	39.4
BMI corrected for oedema (kg/m^2)	384	19.1	4.9	8.2	39.4
BMI corrected for oedema – females (kg/m^2)	212	19.2	5.6	8.2	39.4
BMI corrected for oedema – males (kg/m^2)	172	18.9	3.8	10.6	31.9

BMI: Body mass index; SD: Standard deviation

There was no oedema present in 70.8% (n=272) of patients, with mild (19.5%, n=75), moderate (5.5%, n=21) and severe (4.2%, n=16) oedema present in the remaining cases. The latter was used to determine how much weight was to be subtracted to establish the correct dry weight.

4.3.5.2 BMI category on admission

The BMI of each patient was determined on admission and classified using the cut-off points according to the World Health Organization. After correction for oedema, the average BMI for 384 patients was determined as 19.1 kg/m^2 ±4.9 SD. Furthermore, 51.4% (n=195) of the patients had a BMI of <18.5 kg/m^2, indicating that more than one-half of the patients were underweight, with more females (55%) being underweight than males (45%). The percentage of patients with a normal BMI ranging between 18.6 kg/m^2 and 24.9 kg/m^2 was 19% (n=73). Additionally, 20% (n=78) had a BMI between 25 kg/m^2 and 29.9 kg/m^2, indicating overweight (Female: 73%, Male: 27%), while 10% (n=38) had a BMI >30 kg/m^2, indicating obesity. This category demonstrated more female patients (83%) to be obese than male patients (17%) (Figure 4.5).

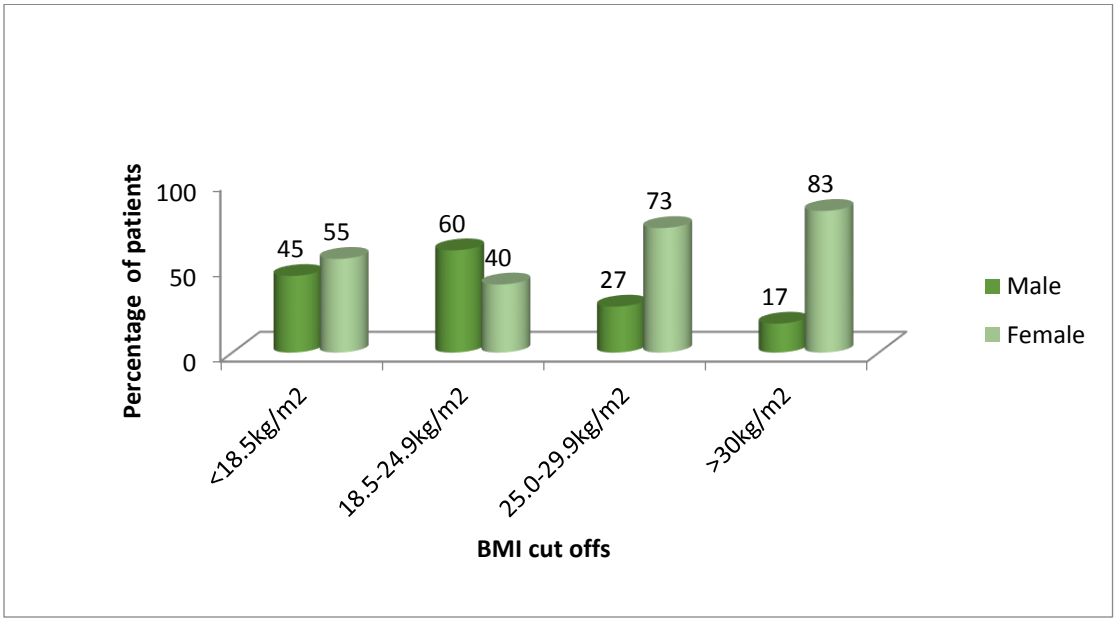

Figure 4.5: Percentage BMI categories by gender on admission

Mean BMI levels varied considerably among the different diagnostic groups. Patients diagnosed with HIV/TB recorded the lowest mean BMI (17.47 kg/m^2), which was significantly lower than all the other categories (p=<0.01), indicating that patients with retroviral diseases were more likely to have low BMIs than in patients in other diagnostic groups and consequently be at an increased risk of malnutrition (undernutrition) (Figure 4.6).

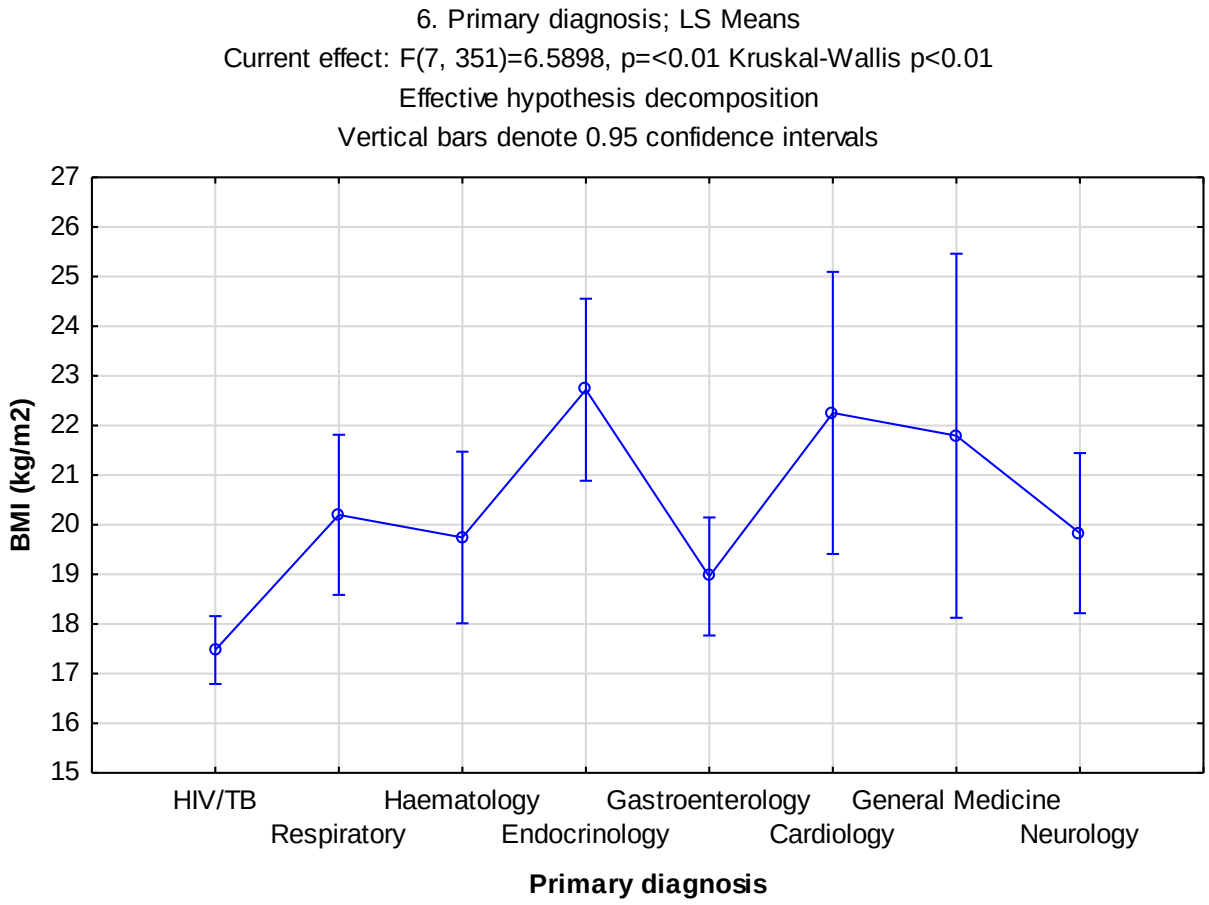

Figure 4.6: Mean BMI according to primary diagnosis

BMI: Body mass index; HIV: Human Immunodeficiency Virus; TB: Tuberculosis

4.3.5.3 Weight loss prior to admission

A significant reported weight loss of more than 5% one month prior to admission was determined , with 45.6% (n=175) of the patients reporting to have lost more than 5% of their usual body weight. Furthermore, 18.2% (n=70) reported a weight loss of not more than 5%, while 36.2% (n=139) did not report weight loss. The average weight loss from the usual weight was 12.6 ±12.5 kg, while the median weight loss was 10.4 kg.

Patients diagnosed with HIV/TB recorded a mean percentage weight loss of 15.5% (n=113), followed by respiratory tract infections (11.1%, n=18). The second-least reported weight loss was for patients suffering from GIT conditions (8.9%, n=39) The difference in reported weight loss among the different diagnostic categories was not significant (p=0.13).

4.3.6 Prevalence of nutritional risk on admission

The NRS was determined for all 384 patients enrolled in the study. The mean NRS on admission was 3.39 ±1.09 SD, while the median score was 4 (a score of ≥3 indicates nutritional risk).

In this study, 49% (n=188) of patients had a score of 4, followed by 24% (n=92) who had a score of 3 and 8% (n=31) who had a score of 5 (Figure 4.7).

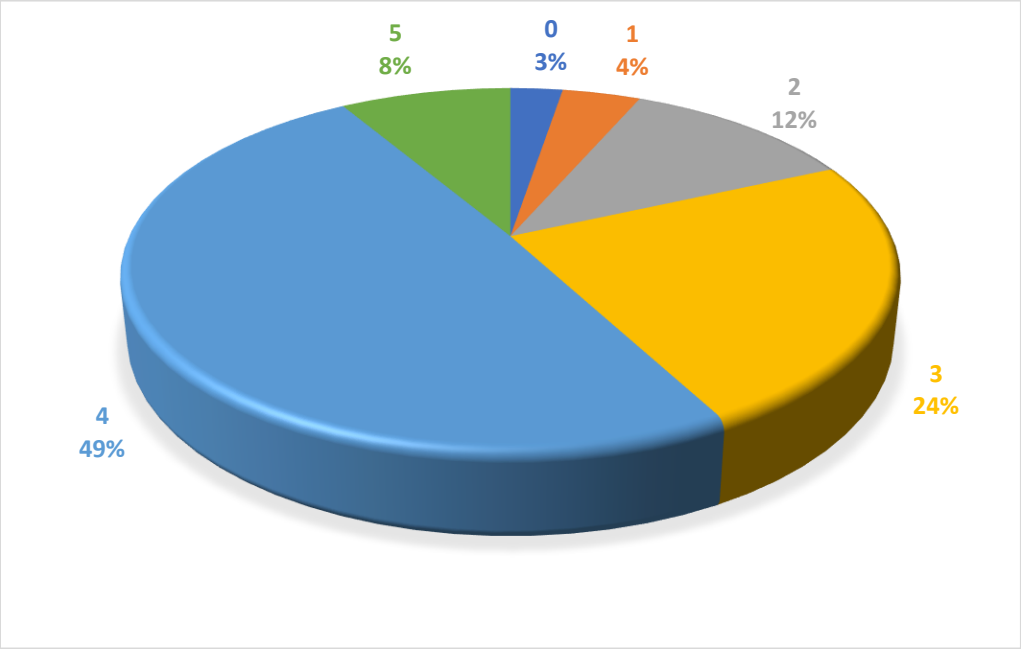

Figure 4.7: Percentage total nutrition risk score

NRS: Nutrition risk score

*0–5: NRS against percentage patients

As indicated in Figure 4.7, 81.8% (n=314) of patients were reported to be at nutritional risk on admission to hospital. To address Objective 1, the prevalence of the risk of malnutrition on admission at Mbagathi District Hospital in Kenya is 81.8%.

4.3.7 Primary diagnosis and risk of malnutrition on admission

Data from the 384 patients with the various disease categories indicated that most patients were at nutritional risk, as illustrated in Figure 4.8.

