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Exploration of Malnutrition Coding Practices at Nebraska Medicine

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EXPLORATION OF MALNUTRITION CODING PRACTICES AT NEBRASKA MEDICINE

By

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ABSTRACT

Background: Malnutrition is present in 25-50% of hospitalized patients. Patients identified as malnourished are assigned a code based on the type and severity of malnutrition in order to gain the necessary reimbursement to care for the patients. There is a current gap in the research regarding the characteristics that define the difference between malnourished patients classified with a major complications and comorbidities (MCC) code versus a complications and comorbidities (CC) code.

Purpose: The purpose of this study was to determine which malnutrition codes are being used at Nebraska Medicine. Additionally, this study obtained clinical factors that are associated with malnutrition to determine how/if these factors differ between categories of reimbursement.

Methods: The malnutrition code used during admission and the reimbursement category the codes belonged to was collected for 923 subjects. In a subset of 200 subjects, admission, discharge, demographic and anthropometric data were collected and analyzed. All data were collected at two time points for each subject: at admission and at discharge.

Results: Six out of a possible eight malnutrition codes were used. Out of 923 subjects, 67.4% were classified with malnutrition codes that are within the CC reimbursement category. Percent of ideal body weight (IBW), body mass index (BMI), and albumin differed significantly between the MCC and CC groups when categorized based on severity criteria. The odds of being classified

with a MCC code are 3.5 times higher for subjects who presented with muscle mass loss at admission, and 2.2 times higher for subjects who had muscle mass loss at discharge.

Conclusion: Both MCC and CC malnutrition codes are utilized at Nebraska Medicine. Muscle mass loss, both at admission and at discharge significantly increased the odds of a subject being classified with a MCC malnutrition code. Malnourished patients are being classified as MCC or CC based on the criteria currently being taught at Nebraska Medicine.

LIST OF FIGURES AND TABLES

LIST OF ABBREVIATIONS

MCC	Major Complications and Comorbidities
CC	Complications and Comorbidities
IBW	Ideal Body Weight
BMI	Body Mass Index
AND	Academy of Nutrition and Dietetics
ASPEN	American Society for Parenteral and Enteral Nutrition
PPS	Prospective Payment System
CMS	Centers for Medicare and Medicaid Services
DRG	Diagnostic-Related Groups
ICD-9	International Classification of Diseases, 9th edition
ICD-10	International Classification of Diseases, 10th edition
U.S.	United States
RD	Registered Dietitian
RR	Relative Risk
OR	Odds Ratio
SGA	Subjective Global Assessment
MS-DRG	Medicare-Severity Diagnostic Related Group
ADX	Admitting Diagnosis
PDX	Principal Diagnosis
SDX	Secondary Diagnosis
RW	Relative Weight
CMI	Case Mix Index
APR-DRG	All Patient Refined Diagnostic Related Group
SOI	Severity of Illness
AP-DRG	All Patient Diagnostic Related Group

EMR	Electronic Medical Record
MD	Medical Doctor
H&P	History and Physical
LOS	Length of Stay
CRP	C-Reactive Protein
NFPE	Nutrition Focused Physical Examination

INTRODUCTION

Malnutrition, at the most basic level, occurs when food and nutrient intake is consistently inadequate to meet individual nutrient requirements. As this progresses, the individual will experience changes in body weight, body composition and physical function. Classically, this type of malnutrition was the product of environmental or social circumstances that would prevent an individual from consuming enough food and nutrients, such examples include: abuse, neglect, famine, poverty, limited understanding of adequate intake, or disordered eating[1]. Recently, it has been acknowledged that malnutrition occurs more along the lines of a continuum of inadequate intake and/or increased requirements, impaired absorption/utilization, and altered transport of nutrients[2].

Evidence dating from as far back as 1976 to as recently as 2013 suggests that malnutrition is present in 25-54% of hospitalized patients at admission[3]. This number is estimated to be even higher in the critically ill, likely due to increased inflammation present, with a prevalence from 50-80%[4]. The negative outcomes that can result from malnutrition include: muscle loss/weakness, increased risk for falls, pressure ulcers, infections, delayed wound healing, increased risk for morbidity and mortality and increased hospital readmission rates. Malnutrition also increases length of recovery time from the primary source of illness and, as a result, increases hospital and rehabilitation lengths of stay[2].

With the treatment of malnutrition also comes increased cost of care to the hospital, making it imperative to obtain reimbursement for this added diagnosis from the insurance providers. Only with a diagnosis and treatment for malnutrition can hospitals obtain this increased reimbursement. The first step in obtaining the necessary reimbursement in order to provide comprehensive treatment is for clinicians to be able to diagnose malnutrition and document it in the medical record[5]. This requires that there be a certain criteria used by the hospital to make a malnutrition diagnosis, something that remains elusive to many healthcare institutions. While there is currently no universally accepted criteria for the diagnosis of malnutrition, in 2012, the

Academy of Nutrition and Dietetics (AND) along with the American Society for Parenteral and Enteral Nutrition (ASPEN) published a consensus statement describing proposed criteria that take into account the most recent, evidence-based aspects to consider when making such a diagnosis[2,5]. While these criteria are the most recently published, they are not always used as the basis for a diagnosis of malnutrition, and, in fact, hospitals have the freedom to use any established criteria to support a diagnosis as long as it is documented in the medical record[5,6]. This presents a unique challenge to clinicians and dietitians both. Dietitians, being considered nutrition experts, are currently in the process of adopting the most recent criteria for diagnosing malnutrition as published by AND and ASPEN. However, these criteria have not always been known or widely accepted, so it is often the case that old criteria for a diagnosis of malnutrition are used and documented in the medical record as justification for a malnutrition code.

In order to develop a way to resolve any malnutrition diagnosis discrepancies, it is important to first establish a basic understanding of how coding works. Under the Prospective Payment System (PPS) set forth by the Centers for Medicare and Medicaid Services (CMS), the costs of acute care hospital inpatient stays are based on prospectively set rates. Each case is categorized into a diagnosis-related group (DRG) and each DRG has a payment weight that corresponds with it, based on the average resources used to treat patients in that specific DRG. In addition to the initial diagnosis that required hospitalization, patients may have other conditions added on that increase the resources needed to provide optimal care. These additional conditions are known as either major complications or comorbidities (MCCs) or complications or comorbidities (CCs). Reimbursement is highest for DRGs associated with MCCs, followed by DRGs associated with CCs. The international Classification of Diseases, both 9th (ICD-9) and 10th (ICD-10) edition codes are utilized to translate medical diagnoses into numerical codes for billing and research purposes[7-9]. Thus, the goal would be to have a thorough enough nutrition assessment in order to document the most accurate level of CC or MCC malnutrition code to have the highest potential for reimbursement.

While the consequences and clinical characteristics of malnutrition are well-documented in the literature, to our knowledge, there are no studies that attempt to describe the differences in characteristics between malnourished patients diagnosed with a MCC malnutrition code versus a CC malnutrition code, nor any studies that attempt to identify what clinical characteristics might be used to predict the use of one type of code over the other. Additionally, specific to Nebraska Medicine, no one has yet described the malnutrition coding practices currently being implemented.

