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Development and Cost-Effectiveness of a Malnutrition Screening Program in a Skilled Nursing Setting

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DEVELOPMENT AND COST-EFFECTIVENESS OF A MALNUTRITION SCREENING PROGRAM IN A SKILLED NURSING SETTING

by

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ABSTRACT

Malnutrition increases the cost of healthcare and is commonly unrecognized and untreated. These facts are especially true for healthcare settings that provide care to the elderly. Research emphasizes the need for malnutrition prevention in extended care facilities such as skilled nursing facilities (SNFs) so that patients receive timely and appropriate intervention(s).

The purpose of this study was to retroactively screen SNF patients using four alternative malnutrition screening tools and to compare results to those from the facility screening tool. A second purpose was to estimate differences in potential Medicare reimbursement based on the number of patients identified at risk for malnutrition/malnourished using each tool. The screening tools were the OakBend Medical Screening tool (facility tool), Mini Nutrition Assessment-Short Form (MNA-SF), Malnutrition Universal Screening Tool (MUST), Nutrition Risk Screening 2002 (NRS-2002), and Malnutrition Screening Tool (MST).

Retrospective data from 200 SNF elder patients aged 65 years and older admitted between March 2017 and March 2018 were used for analysis. Retrospective screening allowed for comparisons among the five tools. Comparison of the number of patients categorized as no risk and at risk/malnourished using the five screening tools and differences in theoretical reimbursement were tested using chi-squared analysis.

MNA-SF identified the highest number of at risk patients (n = 181; 90.5%), while MUST identified the fewest (n = 68; 34.0%). MNA-SF produced the highest amount of

malnutrition and overall theoretical dollar reimbursement value. For this study, MNA-SF and NRS-2002 showed to be the most appropriate screening tools for SNF setting. In comparison to the OakBend Medical Center screening tool, using numbers from MNA-SF and NRS-2002 would have generated significantly more dollars in Medicare reimbursement, respectively. In order to ensure maximum reimbursement for skilled nursing care for elders, it is essential to document the risk of malnutrition, and screening is an important first step.

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CHAPTER 1

INTRODUCTION

Malnutrition can be defined as a “clinical condition caused by a nutrient imbalance or deficiency because of an individual’s clinical outcome or medical adverse effects” (Donini, Neri, De Chiara, Poggiogalle, & Muscaritoli, 2013, p 1; Margetts, Thompson, Elia, & Jackson, 2003, p 69; Stratton et al., 2004, p 799). These nutritional imbalances commonly include protein-energy malnutrition, vitamin deficiencies, and mineral deficiencies (Shum, Hui, Chu, Chai, & Chow 2005). Malnutrition commonly happens when individuals experience any of the following: inadequate intake; increased nutrient needs; impaired nutrient absorption and metabolism; altered nutrient utilization; inflammatory activity; or a combination of any of the above (Evans, 2005; Gallagher-Allred, Voss, Finn, & McCamish, 1996). These factors can be linked to negative consequences like increased length of stay (LOS); high prevalence of infection; impaired immune function leading to poor wound and pressure sore healing; impaired cognitive function; increased morbidity and mortality rates; decreased bone and muscle mass; anemia; higher hospital readmission rate; and increased health care cost (Agarwal, Miller, Yaxley, & Isenring, 2013; Barker, Gout, & Crowe, 2011; Donini et al., 2013; Gallagher-Allred et al., 1996; Isenring, Banks, Ferguson, & Bauer, 2012; Marshall, Young, Bauer, & Isenring, 2016b; Soeters & Schols, 2009; Velasco et al., 2010; Visvanathan, Penhall, &

Chapman 2004). Malnutrition is commonly unrecognized and untreated within the health care system, especially in elderly care (Stratton et al., 2004; Stratton, King, Stroud, Jackson, & Elia, 2006). Additionally, malnutrition tends to influence health care services leading to increased cost of care for malnourished individuals (Lorini et al., 2014; Marshall, Young, Bauer, & Isenring, 2016a; Meijers, Van Bokhorst-De Van Der Schueren, Schols, Soeters, & Halfens 2010; Stratton et al., 2004).

Skilled nursing facilities (SNFs) are medical rehabilitation services provided for patients who are not in the acute phase of their illness, yet require a higher level of care than what can be provided in a long-term care setting (Evans, 2005; Murad, 2012). SNFs' services cover clinical conditions such as complex wound care, specialized therapy, and post-surgical recovery (Murad, 2012). SNFs provide a wide range of services to patients including medical social services, physical therapy, occupational therapy, speech therapy, respiratory therapy, and nursing care (Murad, 2012). Registered dietitians (RDs) provide medical nutrition therapy in these facilities (Murad, 2012). To qualify for SNFs' services, individuals must require daily rehabilitative therapy or skilled nursing services within 30 days of a hospital stay (Murad, 2012). Medicare offers full coverage on the first 20 days and partial coverage until day 100 (Murad, 2012). SNFs must provide physician care and implement an interdisciplinary plan of care within 30 days of admission; have registered nurses (RNs) on staff for eight hours per day; and have RN on call for 24 hours per day (Murad, 2012).

The increased recognition of nutrition-related challenges that elders encounter has led to studies being done in order to document malnutrition in SNFs (Porter Starr, McDonald, & Bale, 2015). In today's society, elder care is growing rapidly (Dorner, 2010). It has been predicted that the 65 years and older population will rise to roughly 72 million by 2030, which is approximately 20% of the United States population (Dorner, 2010). Aging has been shown to be a factor leading to medical and physiological decline causing malnutrition (Porter Starr et al., 2015). Malnutrition prevalence in SNFs and related facilities varies widely (Porter Starr et al., 2015). Many studies have shown the prevalence of malnutrition to be between 10 and 65%, depending on the types of malnutrition screening tools utilized and the studies' settings (Agarwal et al., 2013; Barker et al., 2011; Dorner, 2010; Favaro-Moreira et al., 2016; Isenring et al., 2012; López-Contreras et al., 2014; Margetts et al., 2003; Marshall et al., 2016a; Smoliner et al., 2009; Suominen et al., 2005; Velasco et al., 2010). These high statistics emphasize the need for malnutrition prevention in facilities like SNFs in order for elders to receive appropriate intervention.

Statement of the Problem

Inadequate nutrition intake in elders is a secondary consequence for either acute or chronic disease states, leading to the predominant cause of malnutrition (López-Contreras et al., 2014). Porter Starr et al. (2015) reported nearly 46% of elderly to have 2-3 chronic health conditions, whereas approximately 16% have more than four chronic health conditions. Multiple studies have revealed the following issues associated with poor health conditions within the elderly population: impaired cognitive function; swallowing and chewing difficulties; inadequate intake and appetite; fatigue; immune system dysfunction; wounds and pressure ulcers; delayed recovery from illness; increased risk of falls; dependency on others; increased mortality and morbidity; and polypharmacy

(Dorner, 2010; Isenring et al., 2012; Isenring, Bauer, Banks, & Gaskill, 2009; Porter Starr et al., 2015).

At OakBend Medical Center SNF, RNs complete an initial screening and assessment of their patients upon admission. Their assessment includes a dietary section in which the RN screens for nutrition risk leading to a consult for the registered dietitian (RD). The screening tool (Appendix A-1) is similar to the Malnutrition Screening Tool (MST) (Appendix A-2), where a score of "2" or more will automatically trigger an RD consult. If an RD consult is not indicated through the nursing admission process, the SNF protocol at OakBend Medical Center requires the RD to see patients by day 5 of their admission. Unfortunately, if patients are at risk for malnutrition or already malnourished and the RD does not see them until day 5, the consequences of malnutrition could worsen, causing possible negative outcomes in the patients' disease state, recovery time, and LOS. Furthermore, the OakBend Medical Center's nutrition screen tool has never been validated to ensure it can appropriately categorize patients as at risk versus not at risk for malnutrition. The nutrition screen is simply formatted to bring awareness of nutrition-related concerns that require the RD's services.

Purpose of the Study

The purpose of this study was two-fold: 1) to retroactively screen patients at a skilled nursing facility (SNF) using four alternative malnutrition screening tools and to compare their results to the registered nurses' nutrition screening completed through the OakBend Medical Screening tool developed by OakBend Medical Center RDs; and 2) to estimate differences in potential Medicare reimbursement based on the number of patients identified "at risk for malnutrition/malnourished" using each screening tool as compared to the initial nutrition screening tool. The four screening tools that were compared are the Mini Nutrition Assessment-Short Form (MNA-SF), Malnutrition Universal Screening Tool (MUST), Nutrition Risk Screening 2002 (NRS-2002), and Malnutrition Screening Tool (MST). Copies of the tools are provided in Appendix A.

The first half of the study was done to help determine the accuracy and precision of the current OakBend Medical Center nutrition screening tool in comparison to the alternative screening tools supported by evidence-based research. The second half of the study used the data obtained from the first half of the study allowing the researcher to calculate the theoretical dollars for malnutrition Medicare reimbursement based on the diagnosis of malnutrition using each screening tool.