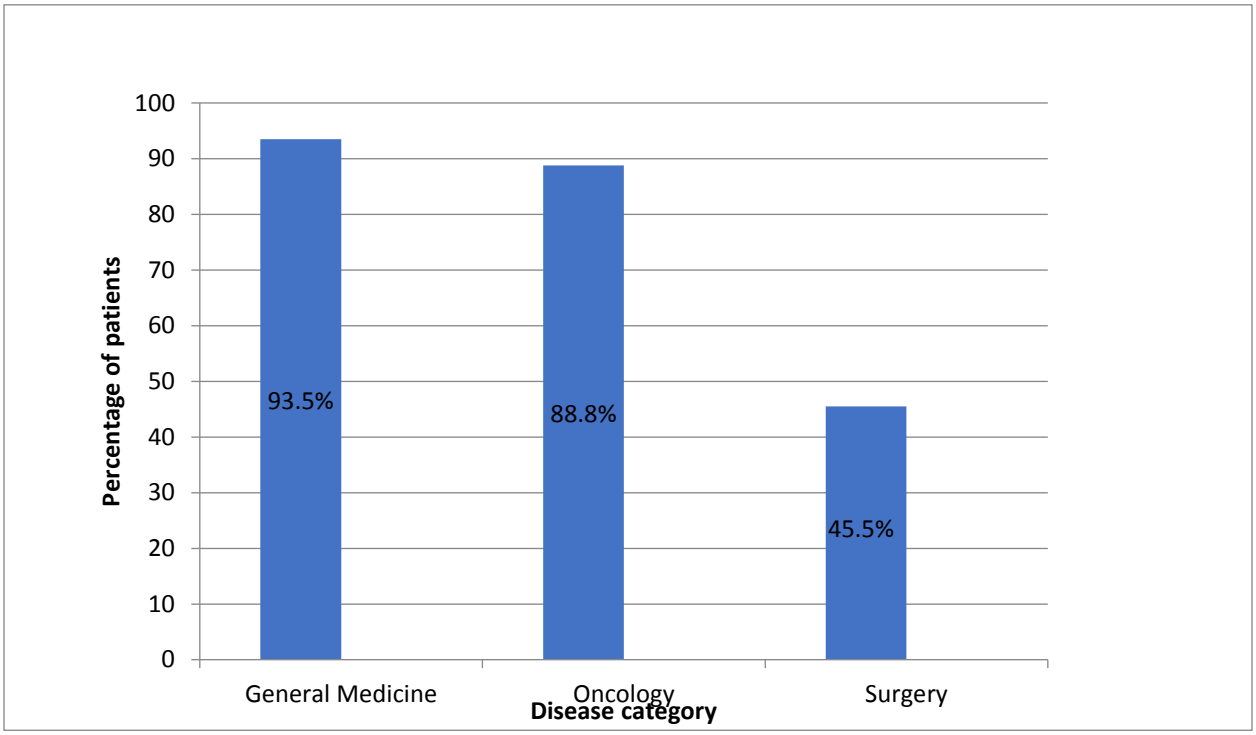

Figure 4.8: Percentage risk of malnutrition in various disease categories on admission

The majority of patients demonstrating a risk of malnutrition were from the general medical wards.

The differences among the diagnostic categories were significant (Chi-square = 34.79; p=0.000). The general medicine patients diagnosed with HIV/TB complications and respiratory and GIT

infections were at a significantly higher risk of malnutrition than patients in the other disease categories.

4.3.8 Patients referred for nutrition support on admission

Of the 314 patients identified on admission as being nutritionally at risk, only 41.0% (n=129) were reported to have been referred for nutrition support (Chi-square = 2.29; p=0.129). No statistical difference was demonstrated, meaning that patients identified as malnourished were not more likely to be referred for nutrition support.

The source of referral was either the doctor or the nutritionist. Of the 129 patients referred, 127 patients were referred by nutrition staff and the other2r patients reported to have been referred by other clinical staff.

The nutrition support offered included enteral nutrition (EN), parenteral nutrition (PN), a combination of EN and PN, oral nutrition supplements (ONS) and nutrition counselling during the hospital stay. Of the 129 patients referred for nutrition support, only 47.3% (n=61) received intervention. Of these, 91.6% (n=55) were placed on ONS, 5% (n=3) were placed on EN and 4% (n=3) were placed on enriched porridge and received other nutritional support that included counselling. No patients were placed on PN or the combination of EN and PN. Enteral nutrition supplements (both full tube feeds and drinks) were administered for a minimum of two days, enriched foods for seven days and supplement drinks for one to seven days depending on the condition of the patient. On average, patients were reported to receive nutrition support for two to four days.

4.3.9 Association between nutritional risk status on admission and selected outcomes

Chi-square tests were done between the variable ‘at nutritional risk’ and other categorical indicators including gender, diagnosis category, referred for nutritional support and BMI category

to determine if there are associations between a patient's nutritional risk status and the various indicators.

For gender, the data of 384 patients were included in the analysis. The majority of patients of both genders were found to be at nutritional risk (93.8% females; 90% males), with no significant difference between gender (Chi-square = 2.25; p=0.134).

The number of malnourished patient referrals for nutrition support was not related to the number of patients identified as malnourished since only 41% of the 314 patients who were identified as malnourished were reported to have been referred for nutrition support (Chi-square = 2.29; p=0.129).

4.4 DISCHARGE DATA

The information portrayed under discharge data reflects the in-hospital period and is based on findings from 94 participants.

4.4.1 Patient discharge profile

Information on discharge was obtained from a total of 94 participants (40 male and 54 female). The majority of patients (78.9%, n=75) were discharged home, 2.1% (n=2) were discharged to other hospitals, 13.6% (n=13) went into the care of relatives, 4.2% (n=4) were discharged to other nursing homes, and 1% (n=1) was deceased on discharge. The average LOS in hospital was 7.5 ±5 days, while the median LOS was 5 days.

4.4.2 Complications developed during hospitalization

The majority of Participants (90%, n=85) developed complications during hospitalization. On average, 2.14 ±0.9 complications were documented, with a median of 2. Figure 4.9 indicates the percentage of participants against the number of complications developed in hospital.

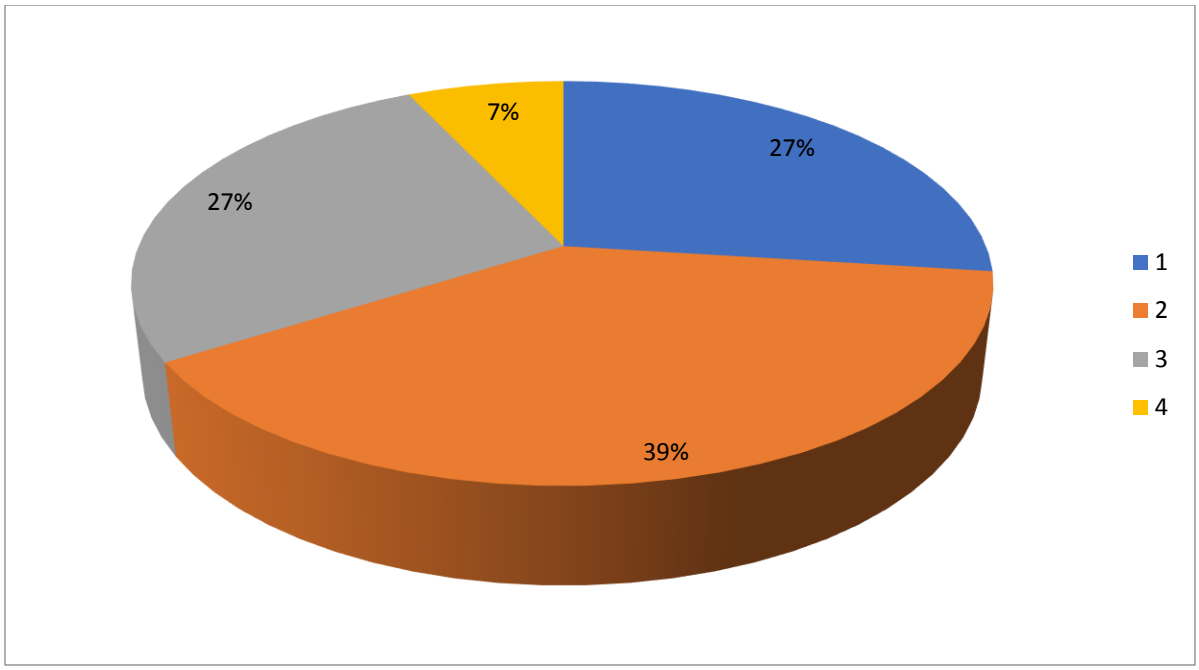

Figure 4.9: Number of complications developing during hospitalization

4.4.3 Gastrointestinal tract symptoms

There was a change in the frequency of GIT complications experienced during hospitalization. These side effects included as in figure 4.10; diarrhoea, vomiting, nausea, constipation and anorexia. The majority of patients appeared to stop experiencing most of the side effects during treatment in hospital. However, anorexia still occurred in more than three-quarters of the patients (76.6%, n=72), as illustrated in Figure 4.10 below.

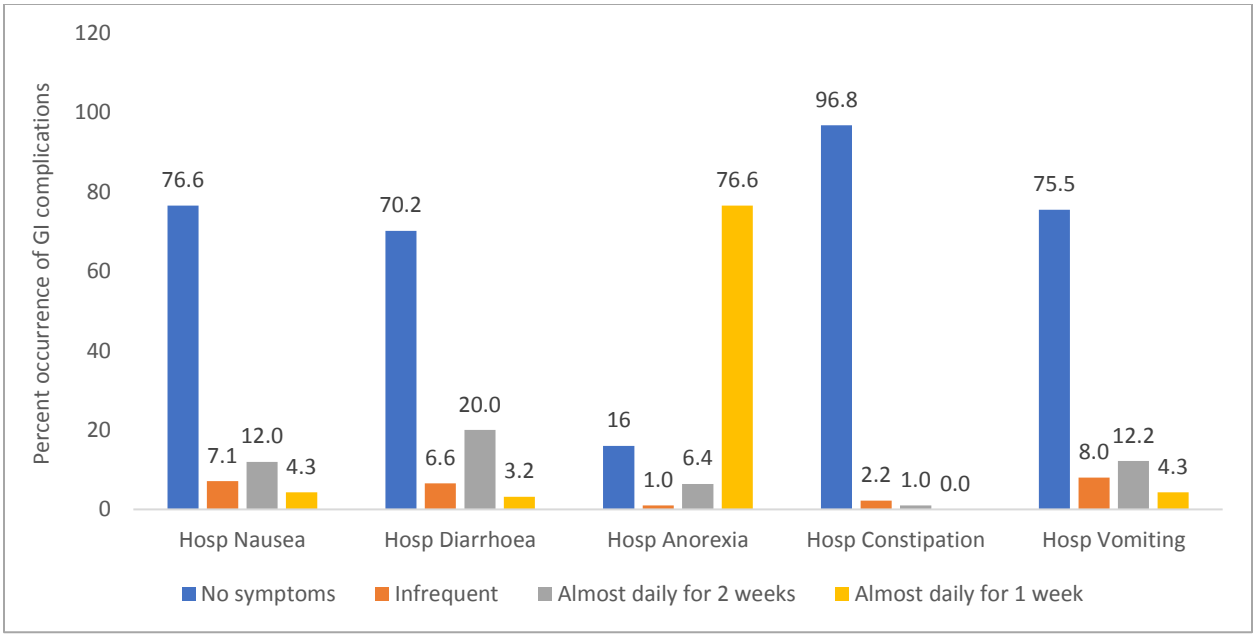

Figure 4.10: Occurrence of gastrointestinal complications during hospitalization

GI: Gastrointestinal,

4.4.4 Dietary intake and referrals for nutrition support during hospitalization

Changes in dietary intake were also determined during hospitalization, with 67.3% (n=62) of the patients reported to have experienced a reduction in food intake during this period.