REVIEW OF THE LITERATURE

Malnutrition Definition and Prevalence

Malnutrition, at the most basic level, occurs when food and nutrient intake is consistently inadequate to meet individual nutrient requirements. As this progresses, the individual will experience changes in body weight, body composition and physical function. Classically, malnutrition has been the product of environmental or social circumstances that would prevent an individual from consuming enough food and nutrients, such examples include: abuse, neglect, famine, poverty, limited understanding of adequate intake or disordered eating. Recently, it has been acknowledged that malnutrition occurs more along the lines of a continuum of inadequate intake and/or increased energy requirements, impaired absorption/utilization, and altered transport of nutrients[1, 2]. At certain points along this continuum of malnutrition and its development, there occur points of increased susceptibility to infection, disease and other negative outcomes[1].

Presence of inflammation is also considered to be of utmost importance when identifying malnutrition. Inflammation is thought to promote malnutrition through its associated side effects of anorexia, resulting in decreased energy and protein intake, as well as altered metabolism in the form of increased resting energy expenditure and increased muscle catabolism. Furthermore, inflammation tends to work against any sort of favorable response to nutrition interventions, which may result in less effective nutritional and medical therapies[10].

Evidence dating from as far back as 1976 to as recently as 2013 suggests that malnutrition is present in 25-54% of hospitalized patients at admission[3]. This number is estimated to be even higher in the critically ill, likely due to increased inflammation present, with a prevalence ranging from 50-80%. The primary reason for such a wide range in prevalence is the lack of a universally accepted definition of malnutrition, and subsequently, a lack of a universally accepted method and criteria to diagnose malnutrition[2, 4].

While malnutrition is recognized as being prevalent in greater than 50% of hospitalized patients, there is much work to be done in determining the best way to identify these patients, and most importantly, provide them with optimal nutrition care to treat the malnutrition while also documenting their condition accurately for proper documentation and reimbursement purposes. In a study that analyzed the prevalence of malnutrition diagnoses among patients discharged from United States (U.S.) hospitals, it was found that the percentage of U.S. hospital discharges that included a malnutrition diagnosis increased from 1993-2010 going from around 1.2-3.2%. This study also found that patients with a malnutrition diagnosis were older (64.8 versus 47.8 years, $P<0.0001$) and were more likely to fall below the 50% percentile of income (57.9% vs 55.0%, $P=0.004$), but did not differ with regard to their residence in urban or rural areas as compared with those patients not diagnosed with malnutrition[11].

Although the percentage of discharged patients having a malnutrition diagnosis documented has increased over the last 18 years, some studies suggest that it is still well below where it should be to paint an accurate picture of malnutrition in the U.S today. Lazarus and Hamlyn showed in their 2005 case study report that out of the 137 patients who were determined to be malnourished, only one was documented as such in the medical record and only 21 (15.3%) were referred for nutrition intervention. While this only represents one hospital, it shows the potentially large discrepancy for the true prevalence of malnutrition and what is being captured for treatment and reimbursement[12].

Due to the lack of a universal way to diagnose malnutrition, there can be great discrepancies in the diagnosis and prevalence of malnutrition, even within a very specific patient population. Platek et al looked into the prevalence of malnutrition among Head and Neck, Gastrointestinal, and Lung Cancer patients by 3 classification methods: 1) looking at the ICD-9 code used (the physician diagnosis), 2) in-hospital nutrition assessment conducted by a Registered Dietitian (RD), and 3) BMI. This study found that prevalence of malnutrition ranged from 8.8% to 26% based on the different methods, and k coefficients indicated a weak to fair strength of agreement (k=0.28 between dietitians and physicians; k=0.23 between BMI and dietitians; k=0.38 between BMI and physicians)[13]. While the study just described used the term RD to label the nutrition professional, for the purposes of this thesis, the term Nutrition Therapist will be used, which holds the same professional standing as RD, this is specific to the practices at Nebraska Medicine.

Adverse Effects of Malnutrition

Malnutrition is associated with increased morbidity, mortality and complications and an increased risk of developing infections, pressure ulcers, longer length of hospital stay (and subsequent rehabilitation stay), greater risk of hospital readmission and higher costs of care[2, 14].

Davalos et al showed that in acute stroke patients, urinary or respiratory infections (50% vs 24%; p=0.017) and bedsores (17% vs 4%; p=0.054) were more prevalent in malnourished patients than well-nourished patients. They also showed that length of stay was significantly longer in malnourished patients (28 days vs 17 days; p=0.001), and that mortality after the first week of hospitalization was more frequent in malnourished patients (5 patients versus 1 patient; p=0.005)[15].

In another study of 709 patients from 25 Brazilian hospitals, it was demonstrated that patients deemed to be malnourished were at significantly higher risk of developing complications, both infectious (pulmonary, urinary, wound, sepsis, intraabdominal) and non-infectious (e.g. respiratory failure, cardiac arrest, wound dehiscence), with a Relative Risk (RR) of 1.60 ($p<0.01$; CI=1.20-2.14) as compared to the well-nourished patients. In the multivariate analysis, presence of malnutrition was found to be an independent risk factor for development of complications when adjusting for age and presence of infection with an Odds Ratio (OR) of 1.60 ($p<0.05$;CI: 1.09-2.35). Furthermore, the malnourished patients also had increased length of hospitalization (16.7 days vs 10.1 days). Though the statistical significance of the length of hospitalization was not provided by the authors, it is clinically significant that the malnourished patients were hospitalized for an additional six days[16].

In addition to malnutrition impacting bodily function, it also impacts the financial burden of hospitalizing these patients. Corkins et al confirmed what is known regarding the consequences of malnutrition, showing that patients who had a diagnosis of malnutrition had longer stays (12.6$\pm$0.5 vs 4.4$\pm$0.1 days, $P<0.0001$), and they also demonstrated that malnourished patients accrued higher costs ($26,944 vs $9,485, $P<0.0001$) compared with patients who did not have a diagnosis of malnutrition[11]. This reinforces what was discovered in earlier studies, such as Correia et al's study in 2003 of Brazilian patients, where it was found that the daily expense of caring for a malnourished patient was 60.5% higher than for a well-nourished patient. Additionally, in a subset of patients suffering from respiratory infections, the combined costs of medications and tests increased the overall cost by 308.9% compared to the well-nourished patients, no statistical significance was provided[16]. The financial impact of malnutrition will be discussed further throughout the rest of this thesis.

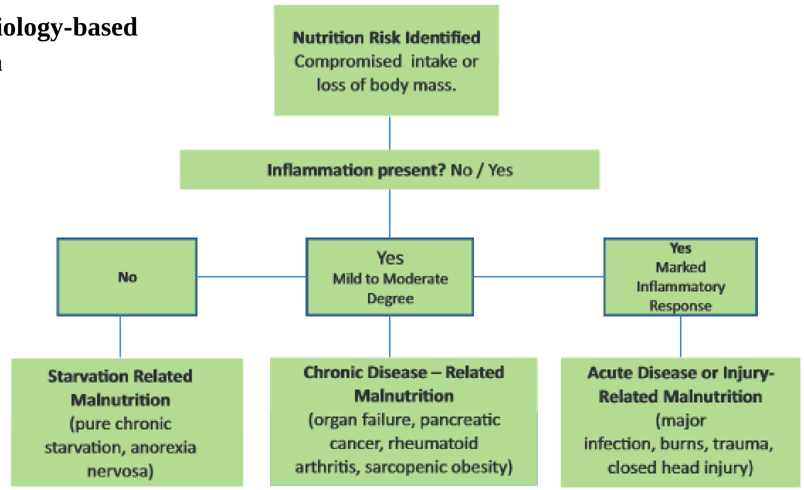
Diagnosing Malnutrition

As previously mentioned, there is currently no universally accepted definition of malnutrition, and thus, there is no universally accepted way to diagnose malnutrition either. Historical definitions for malnutrition have been proven to be very problematic and inaccurate when applied to the typical inpatient adult population seen today, in part because they were initially based on pediatric malnutrition syndromes found in less-developed countries. The limitations of these old criteria include that they lack full validity, resulting in poor specificity and sensitivity. For example, serum albumin has been used (and continues to be used) to not only diagnose the presence of malnutrition, but is used to determine severity. It is a fact that serum albumin is a negative acute-phase reactant, therefore synthesis of albumin, along with breakdown and release out of the vascular compartment with shifts of fluid into peripheral spaces or third spaces are influenced by cytokine-mediated inflammatory responses. Thus, a low albumin is mainly a result of the systemic inflammatory response associated with infection, inflammation or injury, even in the presence of adequate energy and protein intake. Albumin functions as an independent proxy measure for overall disease burden and inflammatory condition or injury, which suggest that non-nutrition factors (mostly inflammation), in most instances, are more influential on serum albumin levels than is the nutritional status of the patient[4, 17].