Hypotheses

The following hypotheses were tested:

1. There will be no significant difference in the number of elderly patients triggered as “no risk” and “at-risk malnourished/malnourished” using the current SNF nutrition screening tool vs. the four alternative malnutrition screening tools.
2. There will be no significant difference in the theoretical dollars that the hospital could be reimbursed based on the screening diagnosis of “no risk” vs. “at risk of malnutrition/malnourished” using the current nutrition screening tool vs. the four alternative malnutrition screening tools.

Justification

Early identification of malnutrition in addition to appropriate nutrition intervention could reverse or even prevent the development of malnutrition and its harmful consequences (Isenring et al., 2012; Thomas, Ashmen, Morley, & Evans, 2000). Favaro-Moreira et al. (2016) reported 25% of elderly individuals do not receive nutrition intervention, even while in contact with their healthcare professionals. Therefore, it is essential for health care facilities to have an established screening program that accurately screens patients for malnutrition risk upon admission. Accurate screening programs can lead to an assessment completed by RDs and physicians in order to accurately diagnose malnutrition using the *International Classifications of Disease*, 10th Revision (ICD-10) codes for reimbursement (Cederholm et al., 2015; Marshall et al., 2017). It should be noted there is no "gold standard" for defining and diagnosing malnutrition (Elia & Stratton, 2012; Isenring et al., 2012; López-Contreras et al., 2014; Marshall et al., 2016a; Marshall et al., 2016b). As a result, different facilities tend to use a wide variety of tools, only some of which are validated, to identify patients at risk. If these tools misdiagnose malnutrition, the results could cause adverse health outcomes potentially leading to billions of dollars in health care expenditures (Meijers et al., 2010; Shum et al., 2005).

This research study design will allow for comparison of the current screening tool used by OakBend Medical Center to alternative screening tools in order to determine accuracy. Also, the data collected will allow for estimating the theoretical dollars that may have been captured using the various tools. This data will provide the healthcare practitioners at this facility the information necessary to make informed decisions about revising the current malnutrition tool as well as the policies and procedures for screening guidelines.

CHAPTER 2

REVIEW OF LITERATURE

Malnutrition within the elderly population tends to be directly influenced by a combination of underlying factors and medical treatments (Agarwal et al., 2013; Dorner, 2010; Evans, 2005). These age-related underlying causes can include oral and swallowing impairments, impaired cognitive function, chronic illness, inflammatory activity, medication, and socioeconomic influences (Ahmed & Haboubi 2010; Meijers et al., 2010; Soeters & Schols, 2009). Identifying these underlying causes will allow proper management of malnutrition that can be achieved by a registered dietitian (RD) and physician (Ahmed & Haboubi, 2010).

Factors of Aging That Influence Malnutrition

According to Green and Watson (2006), the elderly population is defined as a diverse age group ranging from 65 years and older. When age and chronic disease are considered, the risk for elders developing malnutrition is considerably higher than younger adults (Favaro-Moreira et al., 2016; Watson, Leslie, & Hankey, 2006). Even with elders who are considered “healthy”, food intake and appetite tend to decline as their age progresses (Dorner, 2010). The decline in food intake and appetite is an age-related physiological phenomenon sometimes called the “anorexia of aging” (Ahmed & Haboubi 2010; Dorner, 2010). Aging is associated with multiple declining physiological body functions that include gastrointestinal (GI) disorder; altered organ function and electrolyte regulation; reduced lean body mass; and diminished oral functions (Dorner, 2010; Watson et al., 2006). The impairment of esophageal motility and gastric secretions are the leading causes of GI disorder (Favaro-Moreira et al., 2016). GI disorders can range from dysphagia, constipation, gastroesophageal reflux disease (GERD), delayed gastric emptying, and diarrhea, thus promoting poor intake and nutrient malabsorption (Evans, 2005; Favaro-Moreira et al., 2016). As a result, elder individuals have a tendency to recover slowly from illnesses; experience a decline in functional status; have higher mortality and morbidity; have higher hospital and readmission rates; and have an increased risk of dependency (Elia & Stratton, 2012; Favaro-Moreira et al., 2016; Gallagher-Allred et al., 1996; Ziebolz et al., 2017).

Elderly Nutritional Status

Healthy nutritional status is critical for elders. One of the primary goals of nutrition intervention is to promote adequate consumption of nutrients to prevent malnutrition and unintended weight loss (Dorner, 2010; Thomas et al., 2000). Favoro-Moreira et al., (2016) reported through six longitudinal studies that the following factors lead to the development of malnutrition: frailty, excessive polypharmacy, functional decline, impaired cognitive function, constipation, and poor or moderate self-reported health status. Even when individuals have adequate intake, their nutritional status can be affected by compromised nutrient metabolism (i.e., excretion, utilization, storage, distribution, and absorption), food-drug interactions, or altered nutrient needs (Favaro-Moreira et al., 2016). A prospective study by Mudge, Ross, Young, Isenring, and Banks (2011) revealed poor nutrient absorption and intake in elder individuals can be caused by self-limiting factors (dysphagia, social isolation, oral issues, impaired cognitive function, acute disease, and lack of appetite); limited food options (poor menu diversity, unappetizing meals, difficulty accessing food and beverage packaging, and inflexible mealtimes); and other barriers to optimum intake (poor eating positioning, meal interruptions, and inadequate feeding assistance). Medical conditions also could lead to poor nutrient absorption in addition to increased metabolic requirements or anorexia (Suominen et al., 2005; Thomas et al., 2000). Fever, the presence of chronic wounds and pressure sores, and infections are examples of conditions resulting in increased metabolic requirements (Suominen et al., 2005; Thomas et al., 2000). Anorexia may be linked with dementia, mood disorders, or chronic disease (Thomas et al., 2000).

Individual nutrient deficiencies (i.e., vitamins and minerals) are not commonly acknowledged and can be another underlying cause of malnutrition (Ahmed & Haboubi 2010; Crogan, Alvine, & Pasvogel, 2006). Ahmed and Hoboubi (2010) reported macro- and micronutrient deficiencies are typically seen in elders who are slender with muscle wasting; diminished skin integrity and poor wound healing; bone and joint pain; thin hair and nails; and edema. Inadequate intake can explain the prevalence of nutrient deficiencies within the elderly population (Watson et al., 2006). Additionally, elders tend to be prone to hypervitaminosis due to reduced excretion (Ahmed & Haboubi 2010). Increased risk of depression has also been seen in elders with reduced serum levels of vitamin D, B12, B6, and zinc (Porter Starr et al., 2015). Correcting nutrient deficiencies can happen by providing a variety of nutritional interventions (oral supplements, multivitamins, enteral nutrition [EN], parenteral nutrition [PN], and nutritional counseling), with the goal of improving both functional and clinical outcomes in addition to reducing length of stay (LOS) and minimizing health care costs (Ahmed & Haboubi 2010; Gallagher-Allred et al., 1996; Suominen et al., 2005; Velasco et al., 2010).

Therapeutic diets are intended to improve nutritional status but can be a negative factor as well (Dorner, 2010). Sugar, fat, and salt enhance the flavor of foods (Dorner, 2010; Evans, 2005). However, these ingredients are restricted in therapeutic diets for those with cardiovascular diseases (CVD), diabetes mellitus (DM), and chronic kidney disease (CKD) (Dorner, 2010; Evans, 2005). Therapeutic diets tend to limit food variety and diet flexibility (Dorner, 2010; Evans, 2005). Therapeutic diets also can lead to unintended weight loss, reduced food intake and desire for eating, and ultimately malnutrition (Dorner, 2010; Thomas et al., 2000). In contrast, more liberal diets and the use of food enhancers could help increase intake and prevent palate fatigue due to decreased food variety and continuous use of oral supplements (Dorner, 2010, Watson et al., 2006). Examples of food enhancers include the addition of fats like margarine, cream, and cheese to meals (Watson et al., 2006).

Another area of concern for elders is their fluid intake (Ahmed & Haboubi 2010). Individuals' hydration status is capable of affecting their body weight and fluid intake (Thomas et al., 2000). Fluid and electrolyte imbalances tend to happen with changes in thirst perception, renal impairment, physical disability, and impaired cognitive function (Ahmed & Haboubi 2010). Medications like diuretics can alter thirst, leading to dehydration (Ahmed & Haboubi 2010). Dehydration is challenging to detect using only clinical signs and symptoms (Thomas et al., 2000). Biochemical laboratory values such as blood urea nitrogen, creatinine, and electrolytes should be used in tandem with clinical symptoms to accurately diagnose and treat dehydration (Thomas et al., 2000).