Of the 94 patients assessed on discharge, 77.6% (n=73) were identified to be at risk of malnutrition. Of these, 80.8% (n=59) were referred for nutrition support during their hospital stay, as reported at the time of discharge.

4.4.5 Prevalence of nutritional risk status on discharge

The average NRS on discharge was 3.79 ±1.09 SD, with 77.6% (n=73) of assessed patients reported to be nutritionally at risk There was, however, no statistical significance relating a single primary diagnosis to the risk of malnutrition ($p>0.05$).

4.4.6 Anthropometric data on discharge

Each of the 94 participants weight was calculated upon discharge. The mean weight was 52.42 ±14.5 kg, which was slightly lower than the mean admission weight of 53.1 ±12.7 kg.

Similar to the data collected on admission, there was no presence of oedema in the majority of patients on discharge (86.8%, n=81). The remaining few patients had mild (9.9%), moderate (2.2%) and severe (1.1%) forms of oedema. This level of oedema was used to calculate the corrected weight.

4.4.6.1 Weight changes during hospitalization

Slightly over one-half (56.6% n=51) of the patients assessed on discharge had lost weight in hospital, with 28.8% (n=26) of these losing more than 5% of their total weight. Significant differences in the percentage weight loss were found among the primary diagnostic categories, with the HIV/TB group experiencing the greatest percentage loss at 15.5% (p=0.027). This is illustrated in Figure 4.11 below.

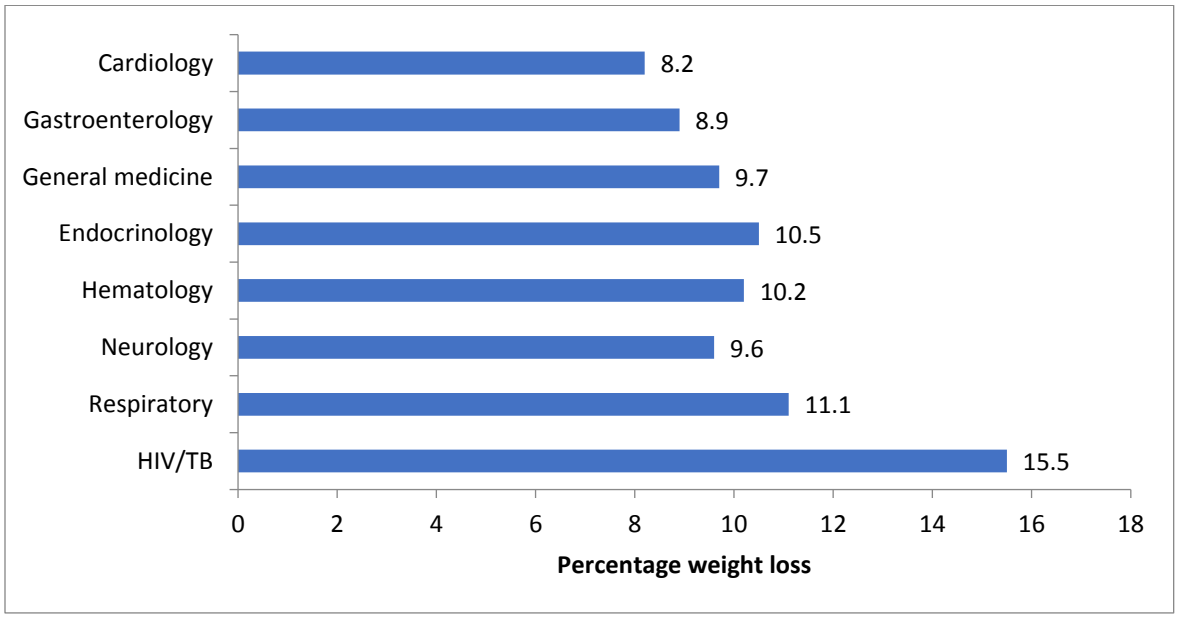

Figure 4.11: Percentage weight loss against disease category

4.4.6.2 BMI categories on discharge

The average corrected BMI on discharge was 19 ±5.5 kg/m^2. Slightly over one-half of the patients (55.4%; n=52) had a BMI of <18.5 kg/m^2, 16.3% (n=15) had a normal BMI ranging between 18.5 kg/m^2 and 24.9 kg/m^2, and 28.3% (n=27) had a BMI >25 kg/m^2 (Figure 4.12).

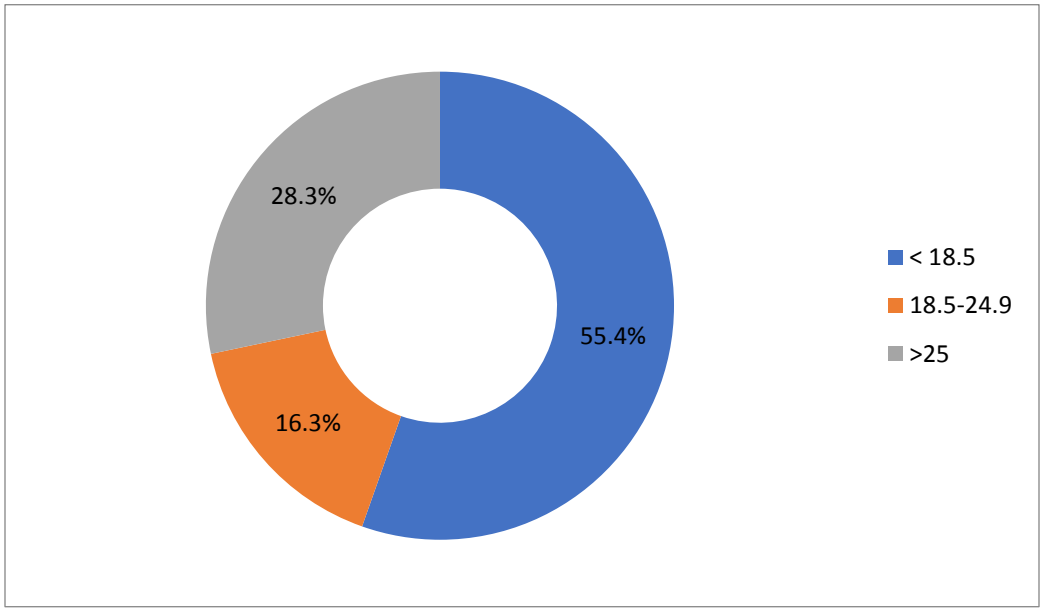

Figure 4.12: BMI categories on discharge
BMI = kg/m^2

4.4.7 Association between nutritional risk status on discharge and selected outcomes

Relationships between at risk for malnutrition and certain variables were determined.

4.4.7.1 Age and gender

Age and gender did not have an impact on the nutritional risk at discharge (p=0.856; Levene's Test Sig. >0.05 and p=0.303 for age and gender respectively).

4.4.7.2 Referral for nutrition support

Of the 73 patients who were identified as being malnourished, only 59 were reported to have been referred for nutrition support on discharge. This indicated that not all identified benefitted from nutrition support during the hospital stay. During the same period, 5 of the patients who were not at risk on admission were reported to be at risk upon discharge.

4.4.7.3 Number of complications

The investigation of the relationship between risk of malnutrition and development of complications showed interesting findings. No significant difference was found between the number of complications that developed in patients at risk of malnutrition on admission (average 2.22) and patients not at risk (average 1.76) ($p=0.18$). However, as indicated in Figure 4.13, significantly more complications were reported in those at risk of malnutrition at discharge than those not at risk (average 2.27 versus 1.76 complications respectively; $p=0.04$).

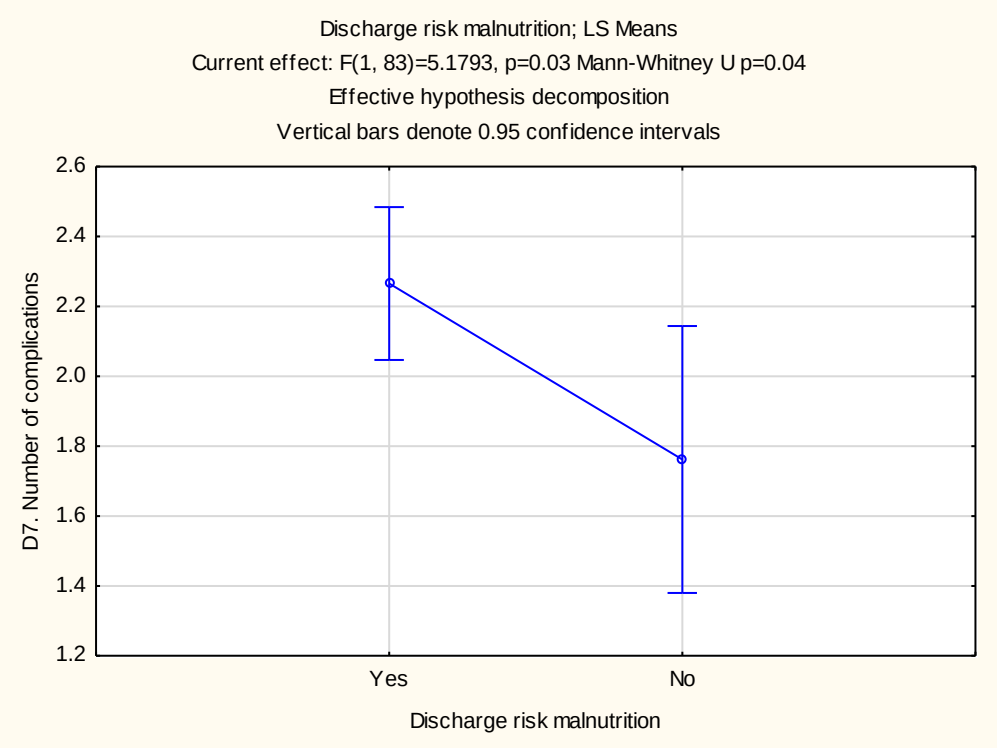

Figure 4.13: Relationship between number of complications and nutrition risk at discharge

4.5 COMPARATIVE ANALYSIS

4.5.1 Comparison of nutritional risk on admission and discharge

McNemar test for repeated measurement was conducted to investigate the relationship between percentage risk of malnutrition on admission and discharge. No significant difference between admission and discharge was shown and in both cases, the risk of malnutrition was high.

4.5.2 Primary diagnosis and increased risk of malnutrition on admission and discharge

The differences among the diagnostic categories were significant on admission (Chi-square=34.79; p=0.000) and discharge (Chi-square=14.25; p=0.71), on discharge all categories were at an increased risk. However, patients diagnosed with HIV/TB complications,

respiratory and GIT infections were at a significantly higher risk of malnutrition than patients in the other disease categories, both on admission and discharge.

4.5.3 Nutritional risk and referral for nutrition support

Not all patients identified as being at risk of malnutrition were referred for nutrition support. Only 41.0% (p=0.129) of 314 identified as at risk were referred. Of these 98.4% (n=127)were referred by nutrition professionals (n=129) for support while only 1.5%(n=2) reported to had been referred by other clinical staff.

4.5.4. Usual anthropometric status and BMI against nutritional risk status on admission

After correction of weight on admission for oedema, the mean weight of patients at nutritional risk (51.63 kg) was significantly lower than the mean weight of patients not at nutritional risk (55.0 kg) (p=0.01) (Figure 4.14).