Additional markers of malnutrition that have been and may be used to diagnose malnutrition include other serum markers such as prealbumin or lymphocyte count and anthropometric markers commonly used in the literature include BMI, mid-arm muscle circumference, tricep skinfold thickness, or weight loss prior to admission. The Subjective Global Assessment (SGA) is a very popular assessment tool that was developed in 1982 as a way to identify the risk for adverse clinical outcomes associated with poor nutritional status, specifically in surgical patients. The SGA is now used in both surgical and non-surgical populations and includes the following components: 1) identifying history of weight loss, dietary intake, gastrointestinal symptoms, functional capacity, and metabolic demand related to the underlying disease, and 2) physical exam focused on the muscle wasting and loss of subcutaneous fat, as well as the presence of edema. The SGA took the focus off of serum markers and, instead, focused on the comprehensive, subjective assessment of patients' nutritional status, which also included a physical assessment to detect changes that might be taking place as a result of malnutrition. The SGA played a key role in the most recently published guidelines for identifying and diagnosing malnutrition[2, 10, 17, 18].

In 2009, the ASPEN and the AND put together a committee that resulted in the most recently published guidelines to help guide the diagnosis of malnutrition. These criteria will be referred to as the ASPEN/AND criteria throughout this thesis. These criteria are etiology-based, stemming from whether or not inflammation is present in the patient's current medical status at the time of the nutrition assessment. The three categories of malnutrition, their chronicity, and whether inflammation would be present are displayed in figure 1[2].

Figure 1: Etiology-based malnutrition



At this time, the consensus guidelines do not distinguish between mild and moderate (non-severe) malnutrition due to insufficient evidence regarding their application in clinical settings. The six clinical characteristics identified to assess for the diagnosis of malnutrition are displayed in Table 1[2, 19, 20].

Table 1: ASPEN/AND Malnutrition Criteria

	Malnutrition in the Context of Acute Illness or Injury				Malnutrition in the Context of Chronic Illness				Malnutrition in the Context of Social or Environmental Circumstances			
Clinical Characteristic	Nonsevere (moderate) Malnutrition		Severe Malnutrition		Nonsevere (Moderate) Malnutrition		Severe Malnutrition		Nonsevere (Moderate) Malnutrition		Severe Malnutrition	
Energy Intake	<75% of estimated energy needs for >7 days		≤50% of estimated energy requirement for ≥5 days		<75% of estimated energy requirement for ≥1 month		≤75% of estimated energy requirement for ≥1 month		<75% of estimated energy requirement for ≥3 months		≤50% of estimated energy requirement for ≥1 month	
Interpretation of weight loss	%	Time	%	Time	%	Time	%	Time	%	Time	%	Time
	1-2	1 wk	>2	1 wk	5	1 mo	>5	1 mo	5	1 mo	>5	1 mo
	5	1 mo	>5	1 mo	7.5	3 mo	>7.5	3 mo	7.5	3 mo	>7.5	3 mo
	7.5	3 mo	>7.5	3 mo	10	6 mo	>10	6 mo	10	6 mo	>10	6 mo
					20	1 yr	>20	1 yr	20	1 yr	>20	1 yr
Body Fat Loss	Mild		Moderate		Mild		Severe		Mild		Severe	
Muscle Mass Loss	Mild		Moderate		Mild		Severe		Mild		Severe	
Fluid Accumulation	Mild		Moderate to severe		Mild		Severe		Mild		Severe	
Reduced Grip Strength	N/A		Measurably reduced		N/A		Measurably reduced		N/A		Measurably reduced	

Even though these ASPEN/AND criteria are the most recent, hospitals do not have to use them as their premise for diagnosing malnutrition. In fact, each hospital or institution has the freedom to determine what their providers and ancillary staff are taught as appropriate criteria for the diagnosis of malnutrition. At Nebraska Medicine, the following criteria are currently being taught and used for the diagnosis of malnutrition: weight as a percent of IBW, BMI, serum albumin, serum transferrin, total lymphocyte count and serum prealbumin. Table 2 displays these criteria in their respective categories for identifying the severity of malnutrition present. These criteria will be referred to as the Nebraska Medicine criteria throughout this thesis[6, 21].

Table 2: Current Nebraska Medicine Malnutrition Criteria			
	Mild	Moderate	Severe
Weight	85-90% of ideal	75-85% of ideal	<75% of ideal
BMI	18-18.9	16-17.9	<16
Serum albumin	3.1-3.4	2.4-3.0	<2.4
Serum transferrin	201-219	150-200	<150
Lymphocyte count, Total	1501-1999	800-1500	<800
Prealbumin	13-18	8-12	<8.0

Coding Based on Diagnostic Related Groups

In order to understand how malnutrition fits into the world of hospital coding and reimbursement, it is important to establish a basic understanding of how coding, in general, works and is categorized. Firstly, hospital reimbursement versus professional reimbursement differs, this thesis will overview hospital reimbursement, specifically inpatient acute care stays only; ambulatory medical nutrition therapy billing and reimbursement may follow different steps. There are four main sources of reimbursement for any inpatient hospital stay: 1) Medicare (federal) usually provides reimbursement for the those > 65 years in addition to some conditions, such as end-stage renal disease, at any age, 2) Medicaid (state) provides reimbursement for any age who qualify, 3) Private insurers reimburse according to individual contracts (these tend to follow federal methodologies), and 4) Self-pay, which means the patient is responsible for his/her own payment[22].

Based on the PPS set forth by CMS, the costs of acute care hospital inpatient stays are based on prospectively set rates. Each case is categorized into a DRG, and each DRG has a payment weight that corresponds with it, based on the known average resources used to treat patients in that specific DRG. In 2007, Medicare moved to its current system of inpatient reimbursement called the Medicare Severity DRG (MS-DRG) system. This system relies on diagnoses, and there are three major types of diagnoses associated with each inpatient hospitalization: 1) Admitting diagnosis (ADX), which is the initial reason for admission, commonly known as the patient's "chief complaint," which is usually non-specific and not used to influence reimbursement because many patients are not familiar with official medical terminology, 2) Principal diagnosis (PDX) is the condition that the physician establishes as the primary reason for causing the patients' complaints that led to admission, and the PDX is used for reimbursement purposes, and 3) Secondary diagnoses (SDXs) are the conditions that co-exist at the point of admission, that develop throughout the admission, or that affect the treatment received[5, 7, 8, 9, 22].