Oral Impairments

Oral impairment can lead to poor food variety and enjoyment in addition to a possible increase in sugar, fat, and salt intake to compensate for the lack of flavor (Mann, Heuberger, & Wong, 2013). Chewing plays an essential role in the swallowing process, because chewing breaks food down into small particles for adequate swallowing (Mann et al., 2013). Ill-fitting dentures and tooth loss are examples of chewing disorders that can cause food avoidance, specifically within the meat, fruit, and vegetables food groups (Ahmed & Haboubi 2010; Donini et al., 2013; Mann et al., 2013). Mann et al. (2013) found subjects who reported chewing or swallowing issues had deficient intakes of zinc, fiber, vitamins A, D, E, and K, linolenic acid, linoleic acid, molybdenum, calcium, selenium, magnesium, folate, and biotin compared to the Dietary Reference Intake (DRI) recommendations. These deficiencies were 44.9% below the normal levels for age and gender (Mann et al., 2013). Xerostomia, or dry mouth, is also common in elders and tends to be a side effect of medications, thereby leading to swallowing difficulties (Watson et al., 2006). Additionally, the inability to chew and swallow can decrease body mass index (BMI); negatively impact the quality of life; increase susceptibility to disease and infection; and result in the need for EN and PN options (Ahmed & Haboubi 2010; Mann et al., 2013).

Early intervention for oral impairment should include family, caregiver, and staff assistance with feedings at mealtimes as well as the provision of food alternatives and preferences within the patient's diet and texture restrictions (Thomas et al., 2000). Patients with swallowing difficulties need a speech and language pathologist (SLP) to evaluate the seriousness of their condition (Ahmed & Haboubi 2010). Swallowing disorders like dysphagia tend to cause aspiration, thus requiring an SLP to provide appropriate swallowing interventions (food and liquid texture alterations or consideration of EN or PN) (Ahmed & Haboubi 2010; Mann et al., 2013; Thomas et al., 2000). SLPs and RDs need to provide education to the patient, caregiver, and family along with their intervention to ensure the safety of the patient (Ziebolz et al., 2017).

Cognitive Function

Patients with impaired cognitive function require special attention and care (Ahmed & Haboubi 2010). Typically, disease and trauma are associated with disturbances in mood, memory, and intellectual function causing impaired cognitive function (Soeters & Schols, 2009). Alzheimer's disease (AD), Parkinson's disease (PD), dementia, and depression are the four most common impaired cognitive functions; all four disproportionally affect the elderly (Ahmed & Haboubi, 2010). Impaired cognitive function affects daily functional status resulting in dependency, disability, weight loss, decreased oral intake, and use of anorexigenic medication (Saka, Kaya, Ozturk, Erten, & Karan, 2010; Secher, Soto, Villars, Abellan Van Kan, & Vellas, 2007). Dysphagia tends to be the most common side effect of these dysfunctions (Suominen et al., 2005). Therefore, an impaired cognitive function can be a critical component of malnutrition (Donini et al., 2013; Favaro-Moreira et al., 2016; Saka et al., 2010; Soeters & Schols, 2009). Guigoz (2006) screened and evaluated cognitively impaired elder individuals in 11 studies (n = 2015) by using the Malnutrition Nutrition Assessment (MNA) to show the prevalence of malnutrition within this population. The results confirmed 15% were malnourished, 44% were at risk of malnutrition, and 41% were well-nourished.

AD is highly prevalent in individuals aged 85 years and older, with 24-33% of the population being diagnosed with this condition (Dorner, 2010). According to Dorner (2010), approximately 50% of individuals with AD cannot feed themselves eight years after diagnosis. Unintended weight loss seen in AD and PD patients is most often due to inadequate oral intake (Dorner, 2010).

In the early course of dementia, poor intake is common (Suominen et al., 2005). In the advanced stages of dementia, weight loss becomes prevalent because of behavioral disturbances, adverse eating habits, and restlessness (Suominen et al., 2005; Watson et al., 2006; Ziebolz et al., 2017). Suominen et al. (2005) demonstrated dementia being seen in 43.6% of patients classified as “well nourished”, 69.9% classified as “at risk”, and 83.1% classified as “malnourished”.

Depression is also a widespread risk that often goes undiagnosed and untreated within the elderly population, and it is seen in up to 45% of institutionalized elderly patients (Crogan et al., 2006; Saka et al., 2010; Smoliner et al., 2009). Depression is a risk factor for malnutrition because it is a significant contributor to loss of appetite and unintentional weight loss (Crogan et al., 2006; Donini et al., 2013; Evans, 2005; Saka et al., 2010; Smoliner et al., 2009; Thomas et al., 2000; Ziebolz et al., 2017). Financial loss, social loss, and adverse physical health changes are common factors that lead to depression (Donini et al., 2013; Evans, 2005). Consequences of untreated depression can cause increased use of healthcare services leading to increased healthcare cost; negatively affect the quality of life and functional status; and increase mortality rate (Donini et al., 2013; Porter Starr et al., 2015; Smoliner et al., 2009). Early assessment of depression and the use of antidepressant medications could reduce the threat of malnutrition (Crogan et al., 2006).

Medications

Medications affect nutritional status through their side effects, leading to alterations in the absorption, metabolism, and excretion of nutrients (Evans, 2005; Watson et al., 2006). Side effects may include anorexia, nausea, decreased appetite, xerostomia, and constipation (Evans, 2005; Persenius, Glawing, Hermansson & Karlsson, 2014; Watson et al., 2006). Even appetite stimulants should not be considered as first-line treatment for poor intake due to their potential side effects (Evans, 2005). Although most disease states require pharmacologic treatment, advanced age is linked to the increasing prevalence of polypharmacy, which is the prescription of five or more drugs simultaneously (Favaro-Moreira et al., 2016; Persenius et al., 2014). A study done by Persenius et al. (2014) showed a majority of participants identified as malnourished or at risk of becoming malnourished were prescribed more than three medications. Intervention for those affected by the side effects of medication should include reducing medications if possible or finding alternative medications with fewer or less severe side effects (Evans, 2005).

Body Composition in Relation to Malnutrition

Malnutrition can be referred to as the loss of structural body composition and unintentional weight loss (Meijers et al., 2010). Anthropometry is a crucial tool used to evaluate body composition as part of the nutritional screening and assessment process (Perissinotto, Pisent, Sergi, Grigoletto, & Enzi, 2002). However, anthropometry can be influenced by inflammation, edema, ascites, and dehydration (López-Contreras et al., 2014). Both genders' body composition may be altered due to physiological changes caused by aging which affect their anthropometric measures (Perissinotto et al., 2002). Margetts et al. (2003) reported females were seen to have a higher risk of malnutrition than males due to significant weight change (15.4% vs. 11.8%).

Body weight is an anthropometric measure often used as a first significant sign of malnutrition since it is easily measured (Thomas et al., 2000). Unintentional weight loss can be used as an indicator for malnutrition because it reflects inadequate intake or changes in metabolism (Cederholm et al., 2015; Dorner, 2010; Margetts et al., 2003; Thomas et al., 2000; Watson et al., 2006). The observation of three months of involuntary weight loss ranging from mild (<5% of body weight within 180 days) to severe (>10% of body weight within 180 days) is a beneficial measurement of malnutrition status (Barendregt, Soeters, Allison, & Kondrup, 2008; Cederholm et al., 2015). Therefore, scales used for weighing should be regularly calibrated and available at all healthcare facilities (Barendregt et al., 2008).

Of all the anthropometric measurements available, BMI is the most frequently used and easiest way to identify malnutrition risk in healthcare facilities (Perissinotto et al., 2002). BMI is equal to weight (in kilograms) divided by height (in meters squared) (Barendregt et al., 2008; Isenring et al., 2012). The World Health Organization (WHO) provided a broad classification of BMI. A BMI of <18.5 kg/m^2 is "underweight"; 18.5-24.9 kg/m^2 is "normal weight"; 25-29.9 kg/m^2 is "overweight"; 30-39.9 kg/m^2 is "obese"; and a BMI >40 kg/m^2 is "extremely obese" (Barendregt et al., 2008; Elia & Stratton, 2012). The further an individual is from the "normal weight" range, the higher the risk of morbidity and mortality (Watson et al., 2006). Optimal BMI depends on whether the individuals are originally healthy or not, which is important to know in the clinical setting (Elia & Stratton, 2012). BMI <23.5 for men and <22 for women has been identified as a risk factor leading to an increased possibility of death among elders (Barendregt et al., 2008; Elia & Stratton, 2012; Thomas et al., 2000)

Screening vs. Assessment

Screening is viewed as separate and distinct from assessment, even though these terms are often used interchangeably in healthcare facilities and literature reviews (Skipper, Ferguson, Thompson, Castellanos, & Porcari, 2012). Screening and assessment both predict nutrition-related outcomes, yet each has different purposes (Charney, 2008; Correia, 2018). Screening tools identify individuals at high nutrition risk or with poor nutritional status; assessment tools continue to measure and monitor changes in nutritional status and degree of malnutrition (Charney, 2008; Correia, 2018). Assessment differs from screening by allowing more information to be obtained from or about the individual in relation to his or her initial nutrition status screening (Charney, 2008; Correia, 2018). Screening should be a quick-to-use tool that any healthcare staff can carry out (Correia, 2018). Assessment is a more complex approach and would be expected to produce better outcomes if completed by an RD (Correia, 2018).

In summary, screening and, if indicated, assessment should be part of any healthcare facility protocol with the goal of decreasing malnutrition risk (Correia, 2018). Screening is the first step in the provision of nutritional care and provides early identification of nutritional risk in order to improve clinical outcomes and prevent malnutrition (Barker et al., 2011; Isenring et al., 2009; Porter Starr et al., 2015).