There was a statistically significant difference in the corrected BMI values between patients at nutritional risk and those not at nutritional risk. Patients not at nutritional risk had a significantly higher BMI (23.2 kg/m^2) than patients at nutritional risk (18.7 kg/m^2) (p=0.000).

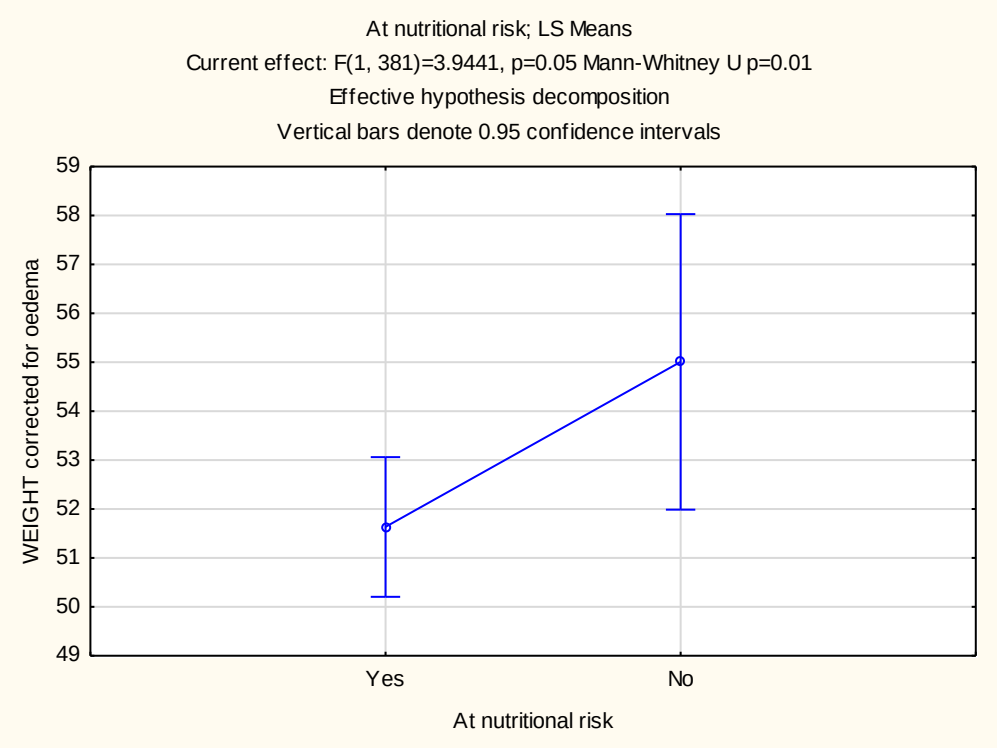

Figure 4.14: Relationship between corrected weight and nutritional risk at admission

CHAPTER FIVE: DISCUSSION

According to the Prague Declaration signed by ESPEN and the European National Health Alliance (ENHA)(77), malnutrition and DRM is an urgent public health and healthcare problem in European countries.(78) However, although malnutrition is also perceived to be a common problem in Africa including Kenya,(2) very few studies have provided malnutrition prevalence data in African hospitals and hence, malnutrition is often considered a silent problem in these institutions. Literature has attributed malnutrition to different disease outcomes, which include effects on patient recovery, increased length of hospital stay and increased risk of re-admission, all leading to a negative impact on the economy.(32,71,79,90)

Nutrition screening is always considered the first step in the nutrition care process, and it is followed by the nutrition assessment process for helping establish those at risk of malnutrition.(1,79,80,82) Various screening tools have been adopted for the identification of malnutrition among adult hospitalized patients. In this study, the NRS-2002 tool was adopted for use to determine the prevalence of malnutrition and the results are discussed under the subsequent subheadings.

This study aimed at establishing baseline information on malnutrition risk among hospitalized adult patients in the Mbagathi District Hospital and to recommend areas of focus to help in early identification and treatment of malnutrition within similar hospital settings. The discussions in this chapter are according to the objectives that were set for the study.

5.1 PATIENT DEMOGRAPHICS

A total of 384 adult in-patients were enrolled to participate in the study, which was slightly less than the intended number of 400 patients.

This was a calculated representative sample of the number of patients admitted to Mbagathi District Hospital.

The mean age on admission for the patients was 39.7 ±13.8 years (range: 19–73 years), and the average LOS calculated on discharge was 7.5 ±5 days.

Some studies report that advancement in years is associated with an increased risk of malnutrition due to various factors such as dementia, poor dentition, immobilisation (functional capacity) and anorexia.(1,17,61,82,83,84) In investigating the relationship between malnutrition and age, a study conducted in Spain targeting 1 707 participants reported a strong relationship between these two variables.(85) However, despite age being a contributor to increased malnutrition risk as evidenced in several studies,(84,85) there was no significant influence of age on malnutrition in the population studied in the current research.

5.2 PREVALENCE OF MALNUTRITION

Malnutrition is an imbalance that affects both overweight and underweight patients and can result from a lack of adequate calories, proteins and other nutrients needed for tissue maintenance.(1,80) The prevalence of hospital malnutrition has been reported to range between 20% and 73% and is seen as a major problem, with concerns raised on its early identification and treatment.(3,20)

The prevalence of malnutrition as determined in this study was 81.9% , with a mean NRS of 3.39 ±1.09 SD withno statistical significance reported between gender. Upon discharge, 77.6% were identified to be at risk, which was lower as compared to admission at risk. The high prevalence of at risk among these patients could possibly indicate that most adult patients admitted to Mbagathi District Hospital have a high risk of developing malnutrition either on admission or during hospitalization. When compared with other studies that have been conducted and documented in which the prevalence of malnutrition ranged between 32.6% and 76%,(20,26,80,86,87,88) the prevalence of malnutrition in this study was determined to be high. This could be associated to the kind of population that seeks medical services in public hospitals, in this case Mbagathi. Majority of the people here are from rather humble setting, indicating a

possible association between socio-economical background and nutritional status/health, although this was not determined in the current study.

This high prevalence could be not only a reflection of the nutritional status of the hospitalized patients but also an indication that most adults only seek medical attention when their condition has greatly deteriorated. Coupled with the household food insecurity in Kenya and factors such as drought and low purchasing power, malnutrition rates could indeed be within the high range determined in this study.(35)

5.3 RISK FACTORS FOR MALNUTRITION

This study also investigated the disease-related risk factors that have an impact on the nutritional status of hospitalized adult patients. The common factors reported to be main contributors to malnutrition in this study were HIV/TB related complications which included; gastrointestinal disorders/diseases, dietary intake, weight changes and general disease. This related to other studies that have also shown a close relationship between HIV/comorbidities and malnutrition.(2,93)

5.3.1 Gastrointestinal disorders

Increased risk of malnutrition has been attributed to various factors that include inflammation, reduced dietary intake, anorexia, vomiting, other GIT-related conditions and general disease.(1,13,91) Other factors associated with increased risk may also include impaired GI function, which reduces digestion, increased nutrient loss from the gut, altered metabolism, excessive weight loss and treatment of disease.(91,92) Changes in the GIT resulting in pH changes, intestinal permeability associated with sepsis, and inflammation due to disease or medication(69,91,93) have also been attributed to the increased risk of malnutrition.(93)

In the current study, on admission, almost three quarter of patients (66.4%, n=255) reported having gastrointestinal side effects for at least two weeks prior to admission. Gastrointestinal

symptoms included nausea, anorexia and vomiting. These symptoms were common among all the patients admitted and may have contributed greatly to the noted reduced weight and reduced appetite and may have also been a possible cause of the risk of malnutrition seen on admission. As reported in other studies, these are common causes of the development of malnutrition among adult patients.(90-93)

On discharge, there were reduced GIT complications reported, which could have been attributed to medication and control of the primary disease.(93) However, this was not determined in the study since it was an observational study.

5.3.2 Reduced dietary intake

Studies conducted have shown that patients who take less than half of their required food quantities are more likely to be malnourished than those who take more than half.(9,99,100

0 In this study, 39% representing a third of participants reported to have reduced their normal food portions by more than one-half prior to admission, and a general reduction in food intake was reported for more than half (76.4%) of the patients. Upon discharge, 67.3% of the patients reported a reduced intake of more than 50%. Other studies have reported changes in dietary intake on admission in the range of 17–52%.(1) This raises concerns since reduced dietary intake is seen to be one of the pathways to the development of malnutrition.(8,87,90,92)

According to the Nutrition Care Day Survey of Agarwal et al. malnutrition and poor dietary food intake are independently associated with patient outcomes in acute-care patients.(92) The findings from this study strengthen the crucial need for nutrition intervention and screening among hospitalized patients in Kenya.

5.3.3 Reduced BMI and weight changes

Patients with a reduced BMI have been reported to be at an increased risk of malnutrition.(1,94,95) Results from this study indicated that patients with a reduced BMI were more likely to be undernourished compared with patients with a normal BMI.

Other factor reported in the study to increase the risk of malnutrition was reduced BMI. The BMI of more than half of the patients was reported to be <18.5 kg/m^2 both on admission and dischargeand thus indicating high numbers havingundernutrition. It is well established that patients with a low BMI are at a higher risk of mortality and poor wound healing and demonstrate an increased risk of infections, pressure ulcer development and increased length of hospital stay, which negatively affects the economy.(88,96,97)

Only a few patients in this study had a BMI of >25 kg/m^2, which is an indicator of overweight, obesity or overnutrition

On admission, more than three quarter (71% n=175) of the patients were reported to have lost more than 5% of their normal weight prior to their admission into hospital. Some studies have shown that prior to admission, at least 40–50% of patients lost weight prior to admission, which is attributed to reduced dietary intake, nausea, vomiting and other GIT complications that worsen the condition.(91) This study reported very high losses in weight. However, this could also be related to the diagnosed primary disease on admission(HIV/TB), with retroviral infections increasing the risk of weight loss and malnutrition.(2,94,97,98)

5.3.4 Disease categories

The majority of patients in this study were admitted with HIV/TB comorbidities. Gastrointestinal tract complications, respiratory conditions and malnutrition are more likely to occur in these patients. Studies have reported that most of these conditions are associated with increased risk of inflammation and other inflammatory diseases, which further predisposes those affected to malnutrition.(2,93,94,96)

The majority of the people who seek medical services at Mbagathi District Hospital come from rather humble settings. Those living in and around the slum areas are reported to experience increased GIT complications and co-infections that are closely linked to HIV/AIDS such as TB.(94,96,97) most of the patients who were co-infected recorded a BMI of <18.5 kg/m^2. The differences among the diagnostic categories were significant [Chi-square=34.79; p=0.000], with the majority of patients that were reported to be at risk of malnutrition having HIV/TB complications.

5.4 CHANGES IN NUTRITION STATUS ON ADMISSION AND DISCHARGE

According to the current study, on admission, more than three quarters (81.7%) of the patients assessed had a BMI of <18.5 kg/m^2. On discharge, of the 90 patients that had their BMI calculated, slightly more than half (55.4%) had a BMI of <18.5 kg/m^2. The NRS score, on admission and discharge indicated that increased risks existed on both admission and discharge. Despite the prevalence being high on both admission (81.9%)and discharge (77.6%), there was a slight decrease in the percentage risk on discharge among the patient sampled.