CMS has set a relative weight (RW) for each MS-DRG, which is used in the ultimate calculation when deciding reimbursement amounts. Additionally, a base rate for the reimbursement of each patient's care is assigned for each hospital, based on different factors, including: geography, resident and medical education costs, overhead costs and average case mix index (CMI), which indicates acuity level of the patients of each institution[22, 23]. The general equation for determining reimbursement of an inpatient hospitalization consists of the RW of a MS-DRG multiplied by the base rate in order to determine the payment amount for each patient case[5, 22].

The ultimate reimbursement for an inpatient stay can be influenced by SDXs. These SDXs are classified as being either a CC or a MCC. Reimbursement has the potential to increase the most for DRGs associated with MCCs, followed by DRGs associated with CCs. Thus, the goal would be to accurately identify any SDXs along the course of a patient's admission, so as to gain the necessary reimbursement to cover the costs of the care provided. The MS-DRG can only be affected by one MCC or one CC, so, though it is clinically correct to document all SDXs present, it will not shift the MS-DRG if it is already associated with a MCC or CC[7, 8, 9, 22]. However, accurately and correctly documenting the severity of an illness, along with the appropriate MCC or CC additions, not only helps to gain the necessary reimbursement to care for the patients, but also can adjust the hospitals' CMI. The CMI is used to estimate the level and complexity of services provided at any given hospital, with higher CMIs reflecting higher complexity of care[5].

The coding processes described thus far are all specific to Medicare methodologies. Nebraska Medicaid, as well as in other states, uses the All Patient Refined DRG (APR-DRG) system, which uses a significantly different methodology than MS-DRG. Within the APR-DRG system, there are no CC or MCC diagnoses, but rather SDXs are assigned a severity of illness (SOI) level, which is based on how much physiologic decompensation or loss of organ system function is present. In this system, more than one SDX is usually needed to develop an overall SOI level, and, in general, the more body systems that are affected, the greater increase there is in the SOI level. Malnutrition is one of the SDXs that can influence the SOI level. The above is a general overview of the SOI concept. The exact intricacies of the SOI calculation are beyond the scope of this thesis. Private payers may use the All Patient DRG system (AP-DRG), which uses a very similar methodology to that of the MS-DRG system except that the RWs, the base rates, and the DRG names differ from those for MS-DRGs[22, 24].

Coding for Malnutrition

After the PDX and any associated SDXs are identified, numerical codes called the ICD codes are used to translate the medical diagnoses into numerical codes for billing and research purposes[7, 8, 9]. During the time of data collection for this thesis, the ICD-9 codes were being used. Since that time, the ICD-10 codes have been implemented, and any differences between these codes will be described. All possible malnutrition ICD-9 codes are displayed in Table 3, along with the corresponding ICD-10 codes, also displayed is the classification as MCC or CC of each code[5, 25, 26, 27].

Table 3: Malnutrition ICD-9 Codes versus ICD-10 Codes		
ICD-9 Code and Title	**ICD-10 Code and Title**	**MCC/CC Designation**
260: Kwashiorkor	E40: Kwashiorkor E42: Marasmic kwashiorkor	MCC
261: Nutritional marasmus	E41: Nutritional marasmus	MCC
262: Other severe protein-calorie malnutrition	E43: Unspecified severe protein-calorie malnutrition	MCC
263: Malnutrition of moderate degree	E44: Moderate protein-calorie malnutrition	CC
263.1: Malnutrition of mild degree	E44.1: Mild protein-calorie malnutrition	CC
263.2: Arrested development following protein-calorie malnutrition	E45: Retarded development following protein-calorie malnutrition	CC
263.8: Other protein-calorie malnutrition	E46: Unspecified protein-calorie malnutrition	CC
263.9: Unspecified protein-calorie malnutrition	E46: Unspecified protein-calorie malnutrition E64: Sequelae of protein-calorie malnutrition	CC

A diagnosis of malnutrition is usually not enough to obtain the necessary reimbursement to provide the increased level of care for these patients. Reimbursement is only increased if the malnutrition is identified, diagnosed and treated by the physician in combination with providing care for the primary illness, also identified via ICD codes[5].

As already stated, CMS has not accepted any one definition of malnutrition over the other, so it is up to each hospital or other type of care facility to develop policy and procedures for the documentation of and treatment for malnutrition, and ultimately coding for malnutrition. Several articles emphasize the importance of having a validated screening tool to use for each patient at admission, followed by a full RD assessment for those patients identified to be at risk for malnutrition. The next step is to develop a way to communicate the findings of the RD (whether or not malnutrition is present and needs to be coded for) to the primary physician. Many hospitals are in the process of developing the most effective ways to communicate the malnutrition diagnosis from the RD’s assessment to the physician. This is imperative because if an RD documents malnutrition in his/her assessment, it cannot be coded for reimbursement purposes until it is mentioned/acknowledged by the physician caring for the patient[5]. Therefore, many hospitals are starting to work with their coding personnel to come up with electronic alerts that can be created within each patient's medical record to send a notification to the physician when malnutrition is identified, or at least to notify the coding personnel so that they can query the physician[5, 22, 28].

The economic effect of malnutrition and the financial impact of both under-documentation as well as accurate documentation is well documented in the literature. The total reimbursement can more than double if the correct CC or MCC malnutrition code is used to describe a patient's nutritional status. Although only one MCC or CC code can be used to increase the dollar amount of total reimbursement, it is still beneficial to code for all appropriate diagnoses in order to provide the most optimal care for the patient and to describe the overall population of each hospital/facility accurately[5, 22, 27]. Amaral et al showed that even the cost of treating patients who are identified as being *at risk* for malnutrition is, on average, 20% higher than patients who are not at risk[29].

Even with the knowledge that accurate documentation can help to provide hospitals with the reimbursement necessary to provide optimal patient care, malnutrition continues to be under-recognized, resulting in under-documentation, and ultimately resulting in hospitals missing out on needed additional resources to care for malnourished patients. In a study by Konturek et al, they were looking to identify clinical characteristics of patients who were malnourished versus not malnourished in a European hospital. Along with identifying clinical factors associated with their malnourished population, they also identified that 84.5% of the time malnutrition was not correctly coded, leading to significant financial losses[30].

In order to determine where patients are falling undiagnosed or where coding practices are falling short of obtaining the necessary reimbursement, it is important to gather benchmark data regarding current coding practices and clinical characteristics that may or may not be driving these coding practices.

METHODS

Study Design and Participants

This study protocol was approved by the Institutional Review Board at the University of Nebraska Medical Center in Omaha, Nebraska. This was a retrospective, electronic medical record (EMR) review on subjects who had any of the following malnutrition ICD-9 codes used during an inpatient stay at Nebraska Medicine: kwashiorkor, nutritional marasmus, other severe protein-calorie malnutrition, malnutrition of moderate degree, malnutrition of mild degree, arrested development following protein-calorie malnutrition, other protein-calorie malnutrition, or unspecified protein-calorie malnutrition. Data were collected from the time period of January 20th, 2015 – July 20th, 2015.

The malnutrition ICD-9 code used during admission and the reimbursement category the codes belonged to was collected for 923 subjects. In a subset of 200 subjects from January 20th – June 21st, 2015 a more extensive medical record review was performed where admission, discharge, demographic and anthropometric data were collected and analyzed. One ICD-9 code, kwashiorkor, included only one subject who was admitted from June 21st – July 7th, 2015 and this subject was included in the subset analysis. Subjects were excluded if they were less than 19 years of age, if their inpatient stay fell outside of the previously mentioned timeline, or if they did not have a malnutrition ICD-9 code used during their inpatient stay.