Screening also helps increase overall awareness to potential malnutrition by informing the multidisciplinary staff (Correia, 2018).

Screening Tools

Screening tools should be easy to use, quick, and inexpensive (Barker et al., 2011; Kondrup, Allison, Elia, Vellas, & Plauth, 2003; Phillips & Zechariah, 2017; Stratton et al., 2006; Visvanathan et al., 2004). Non-RD health care staff members (e.g., RN, aides, or diet technicians) typically complete the screening process, but it is recommended that RDs develop the nutrition screening criteria as well as supervise the screening process (Dorner, 2010; Marshall et al., 2016a; Marshall et al., 2016b). It should be noted there is no universally accepted nutritional screening tool (Elia & Stratton, 2012). In the absence of a "gold standard" nutritional screening tool, information on current research-based screening tools can be valuable to those developing or using their facility-specific tools (Elia & Stratton, 2012; Isenring et al., 2009; Meijers et al., 2010; Velasco et al., 2010). Most screening tools concentrate on four primary factors: 1) weight loss; 2) food intake; 3) BMI; and 4) severity of the disease or another measurement of predicting malnutrition risk (Barendregt et al., 2008; Cederholm et al., 2015; Velasco et al., 2010). The efficiency of each method is based on qualities such as reliability, ease of use, predictive and content validity, acceptability, and practicability (Barendregt et al., 2008; Elia & Stratton, 2012; Green & Watson, 2006; Kondrup et al., 2003; Van Venrooij et al., 2007; Velasco et al., 2010). The ability to predict clinical outcome, or predictive validity, is critical to provide effective and efficient nutrition screening (Stratton et al., 2006). When used by individuals who are properly trained, these tools can achieve a high degree of content validity (Kondrup et al., 2003). Additionally, each method needs to be sensitive enough to identify malnutrition among all patients of varying ages, disease conditions, disease stages, and current nutritional status (Barendregt et al., 2008). Accurate screening tools will lead to appropriate nutrition interventions and optimal patient care, improved outcomes, and cost containment (Gallagher-Allred et al., 1996; Van Venrooij et al., 2007).

Different Screening Tools Available

The utilization of multiple nutritional screening tools with different aims, principles, applications, and criteria has produced varying results and has contributed to confusion in selecting the most appropriate tool (Elia & Stratton, 2012). Some tools were initially established as a prognostic tool rather than a diagnostic tool, with the purpose of predicting health care use or clinical outcome (Elia & Stratton, 2012). It is essential to select the screening tool that aligns best with the demographics and disease conditions of the population served (Elia & Stratton, 2012). The following tools are some of the most common: Mini Nutrition Assessment-Short Form (MNA-SF), Malnutrition Universal Screening Tool (MUST), Nutrition Risk Screening 2002 (NRS-2002), and Malnutrition Screening Tool (MST). These tools have been established, validated, and commonly used for malnutrition detection in clinical practice (Elia & Stratton, 2012; Stratton et al., 2006). These tools are used to screen patients into two or three categories (no risk and at risk vs. no risk, at risk, or high-risk of malnutrition). Those identified at risk or high risk of malnutrition by these screening tools will need a further evaluation from the RD and physician.

Mini Nutrition Assessment Short-Form (MNA-SF)

The MNA-SF, an adaption of the more extensive Mini Nutrition Assessment (MNA), was designed to be a quicker and more practical nutritional screening tool to screen a larger population of elderly patients (Rubenstein, Harker, Salva, Guigoz, & Vellas, 2001). Rubenstein et al. (2001) demonstrated in their analysis that MNA-SF has a high diagnostic accuracy relative to clinical status. The data also revealed MNA-SF could be performed as part of a two-step screening process with MNA, where MNA-SF is the screening portion, and MNA is the assessment portion of the process (Rubenstein et al. 2001).

MNA-SF takes about three minutes to complete (Secher et al., 2007). MNA-SF uses six of the original 18 key parameters of the MNA (Elia & Stratton, 2012; Isenring et al., 2012; Secher et al., 2007). The parameters are: 1) recent poor intake (within the past three months); 2) recent weight loss (within the past three months); 3) BMI; 4) mobility; 5) acute disease or psychological stress; and 6) neuropsychological problems (Isenring et al., 2012; Secher et al., 2007). Once the parameters are rated, the score is used to classify the patient using three categories: a score of 0 to 7 represents “malnutrition”, 8 to 11 suggests “at malnutrition risk”, and 12 to 14 is indicative of “well-nourished” (Marshall et al., 2016b; Rubenstein et al., 2001).

Malnutrition Universal Screening Tool (MUST)

A multi-disciplinary malnutrition advisory group of the British Association for Parenteral and Enteral Nutrition developed the MUST as a five-step screening tool with the aim of verifying malnutrition risk in adult patients (Stratton et al., 2004). The main reason for the development of MUST was the need to use valid, reliable, and consistent standards to diagnosis and control malnutrition in all healthcare settings for all types of patients (Ahmed & Haboubi 2010; Barker et al., 2011; Elia & Stratton, 2012; Lorini et al., 2014; Stratton et al., 2004). Even if the height, weight, or biochemical information cannot be measured, they can be obtained using recall measurements when necessary (Elia & Stratton, 2012; Lorini et al., 2014; Stratton et al., 2006). Stratton et al. (2004) suggested that MUST has a “fair” to “excellent” concurrent validity within an inpatient setting.

MUST is straightforward and takes about five minutes to complete (Ahmed & Haboubi 2010). MUST consists of three parameters: 1) current status of weight; 2) weight status changes within the past three to six months; and 3) presence of acute disease (i.e., stroke) (Ahmed & Haboubi 2010; Elia & Stratton, 2012; Isenring et al., 2012; Lorini et al., 2014; Stratton et al., 2004; Velasco et al., 2010). Each component is scored and classified as 0 (low risk), 1 (medium risk), or 2 (high risk) (Ahmed & Haboubi 2010; Elia & Stratton, 2012; Lorini et al., 2014; Velasco et al., 2010). Each risk has an intervention with “low” indicating the need for routine care; “medium” indicating the need for observation; and “high” indicating the need for treatment (Ahmed & Haboubi 2010; Elia & Stratton, 2012; Stratton et al., 2004). In practice, patients scored as medium and high are typically referred to the RD for a detailed nutrition assessment.

Nutrition Risk Screening-2002 (NRS-2002)

NRS-2002 was initially established by using a retrospective analysis of controlled trials, nutrition characteristics, and clinical outcomes (Rasmussen, Holst, & Kondrup, 2010). NRS-2002 was presumed to forecast presence and risk of emerging malnutrition within a hospital setting (Elia & Stratton, 2012; Kondrup et al., 2003; Phillips &

Zechariah, 2017; Rasmussen et al., 2010). NRS-2002 tends to be different from other tools in regards to its scoring method because it was created for predicting response to interventions (Elia & Stratton, 2012). NRS-2002 can be completed within a few minutes and requires less training (Velasco et al., 2010).

NRS-2002 uses the nutrition components of MUST and the grading for severity of disease as a reflection of increased nutritional requirements (Rasmussen et al., 2010). NRS-2002 evaluates three parameters: 1) nutrition status separated into three groups: BMI, weight loss, and food intake assessment; 2) the severity of disease; and 3) age (Barker et al., 2011; Elia & Stratton, 2012; Phillips & Zechariah, 2017; Velasco et al., 2010). Each factor is scored from 1-3 points, while an age adjustment is used to add one point to individuals age >70 years old (Elia & Stratton, 2012; Velasco et al., 2010). Total scores can range from "0 to 7" with >3 suggesting the patient would benefit from intervention by the RD (Elia & Stratton, 2012). Rasmussen et al. (2006) used NRS-2002 to screen 750 patient hospital admissions, and the practicability of the tool was 99% in addition to validating the tool as reliable. The content validity of NRS-2002 was improved when the European Society for Clinical Nutrition and Metabolism (ESPEN) ad hoc working group joined with ESPEN Educational and Clinical Practice Committee to conduct a literature-based validation (Rasmmusen et al., 2010).

<u>Malnutrition Screening Tool (MST)</u>

MST is a valid nutrition screening tool designed for acute and sub-acute hospital settings (Charney et al. 2008, Isenring et al., 2012; Isenring et al., 2009, Marshall et al., 2017). MST is comprised of two questions related to appetite and recent unintentional weight change (Isenring et al., 2012; Isenring et al., 2009; Marshall et al., 2016; Marshall et al., 2017; Phillips & Zechariah, 2017). The two questions are “Have you lost weight recently without trying?” (scored 0 to 4), and “Have you been eating poorly because of a decreased appetite (i.e., <75% of usual intake, chewing difficulties, or swallowing problems)?” (scored 0 to 1) (Marshall et al., 2017; Phillips & Zechariah, 2017). A score of >2 indicate malnutrition risk (Isenring et al., 2012; Isenring et al., 2009; Marshall et al., 2016b; Marshall et al., 2017). Marshall et al. (2016b) showed MST to have a robust concurrent validity when compared with ICD-10 classification of malnutrition within their elder sample size. Copies of all four screening tools are provided in Appendix A.