5.5 REFERRALS FOR NUTRITION SUPPORT

The impact of nutrition support cannot be overlooked in patient management. Studies investigating the risks and occurrence of malnutrition and the clinical effects of early and continued nutrition support have mostly shown positive treatment outcomes among patients identified as being at an increased risk of malnutrition.(31,56,57,100,101,102,103)

Placing malnourished hospitalized patients, both surgical and non-surgical, on nutrition support has been associated with reduced length of hospital stay, reduced costs, reduced medical complications and positive treatment outcomes.(1,50,91,95,100,103)

The evidence from various individual studies and meta-analyses show that nutritional supplementation, with special reference to oral supplements, provides benefits to malnourished

patients in the areas of nutritional, clinical, functional and economic outcomes.(95,99,101,103) According to the current study, less than half (41%) of the patients at nutritional risk were referred for nutrition support and less than half of these patients(47%), received nutrition intervention. Upon discharge, almost three quarters (81%) of the 73 identified as at risk were referred and 65.6% (n=47) of these received an intervention. This indicated that it was very unlikely for an intervention to be put in place upon identification of an increased risk of malnutrition on admission and during the hospital stay.

The majority of the patients identified as being at risk were referred for support by nutrition professionals (n=127), and only a small number of patients reported to have been referred by a clinician (n=2). However it was evident that there were no clear structures in place to ensure follow-up and proper interventions put in place.

5.6 LIMITATIONS

Various limitations were experienced during the study period.

Initially, various measures were put in place to determine the eligibility of participants. However, the participants were patients who were predisposed to the development of malnutrition as secondary to their health condition. The possibility that the risk of malnutrition was higher than reported is present.

The hospital did not have an electronic database for easy access to patient information. Some patients who had been enrolled in the study were discharged during the weekends, and gathering their information was a challenge.

During the study period, the nursing staff undertook strike action for more than a month, which definitely influenced the patient flow at the hospital. Consequently, the study had to be delayed for a month. Upon resuming the study, the patient turnout was low, which increased the study period.

In cases where the patients were unable to stand for anthropometric measurements, the researcher and assistants would estimate the measurements, this was done by taking the knee length using a tape measure for the height as well as asking the last weight taken if within last three months, 5% of that weight would deducted if patient reported to have lost weight. These could have slightly differed from the actual weight measurements. However, the majority of patients had their actual measurements taken.

There were instances in which patients were not at their bedside during screening and data collection. Despite their possible eligibility for the study, these patients were thus disqualified.

The discharge sample was also small, which was not 50% of the actual numbers that had been admitted to the study.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSION

The study presented four main objectives:

Objective 1: To assess the prevalence of the risk of malnutrition in adult patients on admission

Objective 2: To compare the risk of malnutrition per different disease category on admission

Objective 3: To assess the risk of malnutrition in adult hospitalized in-patients between admission and discharge from hospital

Objective 4: To determine the percentage of at-risk patients referred for specialised nutritional support

The study results indicated that the prevalence of malnutrition among hospitalized adult patients in Mbagathi District Hospital is very high. The need to intensify screening and to implement measures to treat malnutrition and prevent further deterioration of the patient's health by improving assessment and nutritional care in hospital is highlighted.

The study determined that HIV/TB, GIT infections and respiratory infections were among the leading diseases that predisposed patients to malnutrition and increased the risk of malnutrition.

There was a correlation between risk of malnutrition and increased weight loss. Patients who lost more than 5% of their actual weight were reported to be more likely to be diagnosed with risk of malnutrition on both admission and discharge.

Changes in the GIT comprised the second-most common factor leading to undernutrition risks in the study, and reduced food intake due to changes in the GIT is reported to increase the risk of development of malnutrition.

It has been frequently reported that nutrition screening is not easily conducted by HCWs due to a lack of understanding on the use of the tools and the fact that nutrition screening is considered an additional responsibility by the HCWs. Despite the high prevalence of malnutrition, the

identification of malnutrition is frequently missed even though it is an important component in patient care and management. At Mbagathi District Hospital routine anthropometric assessment was being conducted, but compared to the number of patients identified as being at a risk of malnutrition and those referred, the numbers were still low, as seen from the study. It was evident that not all patients identified as at risk of malnutrition or malnourished were referred for nutrition support. The majority of the referrals were made by nutrition staff, and very few patients were reported to have been referred by other healthcare professionals such as doctors. This could possibly indicate a gap of knowledge among these HCWs and a lack of service integration in patient care, hence a need to sensitise staff and capacity build them.

There was also no evidence of nutrition policies and protocols in the various wards, which further increased the gap between early identification and the subsequent nutrition management.

Special care focusing on nutritional status can help to reduce the cases of undiagnosed undernutrition in hospitalized patients. It is, therefore, important to determine the nutritional problem that is causing the significant clinical risk. Routine screening at both the outpatient and the in-patient level should be done on admission and thereafter weekly for in-patients who have been identified as being at an increased risk of malnutrition. Nutrition support is recommended for patients who are malnourished with a BMI of <18.5 kg/m^2 and an NRS of >3, for at-risk patients demonstrating excessive weight loss, reporting poor absorption due to GI disorders and indicating increased nutritional needs due to catabolism.

6.2 HYPOTHESES ACCEPTANCE / REJECTION

Ho: There is no difference in the prevalence of risk of malnutrition between admission and discharge.

There was no difference between admission and discharge risk of malnutrition status in this study. The risk was high on both admission (81.9%) and discharge (77.6%) and hence, the Ho is accepted.

Ho: There is no difference in the prevalence of risk of malnutrition within different disease categories.

The Ho is rejected since there was a statistical difference in nutritional risk among the various disease categories (p=0.000).

Ho: There is no association between nutritional status on admission and development of malnutrition prior to discharge.

There was an association between the nutritional status on admission and the development of malnutrition prior to discharge. Patients who had a BMI of <18.5 kg/m^2 had a higher chance of developing malnutrition during their hospital stay than patients with a BMI of >18.5 kg/m^2. Those at risk of malnutrition on admission were still at an increased risk of malnutrition on discharge. Hence, the Ho is rejected.

Ho: There is no association between malnourished patients and referrals for nutrition support.

The Ho is accepted since the statistical result of p=0.129 indicates that there was no relationship between patients identified as being at risk of malnutrition and patients referred for nutrition support.

6.3 RECOMMENDATIONS

Hospitals should have specific policy and protocol for the identification of adult patients at nutritional risk in order to determine appropriate nutritional care plans.

Various actions should be adopted:

- *Screening of adult patients for malnutrition:* From the study results, the risk of malnutrition was high both on admission and discharge, this calls for early initiation of screening for all adult inpatients preferably within 48 hours on admission. Since various tools are available for assessment, the institution can adopt a tool that would best suit its setting. This tools should be easy to use, readily available, and accurate enough for

determining risks of malnutrition and associated outcomes as well as have provision for proper documentation.

- *Nutrition assessment:* This process becomes important in patient management, the importance of including indicators that look atmetabolism, functional ability and anthropometry was seen as necessary in helping have a clear diagnosis. All these should relate to the interventions put in place, to be able to influence positive patient outcomes.
- *Defining and monitoring outcomes:* Despite not having a clear definition of the nutrition related treatment outcomes it is important to have a clear definition and the monitoring process documented. It is necessary to have dietary plans that are specific and these are to be continuously monitored. In addition, issues such as patient progress in regard to dietary intake, weight changes, changes in functional ability and side effects either from medication or nutrition prescriptions should be factored in. These actions would ensure that positive outcomes are achieved.
- *Communication:* This becomes key to both the patient and the HCWs. All HWCs should be aware of the nutrition screening and assessment procedures and the care plans clearly documented and availed in the patient files, during their hospital stay and on discharge. Activities such as On-the-job training mentorship should be continuous, with the aim of ensuring that all personnel handling patients are aware of the nutrition care process.
- *A multidisciplinary approach:* Various cadres are involved in patient care during their hospital stay. From the study, it was clear that the number of referrals made were mostly from nutrition staff and very few from the other medical personnel. When the nutrition care process is well understood by other staff, their role in identification of malnutrition and referrals for those identified would coordinate well without having any conflict. It needs team work to provide a comprehensive nutrition package in hospitalized adults. Considering the staffing constraint in most public setting, working in coordination with other cadres will help to ensure limited time is used during the assessment and no patient is missed out on , in case the nutrition staff are not available during patient admission.
- *Availability of basic screening equipment:* Not all wards had the basic anthropometric equipment, hence hindering proper and timely screening. These basic screening

equipment should be accessible to HCWs in all wards and calibration should be done frequently to ensure accuracy is maintained.

6.4 FUTURE RESEARCH

Malnutrition and outcomes among hospitalized patients are areas that need further investigation. It is necessary to ensure that the developed and implemented nutritional guidelines and protocols are nurse driven since most triage processes are initiated by the nurses. Studies on malnutrition in hospitalized patients should focus not only on children but also on adults since the prevalence of malnutrition among this group is high and often overlooked due to lack of screening. The aim should be early identification and treatment in a bid to ensure that positive treatment outcomes are achieved.

Malnutrition should not only be considered in stable patients but also in critically ill patients, thus providing an unbiased determination of malnutrition.

Future studies in Kenya should adopt malnutrition screening tools that have been used in studies conducted in other parts of the world so that the most appropriate tool is determined for the Kenyan hospitalized population. Finally, there is a need to research the possible impact of adult malnutrition on the Kenyan economy, the cost implications for the healthcare system and the influence of malnutrition on treatment outcomes.

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APPENDICES

APPENDIX A: PARTICIPANT SCREENING AND ADMISSION

Hospital code		Hospital name	
Ward category		Ward number	

Nr	Patient initial and surname	Hospital admission in past 48 hours		Patient age		Patient conscious		Patient pregnant or lactating		Patient in ICU/burns/acute care/ psychiatry or eating disorder wards		Patient on dialysis		Informed consent obtained		If NO consent obtained, provide reason	If consent obtained, allocate participant study number
		Y	N	≤ 18 yr	≥ 18 yr	Y	N	Y	N	Y	N	Y	N	Y	N		
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	

APPENDIX B: PARTICIPANT CONTACT DETAILS

Hospital code		Hospital name	

Nr	Participant Number	Ward	Surname	Name	Contact telephone number 1	Contact telephone number 2
1.						
2.						
3.						
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APPENDIX C: INFORMED CONSENT

TITLE OF THE RESEARCH PROJECT:

Prevalence and impact of Hospital malnutrition on associated outcomes.

REFERENCE NUMBER: N14/06/061

PRINCIPAL INVESTIGATOR: Esther A. Achar

ADDRESS:

Division of Human Nutrition, Faculty of Medicine and Health Sciences, Stellenbosch University

CONTACT NUMBER: +254721524095

You are being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the study staff any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the **Health Research Ethics Committee at Stellenbosch University** and Kenyatta National hospital and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

What is this research study all about?

- It is known that people that are underweight (weighing less than the normal amount for one's age, height, and build) take longer to recover from illness or surgery and are more likely to develop infections. This results in a longer stay in hospital and extra costs.

- This study aims to get information on the number of people that are underweight when they are admitted to hospital and when they are discharged.
- It will be conducted at the Mbagathi Hospital during the period January to December 2015 or until the desired number of study participants have been included.
- A total of 400 participants older than 18 years are needed for the study to provide meaningful results.
- In order to conduct this study, the researcher will first explain the study and ask your approval to participate.
- The information obtained include: asking you questions about your appetite, determining your weight, height and muscle-strength, performing a clinical examination on you to assess for signs of weight loss.
- It should not take more than 45 minutes of your time to obtain all the information. This will be repeated again when you are discharged.
- We will also contact you telephonically 3-months after you have been discharged to ask you a few questions regarding your health.

Why have you been invited to participate?

- You have been asked to participate as you are a patient that has been newly admitted within the last 48 hours and meet our inclusion criteria.

What will your responsibilities be?

- To carefully read the information provided by the researcher about the study and to ask questions about any uncertainties you may have. To then provide your written approval to participate if you are comfortable to do so.
- To speak to the researcher if you want to stop your participation any time during the study or to contact the researcher or research ethics committee if you have any queries, concerns or complaints.
- To provide information that is accurate and honest.