Data Collection

All data was collected at two time points within each subjects' inpatient stay, which were at admission (< 48 hours of the inpatient stay) and at discharge (>48 hours of the inpatient stay up to discharge). Regarding the two time points identified, for all data provided by the medical doctor (MD) that could not be collected solely from flowsheets or laboratory results, the History and Physical (H&P) note, first progress note, last progress note, and discharge summary were selected for representation of what was documented in the EMR. If a Nutrition Therapist also had documentation included for any admission, all nutrition notes were reviewed. Anthropometric data, including height, IBW, weight, BMI, and weight as a percent of IBW were collected at both time points. The following demographic information was collected for all participants: age, gender, mortality, and insurance provider. Additional inpatient data collected for each participant included: length of stay (LOS), malnutrition ICD-9 code used during admission, whether or not a Nutrition Therapist was consulted or following without a consult, and whether or not justification for the diagnosis of malnutrition was provided by both the MD and Nutrition Therapist. If justification was provided, the first incidence of documentation of malnutrition and its justification was used for data collection.

Anthropometrics. Height and weight data were collected from the Comprehensive flowsheets. Admission weight was defined as the first weight taken within 48 hours of admission and was used to calculate admission BMI. Discharge weight was defined as the last weight taken on the date of discharge or nearest weight to the date of discharge and was used to calculate discharge BMI. Weight change and percent weight change throughout admission were calculated from the admission weight and discharge weight, and IBW was calculated manually based on the height and gender of each subject using the Hamwi Equation.

Laboratory Values. Laboratory values were also based on the time periods of at admission and at discharge. Serum Prealbumin, Albumin, Transferrin, and Lymphocyte Count levels were collected at admission and the lowest level throughout the hospital stay. In the event that more than one lab was drawn at admission, the lowest value was recorded. The exception was for C-reactive protein (CRP), in which case the highest level at admission was recorded and the highest level throughout the hospital stay.

Inadequate Energy Intake. Inadequate energy intake at admission was defined as any mention in the H&P, first MD progress note or Nutrition Therapist note within the at admission time period. This could have included a nutrition diagnosis from the Nutrition Therapist of "Inadequate Oral/Energy Intake," or report of inadequate intake from the patient or family in the subjective portion of the nutrition or physician notes. Inadequate energy intake throughout admission was defined as any mention in the final progress note, discharge summary or nutrition note. Additionally, subjects were considered to have inadequate energy intake throughout admission if a Calorie Count was ordered throughout their hospitalization, if they received nutrition support (enteral or parenteral) for less than or equal to half of their LOS, or if their intake as documented in the Intake/Output flowsheet met the ASPEN/AND criteria for inadequate energy intake, which are displayed in Table 4. If the subjects' LOS was less than five days, they were considered to have inadequate energy intake if they consumed less than 75% of two to three meals per day for less than or equal to half of their stay as documented in the Intake/Output flowsheet.

Table 4: ASPEN/AND Energy Intake Criteria
≤50% of estimated energy requirement for ≥5 days
$<$75% of estimated energy requirement for $>$7 days
≤75% of estimated energy requirement for ≥1 month
≤50% of estimated energy requirement for ≥1 month
$<$75% of estimated energy requirement for ≥3 months

Unintentional Weight Loss. Unintentional weight loss at admission was defined as any mention of unintentional weight loss in the H&P, first MD progress note or Nutrition Therapist note upon admission assessment. If quantification of the weight loss was provided, that was also collected. Additionally, if a subject screened positive for unintentional weight loss on the Nursing Admission Screen, they were also recorded as having unintentional weight loss at admission. Unintentional weight loss throughout admission was described as percent weight change over their hospitalization calculated from the admission and discharge weights. The subjects were considered to have unintentional weight loss throughout hospitalization if their weight loss throughout admission met any of the ASPEN/AND criteria, which are displayed in Table 5.

Table 5: ASPEN/AND Unintentional Weight Loss Criteria

%	Time Period
≥1-2	1 week
≥5	1 month
≥7.5	3 months
≥10	6 months
≥20	1 year

Physical Exam (body fat loss, muscle mass loss, fluid accumulation). Body fat loss, muscle mass loss, and fluid accumulation were defined as any mention of these physical changes described in the H&P, first or last progress notes, discharge summary, or any nutrition notes for at admission and throughout admission. Additionally, for muscle mass loss, if a subject screened positive for appearing underweight on the Nursing Admission Screen they were also flagged for muscle mass loss. If body fat or muscle mass loss was identified at admission it was automatically recorded as present throughout admission, but not vice versa. Fluid accumulation was further evaluated in the nursing Assessment flowsheet for both at admission and throughout admission.

Functional Status. Since hand grip strength is not routinely documented in the EMR, functional status was defined as any mention from the MD or Nutrition Therapist at admission of decline in ability to perform usual activities or a significant decline in functional status. Qualitative excerpts were taken from the EMR to demonstrate what was considered as significant enough to warrant a flag for decrease in functional status at admission. Functional status changes during the throughout admission time period were unable to collected.

Data Analysis

Malnutrition ICD-9 code data were categorized into two groups based on their reimbursement potential, MCC and CC to be compared. In the univariate analysis, the differences between categorical variables were evaluated with the Chi-Square Test or the Fischer's Exact Test, and differences between continuous variables were evaluated with the Independent Sample T-Test or Mann Whitney U Test. Categorical variables included: gender, mortality, insurance provider, whether or not a Nutrition Therapist was consulted, justification for the malnutrition diagnosis, energy intake, unintentional weight loss, muscle mass loss, body fat loss, and fluid accumulation. Continuous variables included: age, LOS, BMI, weight, weight loss throughout admission, and laboratory values. Multivariate analysis was performed using Logistic Regression to establish an OR for select variables of interest to further investigate what clinical characteristics might be most associated with each malnutrition code category. Data are often grouped according to whether the variables pertain to the ASPEN/AND criteria or the Nebraska Medicine criteria. Data analysis was performed using IBM SPSS Statistics 22 software and the level of significance was set at $\alpha=0.05$.

RESULTS

The total number of subjects for which data was gathered regarding the malnutrition ICD-9 code used during their admission was 923 subjects from January 20th, 2015 – July 20th, 2015. Six out of the eight possible malnutrition ICD-9 codes were used. Three of the codes that were used are classified as MCC and the other three of the codes are classified as CC. Table 6 provides details regarding the distribution of subjects across the different malnutrition codes. Out of 923 subjects, over half, 67.4% (n=622), were classified with malnutrition ICD-9 codes that are within the CC reimbursement category.

Table 6: Malnutrition Codes (MCC vs. CC)

	260: Kwashiorkor (MCC)	261: Nutritional Marasmus (MCC)	262: Other severe, protein-calorie malnutrition (MCC)	263.0: Malnutrition of moderate degree (CC)	263.1: Malnutrition of mild degree (CC)	263.9: Unspecified protein-calorie malnutrition (CC)
N=923	1	113	187	202	100	320
N=200	1	41	40	39	40	39

Among the 200 subjects included in the subset analysis, the mean age was 59.2 years old and 53% (n=106) of the subjects were male. Baseline characteristics are displayed in Table 7. There were no significant differences in gender (p=0.895), age (p=0.325), or insurance provider (p=0.352) between group 1, MCC and group 2, CC. The majority of the subjects had Medicare as an insurance provider, consisting of 53% (n=106) of the population, followed by Private insurance, consisting of 26.5% (n=53). As would be expected, the proportion of deceased patients was significantly higher in the MCC group versus the CC group (46.3% vs. 24.5%, p=0.001).