Limitations of Screening

Several limitations should be considered and could affect the results of nutrition screening. Insufficient staff training can negatively impact timely and appropriate nutrition intervention (Barendregt et al., 2008; Gallagher-Allred et al., 1996; Marshall et al., 2017). Bed-bound, severely frail, and disabled individuals can inhibit appropriate screening because of the inability to obtain proper anthropometric measurements (Lorini et al., 2014; Stratton et al., 2006). Additionally, obtaining anthropometric measurements verbally could result in an incorrect BMI as well as the misclassification of malnutrition if the measurements are incorrect (Lorini et al., 2014).

Clinical judgment can affect screening, since there may be a difference of opinion regarding the patient’s potential for developing malnutrition or their current level of malnutrition (Phillips & Zechariah, 2017). Also, limited resources and lack of time can produce inappropriate diagnosis (Marshall et al., 2016a). According to Van Venrooiju et al. (2007), up to 50% of malnourished individuals go unrecognized and untreated by medical staff. Thus, there is a need for improvement in timely and accurate identification of malnutrition among patients, which can potentially lead to better management of malnutrition and decreased healthcare costs (Isenring et al., 2009).

False-positives of malnutrition are another factor that can affect not only the patient's intervention but also the RD's workload, leading to inefficiency and ineffectiveness (Phillips & Zechariah, 2017). False-positives occur when a patient is initially classified as malnourished or at risk of malnutrition during screening but is later determined to be at no risk when the RD conducts an assessment of the patient (Phillips & Zechariah, 2017). Loss of productivity and time can decrease the RD's availability to participate in quality assurance activities, multidisciplinary rounds, and performance improvement activities (Phillips & Zechariah, 2017).

Medical Reimbursement

Researchers believe malnutrition is often a hidden contributor to rising healthcare costs (Gallagher-Allred et al., 1996). Malnutrition typically increases patients' LOS and consumes additional resources (Barker et al., 2011; Donini et al., 2013; Favaro-Moreira et al., 2016; Gallagher-Allred et al., 1996; Marshall et al., 2016; Meijers et al., 2010; Stratton et al., 2004). Therefore, it is important to adequately screen and diagnose malnutrition in order to obtain maximum reimbursement from the individual's insurance provider, which in elders is often Medicare (Phillips, 2014). Charges typically are 35-75% higher in malnourished individuals than healthy individuals (Gallagher-Allred et al., 1996). To effectively integrate clinical coding, billing, and reimbursement into a successful healthcare system for the early identification, documentation, and intervention of malnutrition, it is essential to understand the principles of reimbursement (Giannopoulos, Merriman, Rumsey, & Zwiebel, 2013).

Medicare

Medicare is the primary federally funded healthcare payment system in the United States (Phillips, 2015). Medicare generally reimburses for inpatient care for those 65 years and older and is administered by the Centers for Medicare and Medicaid Services (CMS) (Giannopoulos et al., 2013; Phillips, 2015). Medicare reimbursement has evolved from a cost-based reimbursement system to a prospective payment system (PPS) (Barker et al., 2011; Giannopoulos et al., 2013; Phillips, 2015; Phillips, 2014). PPS is based on a reimbursement methodology called Medicare severity diagnosis-related groups (MS-DRGs) (Barker et al., 2011; Giannopoulos et al., 2013; Kellett, Kyle, Itsiopoulos, Naunton, & Luff, 2016; Phillips, 2015; Phillips, 2014). For the vast majority of PPS cases, Medicare reimburses healthcare facilities from the patient's final MS-DRG (Giannopoulos et al., 2013). Length of stay and resources used during the stay does not factor into reimbursement; therefore, the facilities are paid the same dollar amount for each patient in the assigned MS-DRG (Phillips, 2015).

Patients with a single MS-DRG theoretically utilize similar amounts of hospital resources based on their principal diagnosis, additional secondary diagnosis (known as either major complications or comorbidities [MCCs] or complication or comorbidities [CCs]), and the possible presence of various treatments or surgeries (Giannopoulos et al., 2013; Kellett et al., 2016; Phillips, 2015; Phillips, 2014). Documentation of the MCCs or CCs can change the reimbursement provided by the MS-DRG to which the patient is assigned; a higher payment of MS-DRGs is associated with CC and even higher payment for MS-DRGs is associated with MCCs (Kellett et al., 2016; Phillips, 2015; Phillips, 2014). Additionally, documentation of the CCs and MCCs can affect the case mix index (CMI) (Phillips, 2015).

CMI is the average of the relative weights (RWs) for MS-DRGs for all patients admitted to the hospital (Giannopoulos et al., 2013; Phillips, 2015). Average CMI indicates the acuity level of patients cared for at the healthcare facility (Phillips, 2015). Since the CMI is a factor in calculating the base rate, the RW of a patient's assigned MS-DRG can affect the current payment, as well as influence the base rate for the facility for the next year (Giannopoulos et al., 2013; Phillips, 2015). Medicare developed the based rate system by relying on several factors, including but not limited to geography, overhead costs, and the average CMI (Giannopoulos et al., 2013; Phillips, 2015). These factors are illustrated in Figure 1. Hospitals with higher CMIs provide a higher complexity of care (Phillips, 2015).

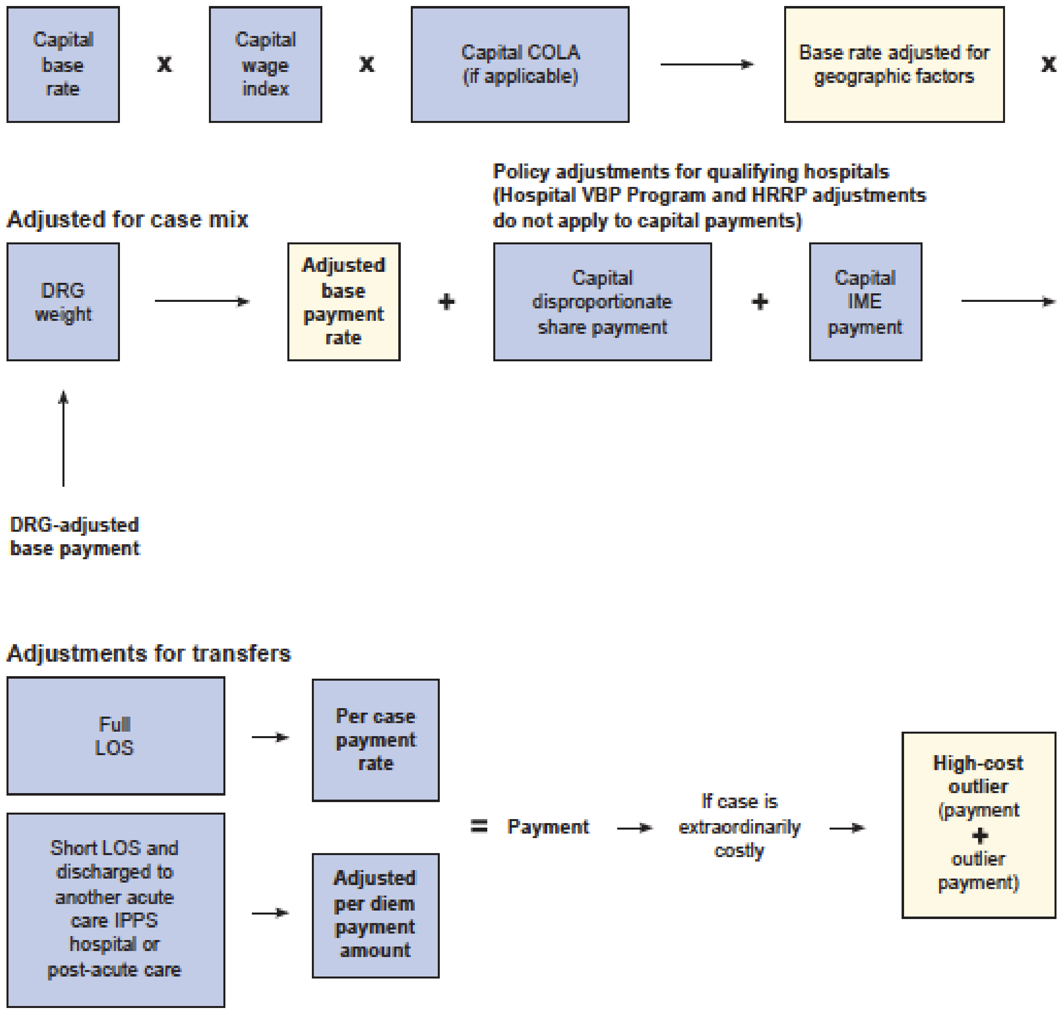


Figure 1: Acute Care Hospital Inpatient Prospective Payment System: Capital Base Payment Rate (Phillips, 2015)