- To keep a copy of the consent form for your own record keeping.

Will you benefit from taking part in this research?

- You will not benefit directly from the research, but you have the opportunity to help researchers answer the question about the nutritional status and health of Kenyans that are admitted to hospital.

Are there in risks or discomforts involved in your taking part in this research?

- There are no risks involved by participating in this study.
- Depending on your health condition, getting undressed into minimal clothing and walking to the scale and height metre may be a discomfort.

If you do not agree to take part, what alternatives do you have?

- If you choose not to participate, this will not affect your quality of hospital treatment. You will receive all the medical care that is routinely provided.

Who will have access to your medical records?

- Only the research team that is involved in data collection will have access to your medical files. Even though some of the information may be recorded, your identity will be kept anonymous by using coding rather than names on the questionnaires.
- The data will be stored by the researcher for 5 years, after which it will be destroyed.
- Sponsors of the study, study monitors or research auditors or members of the Health Research Ethics committee may need to inspect the research records.

Will you be paid to take part in this study and are there any costs involved?

- You will not be paid to take part in the study.
- There are also no costs involved for you, if you do take part.

Is there anything else that you should know or do?

- You can contact the researcher at +254721524095 if you have any further queries or encounter any problems.
- You can contact the Kenyatta Hospital Health Research Ethics Committee if you have any concerns or complaints that have not been adequately addressed by the researcher.
- You will receive a copy of this information and consent form for your own records.

Declaration by participant

By signing below, I …….. agree to take part in a research study entitled **Prevalence and impact of Hospital malnutrition on associated outcomes**.

I declare that:

- I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurized to take part.
- I may choose to leave the study at any time and will not be penalized or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.

Signed at (place) ……. on (date) …….. 2015.

…… ……

Signature of participant **Signature of witness**

Declaration by investigator

I (name) …… declare that:

- I explained the information in this document to ……..
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above
- I did/did not use an interpreter. (If an interpreter is used then the interpreter must sign the declaration below.

Signed at (place) ……. on (date) …….. 2015.

…… ……

Signature of investigator **Signature of witness**

Declaration by interpreter

I (name) …… declare that:

- I assisted the investigator (name) …….. to explain the information in this document to (name of participant) ……..…….. using the language medium of Kiswahili.
- We encouraged him/her to ask questions and took adequate time to answer them.
- I conveyed a factually correct version of what was related to me.
- I am satisfied that the participant fully understands the content of this informed consent document and has had all his/her question satisfactorily answered.

Signed at (place) ……. on (date) ……..……(2015).

…… ……

Signature of interpreter **Signature of witness**

TAARIFA TOLEO NA FORMU IDHINI YA MSHIRIKA

JINA LA MRADI WA UTAFITI:

Maambukizi na matokeo ya utapiamlo hospitali na kuhusishwa matokeo.

REFERENCE NUMBER: N14/06/061

MTAFITI MKUU: Esther Achar

KANUNI:

Aphia plus Nuru ya Bonde Nakuru

NAMBARI YA SIMU: 0721524095

Wewe waalikwa kuchukua sehemu katika mradi wa utafiti. Tafadhali chukua muda wa kusoma habari iliyotolewa hapa, ambayo itakupa maelezo ya huu mradi. Tafadhali uliza wafanyakazi wa utafiti maswali yoyote kuhusu sehemu yoyote ya mradi huu usio elewa. Ni muhimu sana kwamba upate kuridhika kikamilifu, na kuelewa wazi nini utafiti huu unahusu na jinsi gani unaweza kuwa wanaohusika. Pia, ushiriki wako ni hiari kabisa na kutoshiriki pia si hatia. Kusema hapana, haitakuathiri vibaya kwa namna yoyote ile. Waweza kuondoa kutoka utafiti katika hatua yoyote, hata kama hautakukubaliana kuwa katika mradi huu.

Utafiti umeupitishwa na Utafiti wa Afya Kamati ya Maadili katika Hospitali ya Taifa ya Kenyatta na chuo kikuu cha Stellenbosch University (Afrika Kusini) na itafanyika kulingana na miongozo ya kimaadili na kanuni za Azimio la kimataifa la Helsinki, Afrika Kusini Miongozo kwa ajili ya Habari Mazoezi ya kimatibabu na Medical Council Utafiti (MRC) Miongozo Maadili kwa utafiti

Utafiti huu unahusu nini?

- Inajulikana kwamba watu walio na uzito wa chini (kipimo chini ya yale waliyo kuwa katika siku za nyuma) huchukua muda mrefu kupona kutokana na ugonjwa au upasuaji na ni zaidi uwezekano wa kuendeleza maambukizi. Hii husababisha wagonjwa kukaa muda mrefu katika hospitali na malipo pia yanazidi.
- Utafiti huu unalenga kupata taarifa juu ya idadi ya watu walio na uzito wa chini wanapo lazwa hospitalini an wakati wanapo ruhusiwa kuenda nyumbani.
- Utafiti huu hutafanyika katika Hospitali ya Mbagathi kwa muda wa mwaka moja kuanzia mwezi wa January hadi Decemba 2015 ama hadi wanaohitajika watakapo patikana.
- Jumla ya washiriki 400 wanao zidi miaka 18 ndiyo watakao kuwa kwa utafiti ili kupata matokeo ya maana.
- Ili kufanya utafiti huu, mtafiti atapata kukueleza kuhusu utafiti huu kisha atauliza idhini yako ya kushiriki.
- Taarifa zilizopatikana ni pamoja na: kuuliza maswali kuhusu hamu yako ya kula, kupima uzito na urefu wako, na kuangalia kama kuna ishara yoyote ya wewe kupoteza kilo.
- Hatutachukuwa Zaidi ya dakika 45 tutakapo kuuliza maswali. Utakapo ruhusiwa kuenda nyumbani, tutapata maelezo Zaidi pia wakati huwo.
- Baada ya miezi mitatu, tuweza kuwasiliani kwa njia ya simu ilitupate kujuwa jinsi unavyo endelea. Tutakuuliza maswali chache.

Mbona amealikwa kushiriki?

- Kwa vile wewe nimgonjwa ambaye amelazwa upya kwa masaa 48 iliyopita na umehitimu matarajio yetu.

Nini wajibu wako?

- Kusoma kwa makini habari zilizotolewa na matafiti kuhusu utafiti na kuuliza swali lolote mahala mabapo haujaelewa. Na kisha kutoa idhini ya maandishi yako ya kushiriki bila kulazimishwa.

- Kuongea na mtafiti kama unataka kuacha ushiriki wako wakati wowote katika utafiti au kuwasiliana mtafiti au utafiti kamati ya maadili kama una swali lolote au malalamishi.
- Kutoa taarifa ambayo ni sahihi na waaminifu.
- Kuweka nakala ya fomu ya idhini kwa ajili ya kumbukumbu yako mwenyewe.
- Je utanufaika na kuchukuwa sehemu katika utafiti huu?
- Hutafaidika moja kwa moja lakini una fasi kusaidia watafiti kujibu swali kuhusu hali ya lishe na afya ya wagonjwa waliolazwa hospitalini.
- Je, kuna hatari yoyote kushiriki katika utafiti huu?
- Hakuna hatari ya kushiriki katika utafiti huu.
- Kulingana na afya yako kuvuwa nguo kidogo na kutembea kwa wadogo na kutembea kuenda kwa ratili na kuchukuwa urefu inaweza sababisha usumbufu kidogo
- Kama kuchagua si kushiriki, hii si kuathiri ubora wako wa matibabu ya hospitali. Utapokea wote gari matibabu
- Iwapo hautakubaliana kuchukuwa sehemu una alternative gani?
- Kama hautashiriki, hii si kuathiri ubora wako wa matibabu ya hospitali. Utapokea matibabu jinsi inavyo stahili.
- Ni nani atakaye kuwa na upatikanaji wa kumbukumbu yako ya matibabu?
- Timu ya utafiti ambayo itashiriki katika ukusanyaji wa takwimu itakuwa na upatikanaji wa files yako ya matibabu. Hata ingawa baadhi ya taarifa itaweza recordiwa utambulisho wako itawekwa bila majina kwa kutumia kodi badala ya jina kwenya cheti cha maswali.
- Ujumbe utahifadhiwa na mtafiti kwa miaka 5, baada ambapo baadaye itaharibiwa.
- Wadhamini wa utafiti huo, wachunguzi utafiti au wakaguzi utafiti au wajumbe wa kamati ya Afya Maadili ya Utafiti wana weza hitaji kukagua utafiti .
- Will wewe kulipwa kwa kuchukua sehemu

Je utalipwa kwa kuchukuwa sehemu kwa utafiti huu au kuna pesa yeyote utahitajika kutowa?

- Hautapata kulipwa kuchukuwa sehemu kwenye utafiti huu.
- Hautahitajika kulipa malipo yoyote kwa utafiti huu.

Je kuna maelezo Zaidi ama swali lolote?

- Unaweza kuwasiliana na mtafiti wa 0721524095 kama una maswali yoyote zaidi au tatizo lolote
- Unaweza kuwasiliana na Utafiti wa Afya Kamati ya Maadili katika Hospitali ya Taifa ya Kenyatta kama una matatizo yoyote au malalamiko ambayo si ya kutosha kushughulikiwa na mtafiti
- Utaweka nakala ya fomu ya idhini kwa ajili ya kumbukumbu yako mwenyewe.

Matangazo ya mshirika

Kwa kutia sahihi, mimi …….. na kubali kuhusika kwa utafiti huu wakuangalia Maambukizi na matokeo ya utapiamlo hospitali na kuhusishwa matokeo.
Mimi natangaza kwamba:

• Nimesoma au nimesomewa habari na ridhaa fomu hii na imeandikwa katika lugha ambayo mimi ufasaha na starehe
• Mimi nilikuwa na nafasi ya kuuliza maswali na maswali yangu yote yamejibuwa vya kutosha .
• Naelewa kwamba kuchukua sehemu katika utafiti huu ni bila kulazimishwa
na sijashinikizwa kuchukua sehemu.
• Nina weza kuchagua kuondoka utafiti wakati wowote na hautakuwa na adhabu au kudharauliwa kwa njia yoyote.
• Ninaweza kutakiwa kuondoka utafiti kabla kikamilisho, kama mtafiti anahisi ni kwa maslahi yangu bora, au kama mimi si kufuata mpango wa utafiti, kama tulivyo kubaliana.
Imetiliwa sahihi (mahala) …….. tarehe …….. 2015.

…… ……

Sahihi ya mshirika **Sahihi ya anayeshuhudia**

Matangazo ya mtafiti:

Mimi(Jina) …… :natangaza kwamba

- Nilimweleza mshirika habari katika waraka huu ....
- Nilimruhusu kuuliza maswali na alichukua na muda wa kutosha ya kujibu..
- Nimeridhika kwamba amekutosheka na anaelewa masuala yote ya utafiti, kama ilivyojadiliwa hapo juu
- Sikuweza / Nilitumia mkalimani (iwapo mkalimani alitumiwa, lazima atie sahihi hapa chini)

Sahihi (mahali) ..... tarehe ..... 2015.

....

Sahihi ya mtafiti **Sahihi ya anayeshuhudia**

<u>Matangazo ya Mkalimani</u>

Mimi(jina) ..... natangaza kwamba:

- Nili msaidia mtafiti (Jina) ..... Kupeana maelezo zaidi kuhusu utafiti huu kwa mshirika (jina la mshirika) ..... kupitia lugha ya Kiswahili.
- Nilimruhusu kuuliza maswali na nikampa mdaa wa kutosha.
- Nilimueleza haswa jinsi nilivyo pata maelezo.
- Nimeridhika ya kwamba mshirika huyu anelewa vilivyo maelezo yenye formu hii na maswali yale yote yamepata kujibiwa.