Table 7: Baseline Characteristics				
Variable	Total	MCC	CC	p-value
Total	N=200	82	118	
Gender-M/F	106/94	43/39	63/55	0.895
Mean Age (years)	59.2	60.8	58.1	0.325
Insurance Provider				0.352
Medicare	106	48	58	
Medicaid	22	7	15	
Private	53	22	31	
None	19	5	14	
Mortality	33.5% (67/200)	46.3% (38/82)	24.5% (29/118)	*0.001*

Due to body composition being forefront in the new diagnosis guidelines for malnutrition, admission and discharge anthropometric data are provided in Table 8. Weight loss at admission was more significant in the MCC group, with a mean report of weight loss at admission being 12.9 kg in the MCC group vs 9.5 kg in the CC group (p-value=0.046). Weight at discharge was lower in the MCC group (p-value=0.046). However, weight loss throughout admission, percent weight change throughout admission, admission and discharge BMI and admission and discharge % of IBW were not significantly different between group 1, MCC and group 2, CC.

Table 8: Anthropometric Characteristics				
Variable	Total	MCC	CC	p-value
Height (m)	200	1.69	1.71	0.162
Admission	199			
Wt (kg)		66.1	71.2	0.099
BMI (kg/m2)		23.2	24.3	0.267
% of IBW		106%	110%	0.419
Wt Loss at Admission (kg)	76	12.9	9.5	*0.046*
Discharge	195			
Wt (kg)		65.8	72.5	*0.046*
BMI (kg/m2)		23.2	24.8	0.137
% of IBW		106%	111%	0.233
Wt Loss Throughout (kg)	81	6.3	4.7	0.196
% Wt Change	81	8.9%	6.4%	0.134

Additional admission characteristics are displayed in Table 9. Out of 200 subjects, a Nutrition Therapist was consulted or following without a consult for 153 subjects, thus, 47 subjects who were coded for malnutrition did not have a Nutrition Therapist consulted nor following during their inpatient stay. Justification for the diagnosis of malnutrition was provided by a MD for 46 out of 200 possible subjects, and was provided by a Nutrition Therapist for 22 out of 153 possible subjects. Table 10 shows information regarding what criteria the MDs chose to use when they provided justification for the diagnosis of malnutrition. Table 11 shows what criteria the Nutrition Therapists chose to use when they provided justification for the diagnosis of malnutrition.

Table 9: General Admission Characteristics Between MCC vs. CC			
	MCC	CC	p-value
LOS (days)	13	14	0.784
Nutrition Therapist Consult	67% (55/82)	67% (80/118)	0.914
Nutrition Therapist Following (w/o consult)	27% (8/27)	26% (10/38)	0.769
No Nutrition Therapist consult or Nutrition Therapist Following	19	28	-
Justification by MD	32% (26/82)	17% (20/118)	*0.015*
Justification by Nutrition Therapist	21% (13/63)	10% (9/90)	0.065

Table 10: Justification Provided by MD							
AND/ASPEN Criteria							
	Energy Intake	Wt Loss	Body Fat Loss	Muscle Mass Loss	Fluid Accumulation	Functional Status	
N out of 46	13	12	1	6	0	1	
Nebraska Medicine Criteria							
	Prealbumin	Albumin	Wt as % of IBW	BMI	Transferrin	Lymphocyte Count	Refer to RD Note
N out of 46	2	28	0	10	0	0	4

Table 11: Justification Provided by Nutrition Therapist						
AND/ASPEN Criteria						
	Energy Intake	Wt Loss	Body Fat Loss	Muscle Mass Loss	Fluid Accumulation	Functional Status
N out of 22	16	18	3	12	1	0
Nebraska Medicine Criteria						
	Prealbumin	Albumin	Wt as % of IBW	BMI	Transferrin	Lymphocyte Count
N out of 22	0	3	1	2	0	0

The ASPEN/AND criteria were evaluated with the Chi Square Test and, where appropriate, the Fischer's Exact Test. The only characteristic that was statistically significant was the presence of muscle mass loss at admission (p-value=0.016) and at discharge (p-value=0.010). Table 12 displays the ASPEN/AND criteria at admission and Table 13 displays the ASPEN/AND criteria at discharge between group 1, MCC and group 2, CC.

Table 12: ASPEN/AND Criteria at Admission				
Variable	Total	MCC	CC	p-value
Inadequate Intake	184	77% (59/77)	69% (74/107)	0.264
Weight Loss	189	54% (43/79)	52% (57/110)	0.723
Body Fat Loss	5	4/4	1/1	-
Muscle Mass Loss	182	61% (48/79)	43% (44/103)	*0.016*
Fluid Accumulation	198	36% (29/81)	31% (36/117)	0.458
Functional Status	25	10/10	15/15	-

Table 13: ASPEN/AND Criteria at Discharge				
Variable	Total	MCC	CC	p-value
Inadequate Intake	200	60% (49/82)	65% (77/118)	0.428
Weight Loss	194	46% (36/79)	39% (45/115)	0.372
Body Fat Loss	5	4/4	1/1	-
Muscle Mass Loss	182	62% (49/79)	43% (44/103)	*0.010*
Fluid Accumulation	197	48% (39/81)	49% (57/116)	0.891

The Nebraska Medicine criteria were evaluated with the Independent Samples T-Test and, where appropriate, the Mann Whitney U Test. Results for at admission are displayed in Table 14 and results for at discharge are displayed in Table 15. Serum albumin at admission was found to be lower for group 1, MCC versus group 2, CC (2.2 g/dL vs 2.8 g/dL; p-value=0.000). Since the Nebraska Medicine criteria were collected as continuous variables, they were able to be grouped according to severity. When these variables were grouped by severe versus non-severe, the number of statistically significant variables increased, as displayed in Table 16 and Table 17 for at admission and at discharge, respectively.

Table 14: Nebraska Medicine Criteria at Admission

Variable	Total	MCC	CC	p-value
Weight as a % of IBW	199	106%	110%	0.419
BMI (kg/m2)	199	23.2	24.3	0.267
Serum albumin (g/dL)	181	2.2	2.8	*0.000*
Serum transferrin (mg/dL)*	14	166	101	0.606
Total lymphocyte count (cells/uL)	191	1000	2,414	0.304
Serum pre-albumin (mg/dL)*	11	13.2	7.0	0.279
CRP (mg/dL)*	26	8.5	4.3	0.241

*Median reported due to small sample size

Table 15: Nebraska Medicine Criteria at Discharge

Variable	Total	MCC	CC	p-value
Weight as a % of IBW	195	106%	111%	0.233
BMI (kg/m2)	195	23.2	24.8	0.137
Serum albumin (g/dL)	128	1.9	2.2	0.057
Serum transferrin (mg/dL)*	16	101	130	0.071
Total lymphocyte count (cells/uL)	163	973	1,735	0.407
Serum pre-albumin (mg/dL)*	14	8.5	12.2	0.272
CRP (mg/dL)*	13	7.3	17.9	0.222

*Median reported due to small sample size

Table 16: Nebraska Medicine Criteria by Severe vs Non-Severe Category at Admission

Variable	Total	MCC	CC	p-value
<75% IBW	199	21% (17/82)	4% (5/117)	*0.000*
BMI<16 (kg/m2)	199	13% (11/82)	2% (2/117)	*0.001*
Albumin <2.4 (g/dL)	181	62% (46/74)	22% (24/107)	*0.000*
Transferrin <150 (mg/dL)	14	40% (2/5)	67% (6/9)	0.580
Total lymphocyte count <800 (cells/uL)	191	48% (37/77)	36% (41/114)	0.096
Pre-albumin <8.0 (mg/dL)	11	25% (2/8)	67% (2/3)	0.491