Calculating Reimbursement

Since the hospital is paid an all-inclusive base rate centered on the average cost of patient care classified within each MS-DRG, the RW acts as a “multiplier” to help determine the reimbursement; the larger the RW, the larger the reimbursement (Giannopoulos et al., 2013; Phillips, 2015). CMS annually assigns RWs, and the same RW applies to all healthcare facilities (Giannopoulos et al., 2013). In order to determine the expected reimbursement of Medicare inpatient discharges, the predetermined hospital-base rate is multiplied by nationally established RW for the specific MS-DRG (Giannopoulos et al., 2013). An example could be the following:

Hospital-specific base rate = $10,000

The national RW for a particular MS-DRG = 4.596

Expected MS-DRG reimbursement = $10,000 x 4.596 = $45,960

The national RW for malnutrition = 1.1724

Expected MS-DRG reimbursement with malnutrition RW attached =

$10,000 x 4.596 x 1.1724 = $53,884

International Classifications of Disease, 10^{th} Revision (ICD-10)

The *International Classifications of Disease*, 10^{th} Revision (ICD-10) converts medical diagnoses into numerical codes for research and billing purposes (Marshall et al., 2016; Phillips, 2014). The construction of ICD-10 is more precise with more codes allowing for better flexibility as new technologies and diseases arise (Giannopoulos et al., 2013). Although increased payment for providing services is a benefit of accurate documentation and coding of malnutrition, the ICD system was not created for billing and payment purposes (Phillips, 2015). ICD-10 was created by the World Health Organizations (WHO) as a standard classification of disease, injuries, and cause of death (Phillips, 2015). Regarding reimbursement, ICD-10 should allow for more accurate payment for services rendered and for improved evaluation of medical processes and outcomes (Giannopoulos et al., 2013).

Importance of Documentation and Reimbursement

In the MS-DRGs system, malnutrition is a qualifying diagnosis, but ICD-10 codes are used for verifying various degrees of malnutrition (Marshall et al., 2016; Phillips, 2014). The physician usually assigns ICD-10 codes in order to determine which MS-DRGs can be used for reimbursement (Phillips, 2014). Therefore, a malnutrition program should be created and aligned with ICD-10 criteria, so that the healthcare facility collects their appropriate reimbursement for services (Barker et al., 2011; Kellett et al., 2016; Marshall et al., 2016). For accurate reimbursement, patient's information must be documented and coded in their medical records correctly and all diagnoses and healthcare interventions during admission must be included in their discharge summary (Giannopoulos et al., 2013; Kellett et al., 2016; Phillips, 2014; Phillips, 2015). RDs and physicians must work together to determine the nutrition status of the patients (Phillips, 2014). Failure to accurately classify at risk patients can adversely affect funding (Marshall et al., 2016).

Since documentation is an essential part of the malnutrition program process, a policy needs to be created for defining malnutrition at each healthcare facility (Giannopoulos et al., 2013; Phillips, 2014). The policy should be used consistently among all disciplines for determining the degree of malnutrition for each admitted patient (Phillips, 2014). The development of a valid and reliable program to identify, document, intervene, and code malnutrition is one of the ways RDs can contribute to the financial stability of the healthcare facility and enhance the potential for adequate clinical resources to care for malnourished patients (Kellett et al., 2016; Phillips, 2015). Classifying a patient's degree of malnutrition can help determine how frequently to reassess the patient and his or her response to care in order to provide the best possible outcomes (Phillips, 2015; Phillips, 2014). Failure to accurately classify malnutrition presents a high risk to patients and is a lost opportunity for financial reimbursement for the higher costs associated with the care of these patients (Kellett et al., 2016). Therefore, an effective screening protocol can benefit not only the patient's health but also the healthcare facility's compensation.

CHAPTER 3

METHODS

The purpose of this study was two-fold: 1) to retroactively screen patients at a skilled nursing facility (SNF) using four alternative malnutrition screening tools and to compare their results to the registered nurses' nutrition screening completed using the OakBend Medical Screening tool developed by OakBend Medical Center RDs; and 2) to estimate differences in potential Medicare reimbursement based on the number of patients identified "at risk for malnutrition/malnourished" using each screening tool as compared to the initial nutrition screening tool. The hypotheses being tested were: 1) there will be no significant difference in the number of elderly patients triggered as "no risk" and "at-risk malnourished/malnourished" using the current SNF nutrition screening tool vs. the four alternative malnutrition screening tools; and 2) there will be no significant difference in the theoretical dollars that the hospital could be reimbursed based on the screening diagnosis of "no risk" vs. "at risk of malnutrition/malnourished" between the current nutrition screening tool and the four commonly used malnutrition screening tools.

This study was conducted at OakBend Medical Center Skilled Nursing Facility (SNF) in Richmond, Texas. The Louisiana Tech University Human Use Committee and the OakBend Medical Center Administration approved the study's design. These documents are provided in Appendix B.

Setting and Subjects

OakBend Medical Center SNF provides short-term rehabilitation for patients who have had a recent hospitalization that requires extended 24-hour nursing care and therapy to facilitate recovery. OakBend Medical Center SNF also provides a comfortable transition between the patient's hospital stay and their return to their next living location.

This study included retrospective data from SNF admitted elder patients aged 65 years and older. Patients excluded were those who were admitted for hospice care as well as those under the age of 65 years. Hospice care provides comfort care until the patient passes away; therefore, there is no need to address long-term nutrition concerns. The sample for this study included 200 patients admitted between March 2017 and March 2018.

Data Collection

Demographic information and health characteristics were obtained from the patients' medical records recorded at the time of admission. These variables included age, gender, cultural background, reason for admission, patient's intake throughout their stay, impaired cognitive factors, medication, chewing and swallowing issues, length of stay (LOS), current diet, living arrangements prior to admission, number of wounds, whether the RD was consulted during admission, and the patient's initial malnutrition classification from the OakBend Medical Center screening tool completed by a registered nurse (RN). Average intake was determined using a ranking system. Intake was calculated by rating every recorded meal with Good as 3; Fair as 2; Poor as 1. Any missed meals were recorded as poor since the reason for a missed meal was not recorded. The total score was divided by the total number of days patient stayed in SNF. If the average was 0-1.49 then the intake was considered “Poor”; 1.5-2.49 was considered “Fair”; and 2.5-3 was considered “Good”. The demographic and health characteristics collection tool is provided in Appendix A.

The first phase of this study was the screening phase. The primary researcher retroactively reexamined all available medical charts for one year (March 2017-March 2018). Once the patient was included in the study, five malnutrition-screening tools (OakBend Medical Center screening tool, Mini Nutrition Assessment-Short Form [MNA-SF], Malnutrition Universal Screening Tool [MUST], Nutrition Risk Screening 2002 [NRS-2002], and Malnutrition Screening Tool [MST]) were used to screen the patients based on the information recorded in the medical chart upon admission. MNA-SF, MUST, and NRS-2002 classified patients as “no risk”, “at risk of malnutrition”, and “malnourished”. The OakBend Medical Center nutrition screening tool and MST categorized patients into two groups (no risk vs. at risk) rather than three groups. During data collection, the screening tools were used according to their design. However, for analysis purposes, “at risk” and “malnourished” in MNA-SF, MUST, and NRS-2002 were collapsed into one group (“at risk/malnourished”) to allow for comparisons among the five tools. Additionally, the researcher rescreened the patients using the OakBend Medical Center screening tool for comparison purposes since the researcher is a registered dietitian and RN initially screened the patients. The purpose of the rescreening was to show the difference between a RN and RD being in control of the screening process in addition to determining how many patients were potentially inaccurately screened. Copies of the five screening tools used for this study are provided in Appendix A.

The second phase of this study was the cost-effectiveness phase. The Centers for Medicare and Medicaid Services (CMS) assigned each Medicare severity diagnosis-related group (MS-DRG) a relative weight (RW) that acts as a multiplier used to determine reimbursement. CMS also provided a RW for malnutrition. In order to calculate reimbursement, the researcher first determined the number of patients screened as "at risk/malnourished" with each screening tool. Next, the researcher obtained the hospital-specific base weight and each patient's MS-DRG from OakBend Medical Center's Health Information Management manager. The researcher used an excel sheet to calculate the theoretical dollar value by multiplying each patient's MS-DRG's RW by the hospital base weight, and if they were classified as "at risk/malnourished" using the specific screening tool, then the malnutrition RW was multiplied by the MS-DRG's RW and the hospital base weight. Once all the theoretical dollar values were obtained, the screening tools were compared as to the theoretical dollar value for the OakBend screening tool initially completed by a RN for cost-effectiveness. Overall Medicare reimbursement cost was also determined to show the impact malnutrition has on overall cost.

Statistical Analysis

Data were analyzed using the International Business Machines Statistical Package for Social Science (IBM SPSS version 25) statistical software. Statistical significance was set at $p \leq 0.05$. The mean and standard deviation for age, LOS, and wounds were summarized using the frequencies analysis. Comparison of the number of patients categorized as no risk and at risk/malnourished using the five screening tools was tested using chi-squared analysis. Cost analysis was calculated through an equation in order to show the differences in theoretical reimbursements based on the five screening tools. Differences in theoretical reimbursement rates were tested using chi-squared analysis.