Sahihi (Mahali) ..... tarehe .....(2015).

....

Sahihi ya mkalimani **Sahihi ya aliyeshuhudia**

APPENDIX D: ADMISSION DATA COLLECTION FORM

Participant number	

1. Date of interview			
2. Date of admission			
Hospital code		Hospital name	
3. Ward category	**3.1 Medical**		
	3.2 Surgical		
	3.3 Oncology		
	3.4 Gynaecology		

A. DEMOGRAPHIC INFORMATION

4. Gender	Male		Female	

5. Date of birth of patient

Day		Month		Year			

B. MEDICAL INFORMATION

6. What is the patient's primary diagnosis on admission (Indicate only one)

	Present (x)	**Provide details of specific medical condition**
a. General medicine		
Gastroenterology		

Cardiology		
Respiratory		
Nephrology		
Tuberculosis		
Retroviral Disease		
Endocrine / Diabetes		
Weight control		
Allergies		
Neurology		
Urology		
Nutritional Deficiency		
6.2 Surgery		
Abdominal surgery		
Trauma		
Orthopaedic surgery		
Neurosurgery		
Vascular surgery		
Cardiothoracic surgery		
6.3 Oncology		

6.4 Gynaecology		
6.5 Other (please specify)		

7. Indicate the presence of gastrointestinal side-effects.

Indicate the appropriate options below.

Side-effect		**YES**	**NO**	**If YES to any, please indicate the frequency**		
				Almost daily for 2 weeks	**Between the 2 options**	**Minor / infrequent**
7.1	Nausea					
7.2	Vomiting					
7.3	Diarrhoea					
7.4	Anorexia					
7.5	Constipation					

C. DIETARY INFORMATION

8. Ask the patient to describe any <u>changes in food intake during the past week</u>.

Indicate the appropriate option below.

8.1	No change in usual food intake / consumes all food	
8.2	Decreased intake: consumes only ¾ plate / usual intake	
8.3	Decreased intake: consumes only ½ plate / usual intake	
8.4	Decreased intake: consumes only ¼ plate / usual intake	
8.5	Unable to consume anything	

	9. If a decreased food intake occurred (8.2 – 8.5 above), determine the duration.	
9.1	< 1 month	
9.2	> 1 month - < 3 months	
9.3	> 3 months	

	10. Was the patient referred for specialised nutritional support?	
10.1	Yes	
10.2	No	

	11. If YES to question 10, which health care professional made the referral?	
11.1	Doctor	
11.2	Dietitian	

11.3	Registered nurse	
11.4	Other (specify)	

D. ANTHROPOMETRY

12. How was the anthropometric measurements taken?

Indicate the appropriate options below.

Measurement		**Measured**	**Estimated**
12.1	Weight		
12.2	Height		

13. Indicate the measurements as determined

13.1	Weight measurement (kg)		
13.2	Height measurement (cm)	Standing height (cm)	
		Bedlength height (cm)	
		Half arm-span reading (cm)	

14. Were there any factors affecting the weight measurement e.g. casts, external fixing devices etc.

14.1	**Yes**		Specify:
14.2	**No**		

15. Assessment / Determination of usual weight measurement.		
15.1	Usual weight (kg)	
15.2	Date of last weight measurement	
15.3	Reading unknown	

16. Determination of weight history

Ask the patient to indicate their weight readings at the following time periods. If unable to indicate the actual readings, ask them to compare the weight to what it is currently.

Time frame		Actual measurement (kg)	Same as current	More than current			Less than current		
				Little	Med	Lot	Little	Med	Lot
16.1	2 weeks ago								
16.2	1 month ago								
16.3	2 months ago								
16.4	3 months ago								
16.5	6 months ago								

17. Determine whether clothes / jewellery fit more loosely or adjustment of belt setting made		
17.1	Yes	

17.2	No	
17.3	N/A	

18. If YES to question 17 above, determine the duration.		
18.1	< 1 month	
18.2	> 1 month - < 3 months	
18.3	> 3 months	

E. FUNCTIONAL CAPACITY

19. Indicate the patient's dominant arm		
19.1	Right	
19.2	Left	

20. Measurement of hand-grip strength		
Measurement 1	**Measurement 2**	**Measurement 3**

21. Determine general functional capacity.

Indicate the appropriate options below.

Measurement	**YES**	**NO**	**If YES to any, please indicate change over the past 2 weeks**

				Improved	No change	Regressed
21.1	Experience difficulty with normal activities / ambulation					
21.2	Bed /chair-ridden					

F. CLINICAL EXAMINATION

22. Test around the following areas for the presence of <u>oedema</u>: ankle, orbital, sacral. Please follow the SOP.

Indicate the appropriate option below.

	Clinical finding	Category	Indicate option
22.1	No depression	No edema	
22.2	2-4mm depression Immediate or few second rebound	Mild	
22.3	6mm deep pit 10-12 second rebound	Moderate	
22.4	8mm very deep pit > 20 second rebound	Severe	

23. Test around the <u>orbital area</u> (under the eyes) for the presence of <u>subcutaneous fat loss</u>. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	Category	Indicate option (X)

23.1	Slightly bulged fat pads	Normal / well nourished	6		7
23.2	Slightly dark circles, somewhat hollow look	Mild-moderate malnutrition	3	4	5
23.3	Hollow look, depressions, dark circles, loose skin	Severe	1		2

24. Test around the <u>upper arm area</u> (triceps / biceps) for the presence of <u>subcutaneous fat loss</u>. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	**Category**	**Indicate option (X)**		
24.1	Ample fat tissue obvious between folds of skin	Normal / well nourished	6		7
24.2	Fingers almost touch, some depth to pinch	Mild-moderate malnutrition	3	4	5
24.3	Very little space between folds, fingers touch	Severe	1		2

25. Test around the <u>thoracic/lumbar region</u> (ribs / midaxillary line) for the presence of <u>subcutaneous fat loss</u>. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	**Category**	**Indicate option (X)**

25.1	Chest is full. Ribs do not show. Slight to no protrusion of iliac crest.	Normal / well nourished	6		7
25.2	Ribs apparent. Iliac crest somewhat prominent.	Mild-moderate malnutrition	3	4	5
25.3	Ribs very apparent. Iliac crest very prominent.	Severe	1		2

26. Test around the <u>temple region</u> (temporalis muscle) for the presence of <u>muscle wasting</u>. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	**Category**	**Indicate option (X)**		
26.1	Can see/feel well-defined muscle	Normal / well nourished	6		7
26.2	Slight depression	Mild-moderate malnutrition	3	4	5
26.3	Hollowing, scooping, depression	Severe	1		2

27. Test around the <u>clavicle bone region</u> for the presence of <u>muscle wasting</u>. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	**Category**	**Indicate option (X)**

27.1	Not visible, visible but not prominent	Normal / well nourished	6		7
27.2	Some protrusion	Mild-moderate malnutrition	3	4	5
27.3	Protruding, prominent bone	Severe	1		2

28. Test around the <u>clavicle and acromion bone region</u> (shoulder) for the presence of <u>muscle wasting</u>. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	**Category**	**Indicate option (X)**		
28.1	Lines of bones prominent, no significant depressions	Normal / well nourished	6		7
28.2	Acromion process may protrude slightly	Mild-moderate malnutrition	3	4	5
28.3	Shoulder to arm joint looks square	Severe	1		2

29. Test around the <u>scapular bone region</u> for the presence of <u>muscle wasting</u>. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	**Category**	**Indicate option (X)**	
29.1	Lines of bones not prominent, no depresions	Normal / well nourished	6	7

29.2	Mild depression, or bone may show slightly	Mild-moderate malnutrition	3	4	5
29.3	Prominent, visible bones, depressions between ribs/scapula or shoulder/spine	Severe	1	2	

30. Test around the <u>dorsal hand</u> (Interosseous muscle) for the presence of <u>muscle wasting</u>. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	**Category**	**Indicate option (X)**		
30.1	Muscle bulges, could be flat in well-nourished	Normal / well nourished	6	7	
30.2	Slightly depressed or flat	Mild-moderate malnutrition	3	4	5
30.3	Depressed area between thumb – forefinger	Severe	1	2	

31. Test around the <u>patellar region</u> (knee) for the presence of <u>muscle wasting</u>. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	**Category**	**Indicate option (X)**	
31.1	Muscle protrudes, bones not prominent	Normal / well nourished	6	7

31.2	Knee cap less prominent, more rounded	Mild-moderate malnutrition	3	4	5
31.3	Bones prominent, little sign of musculature around knee cap	Severe	1	2	

32. Test around the <u>anterior thigh region</u> (quadriceps) for the presence of <u>muscle wasting</u>. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	**Category**	**Indicate option (X)**		
32.1	Well rounded, developed	Normal / well nourished	6	7	
32.2	Mild depression on inner thigh	Mild-moderate malnutrition	3	4	5
32.3	Depression on inner thigh, obviously thin	Severe	1	2	

33. Test around the <u>posterior calf region</u> for the presence of <u>muscle wasting</u>. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	**Category**	**Indicate option (X)**	
33.1	Well-developed bulb of muscle	Normal / well nourished	6	7

33.2	Not well developed	Mild-moderate malnutrition	3	4	5
33.3	Well-developed bulb of muscle	Severe	1	2	

Please double-check that all sections are fully completed!

Completed by:	
Checked by:	
Date:	

APPENDIX E: DISCHARGE DATA COLLECTION FORM

Participant number	

24. Date of interview	
25. Date of admission	
Hospital	

This form can only be completed if the patient was in hospital for longer than 7 days.

F. GENERAL INFORMATION

26. Please indicate the discharge option most relevant		
3.1	Transferred to another hospital	
3.2	Transferred to another ward (that falls outside the inclusion criteria for this study)	
3.3	Discharged to own residential home	
3.4	Discharged to nursing home / hospice	
3.5	Discharged to relatives home	
3.6	Other (specify)	

	27. If the patient is lost to follow-up, please indicate the appropriate option below.	
4.1	Deceased in hospital	
4.2	Unexpected discharge	
4.3	Refuse to participate	
4.4	Other (specify)	

	28. If the patient is deceased, indicate the following:		
15.1	**Date of death**		
15.2	**Cause**		
15.3	**Cause of death unknown**		

G. MEDICAL INFORMATION

29. Indicate the presence of gastrointestinal side-effects.

Indicate the appropriate options below.

	Side-effect	**YES**	**NO**	**If YES to any, please indicate the frequency**		
				Almost daily for 2 weeks	**Between the 2 options**	**Minor / infrequent**
6.1	Nausea					
6.2	Vomiting					

6.3	Diarrhoea					
6.4	Anorexia					
6.5	Constipation					

30. Indicate if the patient developed any medical complications during hospitalization and indicate the action taken for each complication listed.

(This information will be used to determine disease severity)

7.1	**Complication 1**
Specify complication	
Organ system involved	
Date of diagnosis	
<u>Specify the treatment taken</u>	
Non-invasive treatment	
Pharmacological treatment	
Interventions	
Life-threatening complications	
Death	
7.2	**Complication 2**
Specify complication	

Organ system involved	
Date of diagnosis	
Specify the treatment taken	
Non-invasive treatment	
Pharmacological treatment	
Interventions	
Life-threatening complications	
Death	
7.3	**Complication 3**
Specify complication	
Organ system involved	
Date of diagnosis	
Specify the treatment taken	
Non-invasive treatment	
Pharmacological treatment	
Interventions	
Life-threatening complications	
Death	
7.4	**Complication 4**

Specify complication	
Organ system involved	
Date of diagnosis	
Specify the treatment taken	
Non-invasive treatment	
Pharmacological treatment	
Interventions	
Life-threatening complications	
Death	
7.5	**Complication 5**
Specify complication	
Organ system involved	
Date of diagnosis	
Specify the treatment taken	
Non-invasive treatment	
Pharmacological treatment	
Interventions	
Life-threatening complications	
Death	

H. DIETARY INFORMATION

31. Ask the patient to describe any <u>changes in food intake during the past week in hospital</u>.

Indicate the appropriate option below.