Table 17: Nebraska Medicine Criteria by Severe vs Non-Severe Category at Discharge				
Variable	Total	MCC	CC	p-value
<75% IBW	195	20% (16/79)	5% (6/116)	*0.001*
BMI<16 (kg/m2)	195	14% (11/79)	3% (3/116)	*0.003*
Albumin <2.4 (g/dL)	128	78% (46/59)	58% (40/69)	*0.016*
Transferrin <150 (mg/dL)	16	100% (7/7)	67% (6/9)	0.213
Total lymphocyte count <800 (cells/uL)	163	47% (33/70)	49% (46/93)	0.769
Pre-albumin <8.0 (mg/dL)	14	38% (3/8)	33% (2/6)	1.00

Select variables, based on their level of statistical and clinical significance, were further analyzed in a multivariate analysis using Logistic Regression. Final regression models are displayed in Table 18 and Table 19. The odds of death are 2.6 times higher for those coded with a MCC malnutrition code versus a CC malnutrition code when controlling for age (p-value=0.002; 95% CI: 1.40-4.81). Regarding the malnutrition code regression models, muscle mass loss at admission and at discharge were evaluated. The odds of being classified with a MCC malnutrition code are 3.5 times higher for those who presented with muscle mass loss at admission versus those without muscle mass loss at admission when controlling for age, gender and weight loss (in kg) at admission (p-value=0.018; 95% CI: 1.24-10.00). The odds of being classified with a MCC malnutrition code are 2.2 times higher for those who had muscle mass loss at discharge versus those without muscle mass loss at discharge when controlling for age and gender (p-value=0.012; 95% CI: 1.19-3.95).

Table 18: Logistic Regression Model for Mortality

Variables	**P-value**	**OR**	**95% Confidence Interval (CI)**
Age	*0.004*	1.03	1.008-1.045
Malnutrition Code Group	*0.002*	2.60	1.40-4.81

Table 19: Logistic Regression Models for Malnutrition ICD-9 Code (MCC vs CC)

Variables	P-value	OR	95% Confidence Interval (CI)
Age	0.582	0.99	0.967-1.019
Gender	0.453	1.47	0.537-4.027
Wt loss at admission (kg)	0.116	0.94	0.875-1.015
Muscle mass loss at admission	*0.018*	3.50	1.24-10.00
Age	0.646	0.99	0.980-1.013
Gender	0.758	1.09	0.601-2.009
Muscle mass loss at discharge	*0.012*	2.20	1.19-3.95

DISCUSSION

The present study explored the current practices at Nebraska Medicine for documenting and coding malnutrition, including whether or not a justification was provided by the MD and/or Nutrition Therapist, and if so, what criteria was used to make the diagnosis. This study also evaluated the differences between subjects who were coded with a MCC versus a CC malnutrition ICD-9 code, including: admission and discharge anthropometric data (i.e. height, weight, BMI, percent weight change throughout admission), LOS, intake, weight loss, body fat loss, muscle mass loss, and fluid accumulation at admission and at discharge, and laboratory values (i.e. serum albumin and prealbumin, total lymphocyte count, transferrin and CRP). There are currently no studies that describe the malnutrition coding practices implemented at Nebraska Medicine, and, additionally, no studies that describe the differences between the MCC and CC malnutrition code populations.

Malnutrition Codes

This study found that, currently, a variety of both MCC and CC malnutrition codes are being used at Nebraska Medicine. The distribution of the 923 subjects was fairly even across the various malnutrition code groups. However, the code for Kwashiorkor only included one patient, which was in itself a surprise as this particular malnutrition description is specific to the pediatric population and is not recommended to be used for adults[2, 5, 17]. Unspecified protein-calorie malnutrition, which is a CC code, had the most subjects. This could be due to the fact that the current Nebraska Medicine malnutrition criteria are outdated and, many times, some of the criteria, such as prealbumin and transferrin, are not even drawn during a patient’s admission. This could have led to increased confusion for the coders and physicians, resulting in a high number of “unspecified.”

While increased mortality has been demonstrated in the malnourished population versus the well-nourished population, the mortality differences between malnourished patients labeled with a MCC malnutrition code versus a CC malnutrition code have not been described[15, 20, 28]. Our results suggest a statistically significant increase in mortality in the MCC group vs. the CC group (46.3% vs. 24.5%; p-value=0.001). In our multivariate model, mortality continued to be significant, with increased odds of mortality of 2.6 times for those in the MCC group versus the CC group when adjusting for age. While the methods of malnutrition diagnosis and justification at Nebraska Medicine were not standardized during the time of our data collection, increased attention should be given to patients labeled with a MCC code, which would indicate a higher severity of malnutrition, and as demonstrated in our study, a higher mortality. Future prospective studies should strive to standardize the method of malnutrition diagnosis and subsequent coding as much as possible to see if this difference in mortality stands.

Justification for the Diagnosis of Malnutrition

Only 46 out of 200 subjects had their diagnosis of malnutrition justified by the MD. Often, the presence of malnutrition was mentioned in the EMR documentation, but instead of providing a justification for this diagnosis, there was only a description of the treatment that was being implemented to help counter the malnutrition. This is likely, in part, due to the lack of universal criteria to diagnose malnutrition, which can lead to confusion as to what criteria are even acceptable for documentation purposes. Since the justification for malnutrition was mostly not provided, the coding personnel would often have to comb through the notes themselves and put together a justification that would suffice for coding/reimbursement purposes, and this was not counted as the MD's justification as it was not produced by them.

Similar to the MD's, less than half of the subjects who were followed by a Nutrition Therapist had a justification for malnutrition provided by the Nutrition Therapist. Again, the explanation for this could be partly attributed to the lack of universal definition and diagnosing criteria. However, specific to Nebraska Medicine, diagnosing malnutrition has not always been on the forefront of the nutrition training priority list. Just over the last two years has official and standardized training for the assessment and diagnosis of malnutrition been provided and implemented by the Nutrition Therapists, so follow up studies will be valuable to assess how the frequency of malnutrition justification changes at this institution.

Even though Nebraska Medicine currently puts forth outdated malnutrition criteria for diagnosis, our study showed that when the MD provided justification for malnutrition, many times it did coincide with the newer ASPEN/AND criteria. Out of the 46 subjects for which malnutrition justification was provided by the MD, inadequate energy intake and weight loss were used 13 and 12 times, respectively. This shows that even though formal malnutrition documentation training is not currently being implemented to physicians, some do know and understand the need for a more comprehensive nutrition assessment versus just using laboratory and anthropometric values, which is encouraging for future education endeavors.

When subjects had a malnutrition justification provided by both the MD and Nutrition Therapist, one thing that was noted throughout the data collection process was that the MD's justification and the Nutrition Therapist's justification, especially in regards to identifying the severity of the malnutrition, often did not align. Frequently, the Nutrition Therapists were identifying severe malnutrition where MD's were identifying it as mild or moderate. Since the MD's notes are used for coding and billing purposes, this could have led to slightly skewed data, especially from the standpoint of severely malnourished patients being coded as only mildly or moderately malnourished. This brings to the forefront the need for more open correspondence between the Nutrition Therapists and the MDs when it comes to identifying and diagnosing malnutrition. Updating and standardizing the malnutrition criteria used across disciplines would be a helpful place to start in unifying the malnutrition documentation.

ASPEN/AND Criteria

The only ASPEN/AND criteria that was significantly different between group 1, MCC and group 2, CC was the presence of muscle mass loss, both at admission and at discharge.