CHAPTER 4

RESULTS

A total of 256 skilled nursing facility (SNF) medical charts dated March 2017 to March 2018 were reviewed. Of these, 200 met the inclusion criteria. Fifty-six patients were excluded because they were under 65 years of age (n = 54) or admitted for hospice care (n= 2).

Characteristics of the SNF Patients

Demographic characteristics of the sample are presented in Table 1. The sample included 115 females (57.5%) and 85 males (42.5%) with the mean age being 81.2±9.1 years (age ranged from 65 to 101 years). Although four different cultural backgrounds were seen in this sample (Asian, African-American, Caucasian, and Hispanic), 75% were Caucasian. The majority of the sample (75.9%) took five or more medications every day.

Table 1

Sample Demographic Characteristics (*n* = 200)

Variable	*n* (%)	Mean ± SD
Age (in years)		81.2 ± 9.1
65-74	50 (25.0%)	
75-84	75 (37.5%)	
85-94	62 (31.0%)	
95+	13 (6.5%)	
Gender		
Male	85 (42.5%)	
Female	115 (57.5%)	
Cultural Background		
Caucasian	150 (75.0%)	
African American	12 (6.0%)	
Hispanic	35 (17.5%)	
Asian	3 (1.5%)	
Medications		
No medication	5 (2.5%)	
1-4 medications/day	36 (18%)	
5+ medications/day	159 (79.5%)	

Table 2 summarizes the health characteristics of patients upon admission. The average length of stay (LOS) was 11.3±6.4 days (LOS ranged from 1 to 39 days). Before admission, 62.5% of SNF patients lived at home with individuals (either their spouse or intermediate family member[s]). There were 26 different reasons for admission seen within the sample. The two main causes of admission were infection (n = 91; 45.5%) and physical deconditioning (n = 39; 19.5%). Though 120 patients (60.0%) had a single reason for admission, 56 patients (28.0%) had two reasons, 19 patients (9.5%) had three reasons, three patients (1.5%) had four reasons, and two patients (1.0%) had five reasons. Almost half of the patients admitted had some kind of wound, and 15 patients (7.5%) admitted with a total of three or more wounds. Twenty-seven patients (13.5%) had dementia, 10 (5.0%) had depression, two (1.0%) had Parkinson's disease, and one (0.5%) was admitted with Alzheimer's disease. A vast majority of the patients (n = 163; 81.5%) had some type of chewing issue. A total of 23 different diets were prescribed for the patients in this sample. The most common diet prescribed was cardiac (n = 48; 24.0%). Almost half of the patients (n = 93; 46.5%) were described as having good oral intake throughout admission. Based on the patient's initial nutrition screening completed by using the OakBend Medical Center (OBMC) Nutrition Screening tool (Appendix A-1), 160 patients (80%) were determined by a registered nurse (RN) to have no risk for malnutrition, while 40 patients (20%) were determined to be at risk for malnutrition. The Registered Dietitian (RD) was consulted for 42 patients.

Table 2

Health Characteristics of Patients Upon SNF Admission (*n* = 200)

Variable	*n* (%)	Mean ± SD
LOS (Days)		11.3 ± 6.4
1-9	94 (47.0%)	
10-19	83 (41.5%)	
20-29	20 (10.0%)	
30+	3 (1.5%)	
Reason for Admission		
Altered Mental Status	7 (3.5%)	
Blood-Related Issues	13 (6.5%)	
Bone Fracture	28 (14.0%)	
Cancer	3 (1.5%)	

Table 2 (cont'd)

Variable	*n* (%)	Mean ± SD
Reason for Admission (Cont'd)		
Fluid-Related Issues	14 (5.5%)	
GI Disorders	18 (9.0%)	
Heart Complications	24 (12.0%)	
Infection	91 (45.5%)	
Kidney Injury	9 (4.0%)	
Physical Deconditioning	40 (20.0%)	
Respiratory Issues	32 (16.0%)	
Stroke	11 (5.5%)	
Uncontrolled Diabetes	5 (2.4%)	
Wound	16 (8.0%)	
Daily Intake Recorded Per RN Throughout Admission (Determined By RN Documentation)		
Good (>75%)	93 (46.5%)	
Fair (50-75%)	82 (41.0%)	
Poor (0-50%)	25 (12.5%)	
Impaired Cognitive Function		
Dementia	27 (13.5%)	
Depression	10 (5.0%)	
Parkinson's Disease	2 (1.0%)	
Alzheimer's Disease	1 (0.5%)	
Dementia & Depression	2 (1.0%)	
Dementia & Parkinson's	1 (0.5%)	
Dementia & Alzheimer's	1 (0.5%)	
None	156 (78%)	
Chewing Issues		
Missing Teeth	117 (58.5%)	
Missing Teeth & Ill-Fitted Dentures	4 (2.0%)	
Ill-Fitted Dentures	19 (9.5%)	
Ill-Fitted Dentures & Edentulous	6 (3.0%)	
Edentulous	17 (8.5%)	
None	37 (18.5%)	
Current Type of Diet		
Cardiac	48 (24.0%)	
Diabetic	39 (19.5%)	

Table 2 (cont'd)

Variable	*n* (%)	Mean ± SD
Current Type of Diet (Cont'd)		
Enteral Nutrition	12 (6.0%)	
Regular	54 (27.0%)	
Renal	8 (4.0%)	
Texture Modifications	39 (19.5%)	
Living Arrangements		
Home (Alone)	44 (22.0%)	
Home (With Individuals)	125 (62.5%)	
Group home/Assisted Living	15 (7.5%)	
Nursing Home	16 (8.0%)	
Swallowing Issues		
Yes	36 (18.0%)	
No	164 (82.0%)	
Number of Wounds		0.77 ± 1.1
None	107 (53.5%)	
1	62 (31.0%)	
2	16 (8.0%)	
3	6 (3.0%)	
4	5 (2.5%)	
5	3 (1.5%)	
6	1 (0.5%)	
Initial Classification of Malnutrition		
No risk	160 (80.0%)	
At risk	40 (20.0%)	
RD Consultation		
Yes	42 (21.0%)	
No	158 (79.0%)	

Nutrition Screening Comparison

A retrospective chart review of patient information upon admission was conducted to compare the OakBend Medical Center Nutrition Screening Tool to four previously validated nutrition screening tools: Mini Nutritional Assessment-Short Form (MNA-SF), Malnutrition Universal Screening Tool (MUST), Nutritional Risk Screening-2002 (NRS-2002), and Malnutrition Screening Tool (MST). For comparison purposes, results for each screening were categorized as no risk and at risk/malnourished as seen in Table 3.

Table 3

Nutrition Risk Difference Among the Five Screening Tools (*n* = 200)

Variable	No Risk	At Risk/Malnourished
OBMC-RN	160 (80.0%)	40 (20.0%)
OBMC-RD	49 (24.5%)	151 (75.5%)
MNA-SF	19 (9.5%)	181 (90.5%)
MUST	132 (66.0%)	68 (34.0%)
NRS-2002	68 (34.0%)	132 (68.0%)
MST	105 (52.5%)	95 (47.5%)

The MNA-SF screening tool identified the highest number of at risk patients (n = 181; 90.5%), while MUST identified the fewest at risk (n = 68; 34.0%). The differences in the number of patients screened as malnourished using each screening tool were compared using chi-squared analysis; these results are reported in Table 4. Table 4 illustrates the screening tools that identified significantly different numbers of patients as at risk/malnourished ($p < 0.05$).

Table 4

Chi-Squared Comparison Among The Screening Tools In Regards To Of Nutritional Risk Significance (*n* = 200)

Variables	Comparison of Patients Diagnosed "At Risk/Malnourished"	*p*-value
OBMC-RD x MUST	151 vs. 68	.000
OBMC-RD x NRS-2002	151 vs. 132	.011
OBMC-RD x MST	151 vs. 95	.002
OBMC-RD x OBMC-RN	151 vs. 40	.000
MNA-SF x MUST	181 vs. 68	.001
MNA-SF x NRS-2002	181 vs. 132	.000
MNA-SF x MST	181 vs. 95	.000
MUST x MST	68 vs. 95	.000
NRS-2002 x MUST	132 vs. 68	.000
NRS-2002 x MST	132 vs. 95	.013

$\chi 2 = 200$; $df = 1$

Theoretical Cost of Malnutrition Comparison

The hospital-specific base rate and Medicare severity diagnosis-related groups (MS-DRGs) for each patient were obtained from the OakBend Medical Center Health Information Management manager. The relative weight (RW) factor for each MS-DRG and malnutrition were acquired from the Centers for Medicare and Medicaid Services (CMS) based on the 2018 database version. The OakBend Medical Center specific base rate is $6109.17. Results are shown in Table 5.