8.1	No change in usual food intake / consumes all food	
8.2	Decreased intake: consumes only ¾ plate / usual intake	
8.3	Decreased intake: consumes only ½ plate / usual intake	
8.4	Decreased intake: consumes only ¼ plate / usual intake	
8.5	Unable to consume anything	

32. Was the patient referred for specialised nutritional support?

9.1	Yes	
9.2	No	

33. Did the patient receive specialised nutritional support?

10.1	Yes	
10.2	No	

34. If YES to question 10, what was prescribed? (More than one option can be ticked)

	Nutrition support option	YES	NO	If YES, indicate duration (in days)
11.1	Enteral nutrition			
11.2	Parenteral nutrition			
11.3	Combination therapy			
11.4	Supplementation drinks			
11.5	Other (specify)			

I. ANTHROPOMETRY

35. How was the anthropometric measurements taken?

Indicate the appropriate options below.

Measurement		Measured	Estimated
12.1	Weight		
12.2	Height		

36. Indicate the measurements as determined

13.1	Weight measurement (kg)	
13.2	Height measurement (cm)	

E. FUNCTIONAL CAPACITY

37. Indicate the patient's dominant arm		
14.1	Right	
14.2	Left	

38. Measurement of hand-grip strength		
Measurement 1	**Measurement 2**	**Measurement 3**

39. Determine general functional capacity.

Indicate the appropriate options below.

Measurement		**YES**	**NO**	**If YES to any, please indicate change over the past 2 weeks**		
				Improved	**No change**	**Regressed**
16.1	Experience difficulty with normal activities / ambulation					
16.2	Bed /chair-ridden					

G. CLINICAL EXAMINATION

40. Test around the following areas for the presence of oedema: orbital, ankle, sacral. Please follow the SOP.

Indicate the appropriate option below.

	Clinical finding	Category	Indicate option
17.1	No depression	No edema	
17.2	2-4mm depression Immediate or few second rebound	Mild	
17.3	6mm deep pit 10-12 second rebound	Moderate	
21.4	8mm very deep pit > 20 second rebound	Severe	

41. Test around the orbital area (under the eyes) for the presence of subcutaneous fat loss. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	Category	Indicate option (X)		
18.1	Slightly bulged fat pads	Normal / well nourished	6		7
18.2	Slightly dark circles, somewhat hollow look	Mild-moderate malnutrition	3	4	5
18.3	Hollow look, depressions, dark circles, loose skin	Severe	1		2

42. Test around the <u>upper arm area</u> (triceps / biceps) for the presence of <u>subcutaneous fat loss</u>. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	**Category**	**Indicate option (X)**		
19.1	Ample fat tissue obvious between folds of skin	Normal / well nourished	6	7	
19.2	Fingers almost touch, some depth to pinch	Mild-moderate malnutrition	3	4	5
19.3	Very little space between folds, fingers touch	Severe	1	2	

43. Test around the <u>thoracic/lumbar region</u> (ribs / midaxillary line) for the presence of <u>subcutaneous fat loss</u>. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	**Category**	**Indicate option (X)**		
20.1	Chest is full. Ribs do not show. Slight to no protrusion of iliac crest.	Normal / well nourished	6	7	
20.2	Ribs apparent. Iliac crest somewhat prominent.	Mild-moderate malnutrition	3	4	5
20.3	Ribs very apparent. Iliac crest very prominent.	Severe	1	2	

1. Test around the temple region (temporalis muscle) for the presence of muscle wasting. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	**Category**	**Indicate option (X)**		
21.1	Can see/feel well-defined muscle	Normal / well nourished	6	7	
21.2	Slight depression	Mild-moderate malnutrition	3	4	5
21.3	Hollowing, scooping, depression	Severe	1	2	

2. Test around the clavicle bone region for the presence of muscle wasting. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	**Category**	**Indicate option (X)**		
22.1	Not visible, visible but not prominent	Normal / well nourished	6	7	
22.2	Some protrusion	Mild-moderate malnutrition	3	4	5
22.3	Protruding, prominent bone	Severe	1	2	

3. Test around the clavicle and acromion bone region (shoulder) for the presence of muscle wasting. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	**Category**	**Indicate option (X)**		
23.1	Lines of bones prominent, no significant depressions	Normal / well nourished	6	7	
23.2	Acromion process may protrude slightly	Mild-moderate malnutrition	3	4	5
23.3	Shoulder to arm joint looks square	Severe	1	2	

1. Test around the scapular bone region for the presence of muscle wasting. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	**Category**	**Indicate option (X)**		
24.1	Lines of bones not prominent, no depresions	Normal / well nourished	6	7	
24.2	Mild depression, or bone may show slightly	Mild-moderate malnutrition	3	4	5
24.3	Prominent, visible bones, depressions between ribs/scapula or shoulder/spine	Severe	1	2	

2. Test around the dorsal hand (Interosseous muscle) for the presence of muscle wasting. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	**Category**	**Indicate option (X)**		
25.1	Muscle bulges, could be flat in well-nourished	Normal / well nourished	6	7	
25.2	Slightly depressed or flat	Mild-moderate malnutrition	3	4	5
25.3	Depressed area between thumb - forefinger	Severe	1	2	

3. Test around the patellar region (knee) for the presence of muscle wasting. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	**Category**	**Indicate option (X)**		
26.1	Muscle protrudes, bones not prominent	Normal / well nourished	6	7	
26.2	Knee cap less prominent, more rounded	Mild-moderate malnutrition	3	4	5
26.3	Bones prominent, little sign of musculature around knee cap	Severe	1	2	

4. Test around the anterior thigh region (quadriceps) for the presence of muscle wasting. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	Category	Indicate option (X)		
27.1	Well rounded, developed	Normal / well nourished	6	7	
27.2	Mild depression on inner thigh	Mild-moderate malnutrition	3	4	5
27.3	Depression on inner thigh, obviously thin	Severe	1	2	

5. Test around the posterior calf region for the presence of muscle wasting. Please follow the SOP.

Indicate the appropriate option below, as well as the relevant scale [1 severe PEM – 7 normal].

	Clinical finding	Category	Indicate option (X)		
28.1	Well-developed bulb of muscle	Normal / well nourished	6	7	
28.2	Not well developed	Mild-moderate malnutrition	3	4	5
28.3	Well-developed bulb of muscle	Severe	1	2	

Please double-check that all sections are fully completed!

Completed by:	
Checked by:	
Date:	

APPENDIX F: FOLLOW-UP DATA COLLECTION FORM

Participant number	

Date of interview	

1. Please indicate the person with whom this interview was conducted		
1.1	Patient self	
1.2	Spouse	
1.3	Other: (specify)	

2. If the patient is deceased post-discharge, indicate the following:			
2.1	Date of death		
2.2	Cause of death		
2.3	Cause of death unknown / family member refuses to answer this question		

In the event of death, there is no need to complete the rest of the form

J. GENERAL INFORMATION

3. Have you been re-admitted to hospital in the past 3 months?		
3.1	Yes	
3.2	No	

4. If YES to question 3, please indicate		
4.1	Date of admission	
4.2	Reason for admission	

A. MEDICAL INFORMATION

5. Have you developed any medical condition for which you consulted a doctor / received treatment in the past 3 months?		
5.1	Yes	
5.2	No	

6. If YES to question 5, please indicate the following information for each complication.	
6.1	**Complication 1**
Specify complication	
Organ system involved	
Date of diagnosis	
Specify the treatment taken	

Non-invasive treatment	
Pharmacological treatment	
Interventions	
Life-threatening complications	
6.2	**Complication 2**
Specify complication	
Organ system involved	
Date of diagnosis	
<u>Specify the treatment taken</u>	
Non-invasive treatment	
Pharmacological treatment	
Interventions	
Life-threatening complications	
6.3	**Complication 3**
Specify complication	
Organ system involved	
Date of diagnosis	
<u>Specify the treatment taken</u>	
Non-invasive treatment	

Pharmacological treatment	
Interventions	
Life-threatening complications	
6.4 **Complication 4**	
Specify complication	
Organ system involved	
Date of diagnosis	
Specify the treatment taken	
Non-invasive treatment	
Pharmacological treatment	
Interventions	
Life-threatening complications	
6.5 **Complication 5**	
Specify complication	
Organ system involved	
Date of diagnosis	
Specify the treatment taken	
Non-invasive treatment	
Pharmacological treatment	

Interventions	
Life-threatening complications	

K. ANTHROPOMETRY

7. Ask the patient if they experienced any <u>changes in weight</u> in the past 3 months?

7.1	Weight remained constant	
7.2	Lost weight	
7.3	Gained weight	

8. Ask the patient if they know their current weight?

8.1	Current weight (kg)	
8.2	Date of last weight measurement	

L. DIETARY INFORMATION

9. Ask the patient to describe any <u>changes in food intake during the past 3 months</u>.

Indicate the appropriate option below.

9.1	No change in usual food intake / consumes all food	
9.2	Decreased intake: consumes only ¾ plate / usual intake	
9.3	Decreased intake: consumes only ½ plate / usual intake	
9.4	Decreased intake: consumes only ¼ plate / usual intake	
9.5	Unable to consume anything	

10. If a decreased food intake occurred (9.2 – 9.5 above), determine the duration.		
10.1	< 1 month	
10.2	> 1 month - < 2 months	
10.3	> 2 month - <3 months	

Please double-check that all sections are fully completed!

Completed by:	
Checked by:	
Date:	

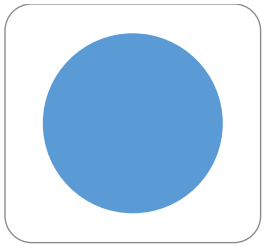
APPENDIX G: PARTICIPANT CHECK LIST

Hospital code		Hospital name	

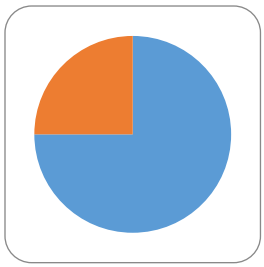
Nr	Participant Number	Participant contact details available (Form 2)	Informed consent obtained (Form 3)	Admission data collection form (Form 4)	Discharge data collection form (Form 5)	Follow-up data collection form (Form 6)
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						

APPENDIX H: PICTORIAL PLATE SAMPLES

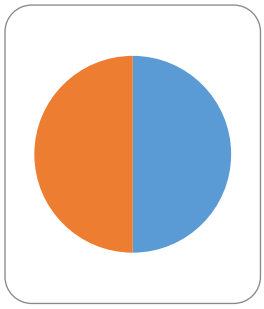
Instructions: This is a guide to help the patient quantify the amount of food taken in the past one week prior to admission. Clearly illustrate to the patient and explain what each picture means. Indicate the one selected by the participant by ticking in the boxes provided.



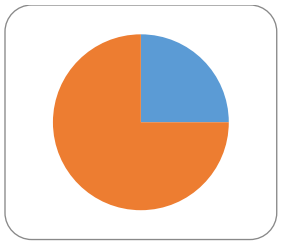
☐ 100% intake



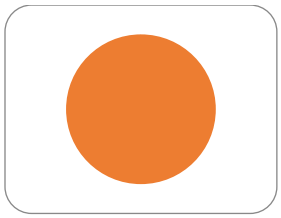
☐ 75% intake



☐ 50% intake



25% intake



0% intake