Muscle mass loss also proved to be an independent predictor for the use of a MCC code versus a CC code. This shows that MDs, coding personnel, and Nutrition Therapists are paying more attention to the importance of physical changes that result from malnutrition, and, subsequently, using these physical changes to help determine the severity of the malnutrition that is present for a given patient.

Currently, Nebraska Medicine is undergoing various workshops, webinars and seminars all focused specifically on the Nutrition Focused Physical Examination (NFPE), which is also being taught at the national level by the AND. Having NFPE being taught to the Nutrition Therapists, and also the dietetic interns, will begin to change the paradigm of malnutrition diagnosing, and will strengthen the Nutrition Therapists' nutrition assessment, and ultimately will strengthen the documentation for our malnutrition coding.

Nebraska Medicine Criteria

The only Nebraska Medicine criteria that proved to be significantly different between group 1, MCC and group 2, CC was serum albumin on admission. Because the Nebraska Medicine criteria are grouped by severity when being taught to the Nebraska Medicine staff, they were grouped this way also for data analysis. Once grouped by severity, multiple variables became significant, including: percent of IBW at admission and at discharge, having a BMI<16 at admission and at discharge, and serum albumin of <2.4 at admission and at discharge.

By grouping the Nebraska Medicine variables according to how they are usually grouped for teaching purposes, it was clear that MDs and other ancillary staff are utilizing the criteria as they are being taught. This leads to the belief that if the Nebraska Medicine criteria were updated to reflect more what the ASPEN/AND criteria are describing as malnutrition assessment criteria, MDs and ancillary staff would likely implement the newer, more evidenced-based criteria. This provides much opportunity for hospital-wide education, beginning with the Nutrition Therapists. As previously mentioned, education sessions have already begun for the Nutrition Therapists at

Nebraska Medicine, and next steps are going to be to become more involved with the coding personnel and their preferred method of communication for identifying malnourished patients, and, just as importantly, to improve education and communication to the MDs so that the most updated malnutrition criteria are being used throughout the hospital to identify and document the presence of malnutrition.

Of note, the mean percent IBW of the two groups was over 100% for both the MCC and CC groups at admission and at discharge. This does coincide with other research that has demonstrated that malnutrition is prevalent in obese patients as well as non-obese patients, and does worsen outcomes for obese malnourished patients as compared to obese well-nourished patients[31].

Study Population

Of the study population, the distribution of males vs. females and ages were not significantly different between the groups, so did not contribute to our results. Our sample of subjects likely represents the typical patient population at Nebraska Medicine, though future studies would likely find benefit in also distributing subjects according to comorbidities that may be present in addition to malnutrition to get a more accurate picture of the populations that tend to have a higher prevalence of malnutrition.

Comparative Research

Many studies have described the differences between well-nourished and malnourished patients, and the subsequent adverse effects that result from malnutrition[1, 2, 10, 12, 14, 15, 31]. However, to our knowledge, no studies have evaluated the differences between reimbursement categories within the overall population of solely malnourished patients.

Limitations

This is a retrospective chart review; therefore, bias may have arisen from misclassification errors. Since this study was not prospective, the subjects were not assessed for physical changes of malnutrition in real time, therefore, it was impossible to be sure the documentation of muscle mass loss or other physical changes were accurate, and, additionally, it was impossible to obtain the physical assessment from the subjects where documentation of their physical appearance was missing altogether.

Though there were 923 subjects included in the analysis regarding the type of malnutrition code used, the small subset sample size of 200 subjects is a limitation as a larger sample size may have resulted in strengthened associations or associations that were not seen at all in this study.

Regarding the variables gathered for each subject included in the study, weights are often inaccurate in hospitalized patients due to fluid status changes and the inaccuracy of bed scales, which are frequently used to obtain the weights. Therefore, our assessment of weight change across admission, in addition to admission and discharge weight may be, in some cases, more a reflection of fluid shifts or complete scale error versus real weight change. This is another limitation that stems from the retrospective nature of this study.

Additionally, a control group of well-nourished subjects was not used for the purposes of this study. Having a control group would be useful to identify if the changes and differences that we identified in our subjects is specific to the malnourished population, and how/if the variables gathered might differ from those in a population of well-nourished subjects.

Strengths

Strengths of this study include the even distribution of subjects between the two groups, MCC versus CC. Having similar groups helped to be able to identify true changes/variations in our statistical analysis rather than having many significant differences in baseline characteristics that would have influenced our outcomes of interest. Another strength of this study is that the population included is very representable of the population treated at Nebraska Medicine and allows the results of this study to be applied to clinical practice.

Applications for Clinical Practice

Interest in this study developed from the recent focus in the nutrition body of literature on malnutrition, and specifically, the call for accurate diagnosis and documentation of malnutrition in order to obtain the necessary reimbursement to care for these patients[1, 2, 3, 4, 5, 13, 17]. Furthermore, basic information regarding what malnutrition codes are currently being used at Nebraska Medicine was previously unknown before this study. It is imperative to have an understanding of the current malnutrition coding situation in order to make plans for future process improvement initiatives and, eventually, changes in clinical practice.

This study also identified that muscle mass loss is a main indicator for determining the severity of malnutrition. These results are encouraging because the entire malnutrition movement is becoming more focused on using a comprehensive physical examination as a part of any standard nutrition assessment[2]. Thus, Nutrition Therapists will continue to be valuable members of the healthcare team as the experts in identifying physical changes that may be taking place as a result of the development of malnutrition, and, insight on the most evidenced-based, realistic way to intervene for the best nutritional outcomes.

Research efforts should continue to investigate the characteristics that are unique to malnourished patients in order to be able to effectively and accurately identify this population. Underlying comorbidities were not gathered in this study, but this information would be helpful to obtain in future studies in order to continue to help characterize which populations are more susceptible to the development of malnutrition, and, what nutrition interventions would be appropriate based on other present comorbidities.

Additionally, many of the original research articles that are used as the basis for our knowledge on malnutrition prevalence and its consequences are from the 1990s and early 2000s, and use no standardized method for diagnosing malnutrition[13, 15, 22]. With the new ASPEN/AND guidelines available, future studies should look at the prevalence and resulting consequences of malnutrition using these newer criteria in order to determine if they find the same adverse effects in the malnourished population, and, what other differences there might be between malnourished patients and well-nourished patients that would help to guide their nutritional and medical care in order to promote the best possible outcomes.

CONCLUSION

We conclude that both MCC and CC malnutrition ICD-9 codes are currently being used at Nebraska Medicine to capture the malnourished population. Muscle mass loss, both at admission and at discharge, proved to significantly increase the odds of a subject being classified with a MCC malnutrition ICD-9 code. This indicates that physical changes resulting from malnutrition do impact the perceived severity of malnutrition, which is in accordance with the most recently published APEN/AND malnutrition guidelines. Thus, implementing a more detailed, nutrition related physical exam would be helpful to support malnutrition diagnoses.

Regarding the Nebraska Medicine criteria that are currently being taught to providing physicians and ancillary staff at Nebraska Medicine, these variables, while outdated according to the most recent malnutrition literature, are being implemented as taught. Therefore, updating the currently taught criteria for diagnosing malnutrition may lead to more widespread acceptance and utilization of the ASPEN/AND criteria. Further research needs to be completed on how comorbidities and admitting diagnosis may impact malnutrition coding, along with how the malnutrition diagnosing and coding paradigm would change at Nebraska Medicine if the ASPEN/AND malnutrition criteria were the standard taught to providers and ancillary staff.

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