Two methods were used to estimate reimbursement. The first method determined the total malnutrition reimbursement of those who were screened as at risk/malnourished for each screening tool. The following equation was used for each patient screened as at risk/malnourished: base rate multiplied by the appropriate MS-DRG's RW, and then by the RW of malnutrition. An example of the cost calculation is: $6109.17 (OakBend base rate) x 1.0772 (the MS-DRG RW for Aftercare Musculoskeletal System and Connective Tissue with CC) x 1.1724 (the RW for malnutrition) = $7,715.33. This computation was done based on the number of at risk/malnourished patients classified using each tool (OakBend Medical Center completed by a RN = 40 patients; OakBend Medical Center completed by the researcher/RD = 151 patients; MNA-SF =181 patients; MUST = 68 patients; NRS-2002 = 132 patients; MST = 95 patients).

The second method determined the total overall amount of theoretical reimbursement for each screening tool (patient assessed as at risk/malnourished and those assessed as no risk). The same equation was used as in the first method (base rate multiplied by the appropriate MS-DRG's RW, and then by the RW of malnutrition, if required). If the patient was screened as no risk, then the base rate was multiplied by the MS-DRG's RW.

Table 5

Cost Comparison of Medicare Theoretical Dollar Value Reimbursement Rate For Each Screening Tool

Variable	Total At Risk/Malnutrition Reimbursement	Total Overall Reimbursement
OBMC-RN	$328,121.30	$1,388,693.38
OBMC-RD	$1,185,698.00	$1,515,781.86
MNA-SF	$1,426,471.80	$1,550,204.49
MUST	$541,922.25	$1,420,132.55
NRS-2002	$1,039,757.13	$1,493,338.56
MST	$774,870.42	$1,454,387.29

The MNA-SF, which identified 181 patients at nutritional risk, produced the highest amount of malnutrition and overall theoretical dollar reimbursement value. The OakBend Medical Center nutrition screening completed by the RN produced the lowest amount of total malnutrition and overall theoretical dollar reimbursement value. When the initial OakBend Medical Center nutrition screening tool completed by a RN was compared to the OakBend Medical Center nutrition screening tool completed by a registered dietitian (RD/the researcher), the results revealed an $857,576.70 theoretical dollar value difference. Furthermore, Table 6 illustrated there were significant differences in the theoretical dollar value of reimbursement based on the screening diagnosis for all screening tools.

Table 6

Chi-Squared Comparison Among The Medicare Theoretical Dollar Value Reimbursement Rate For At Risk/Malnourished Patients Within Each Screening Tools

Variables	Theoretical Dollar Value Comparison Among Tools	*p*-value
OBMC-RD x MNA-SF	$1,185,698.00 vs. $1,426,471.80	.000
OBMC-RD x MUST	$1,185,698.00 vs. $541,922.25	.000
OBMC-RD x NRS-2002	$1,185,698.00 vs. $1,039,757.13	.000
OBMC-RD x MST	$1,185,698.00 vs. $774,870.42	.000
OBMC-RD x OBMC-RN	$1,185,698.00 vs. $328,121.30	.000
MNA-SF x MUST	$1,426,471.80 vs. $541,922.25	.000
MNA-SF x NRS-2002	$1,426,471.80 vs. $1,039,757.13	.000
MNA-SF x MST	$1,426,471.80 vs. $774,870.42	.000
MNA-SF x OBMC-RN	$1,426,471.80 vs. $328,121.30	.000
MUST x MST	$541,922.25 vs. $774,870.42	.000
MUST x OBMC-RN	$541,922.25 vs. $328,121.30	.000
NRS-2002 x MUST	$1,039,757.13 vs. $541,922.25	.000
NRS-2002 x MST	$1,039,757.13 vs. $774,870.42	.000
NRS-2002 x OBMC-RN	$1,039,757.13 vs. $328,121.30	.000
MST x OBMC-RN	$774,870.42 vs. $328,121.30	.000

$\chi 2$ =200; *df* = 1

CHAPTER 5

DISCUSSION

Malnutrition tends to be directly influenced by a combination of underlying medical factors and treatments (Agarwal et al., 2013; Dorner, 2010; Evans, 2005). This study revealed skilled nursing facility (SNF) patients were admitted most often with pneumonia (20%), physical deconditioning (19%), and bone fractures (14.0%). At least 80 patients (40%) had two or more reasons for admission, which is similar to the findings of Porter Starr et al. (2015) who demonstrated 46% of elderly having 2-3 chronic health conditions. As a result, elders tend to recover slowly, which can cause an increased length of stay (LOS) (Elia & Stratton, 2012; Favaro-Moreira et al., 2016; Gallagher-Allred et al., 1996; Ziebolz et al., 2017). The average LOS seen in the patients in this study was 11.3±6.4 days, and this high average LOS can increase medical costs for patients and the healthcare facility. Thomas et al. (2000) showed an 11-day difference between patients who were malnourished compared to those who are potentially at risk within acute care facilities like SNF. Souminen et al. (2005) and Thomas et al. (2000) demonstrated wounds to be related to chronic malnutrition. This study revealed almost half the patients (n = 93; 46.5%) had at least one wound upon admission.

Results of this study are similar to those of Persenius et al. (2014) who reported patients who are prescribed more than three medications were more likely to be identified as at risk or malnourished. Advanced age is linked to the increasing prevalence of polypharmacy (Favaro-Moreira et al., 2016; Persenius et al., 2014). A vast majority of the SNF patients in this study (n = 159; 79.5%) were taking five or more medications on a daily basis. Patients with impaired cognitive function need additional medication for their condition since it can affect daily functional status resulting in dysphagia, potential weight loss, and decreased oral intake (Donini et al., 2013; Favaro-Moreira et al., 2016; Saka et al., 2010; Secher et al., 2007; Soeters & Schols, 2009; Suominen et al., 2005). This study revealed 44 patients (22.0%) with impaired cognitive function. This percentage is low compared to those found by Guigoz (2006) and Suominen et al. (2005), who reported 24-83.1% of all institutionalized elderly patients including long-term care having impaired cognitive function.

Watson et al. (2006) explained how inadequate intake could account for the prevalence of deficiency leading to malnutrition. Over half of the SNF patients in this study (n = 107; 53.5%) were seen to have a “fair/poor” appetite or intake less than 75%, revealing another reason for patients being classified as at risk/malnourished. A few studies suggest therapeutic diets diminish patients’ meal intake even though they are intended to improve clinical status (Dorner, 2010; Evans, 2005; Thomas et al., 2000). Additionally, chewing issues and swallowing problems can lead to food avoidance causing poor intake as well as nutrition deficiencies (Ahmed & Haboubi 2010; Donini et al., 2013; Mann et al., 2013). Almost three-fourths of patients in this study were prescribed therapeutic and texture modified diets (n=146; 73.0%). The potential combination of therapeutic diets, chewing and swallowing issues, or poor intake could be another reason for patients to be screened as at risk/malnourished.

Accurate nutrition screening enables early identification of at risk/malnourished patients allowing the registered dietitian and physician to provide timely intervention in order to prevent malnutrition (Gallagher-Allred et al., 1996; Isenring et al., 2012; Thomas et al., 2000; Van Venrooij et al., 2007). By facilitating early interventions, screening can reduce health care costs (Gallagher-Allred et al., 1996; Van Venrooij et al., 2007). The purpose of this study was two-fold: 1) to retroactively screen patients at a skilled nursing facility using four alternative malnutrition screening tools and to compare their results to the registered nurses' nutrition screening on admission; and 2) to estimate differences in potential Medicare reimbursement based on the number of patients identified "at risk for malnutrition/malnourished" using each screening tool as compared to the initial OakBend nutrition screening tool. The four screening tools compared were the Mini Nutrition Assessment-Short Form (MNA-SF), Malnutrition Universal Screening Tool (MUST), Nutrition Risk Screening 2002 (NRS-2002), and Malnutrition Screening Tool (MST).

Numerous nutritional screening tools have been developed with the purpose of facilitating the "quick-to-use" screening of patients' nutritional status to provide timely and appropriate intervention(s) if needed (Barker et al., 2011; Green & Watson, 2006). Since there is no "gold standard" for nutritional screening, research is valuable when comparing the effectiveness and efficacy of each screening tool (Elia & Stratton, 2012; Isenring et al., 2009; Meijers et al., 2010; Velasco et al., 2010). This study demonstrated that even with the same sample and setting, the number of patients classified as at risk/malnourished using the different tools varied from a low of 68/200 (MUST) to a high of 181/200 (MNA-SF). Though all of the four tools have been validated, they were initially designed for slightly different purposes, which may be the reason for the different numbers seen in this study. The lack of current research on appropriate nutrition screening tools in skilled nursing facilities was the impetus for this study.

The five nutritional screening tools produced vastly different results in the number of individuals screened as “at risk/malnourished” versus “no risk”. The OakBend Medical Center screening tool was facility-developed by dietitians, who previously worked at the facility. The variables and the OakBend Screening tool had not been validated. The MNA-SF, an adaption of the longer mini nutrition assessment (MNA), was designed to be a quicker and more practical nutritional screening tool to screen a larger population of elderly patients (Rubenstein et al., 2001). Its variables focused on recent intake, recent weight loss, BMI, patient’s mobility, current acute disease, and neuropsychological issues. MUST is a five-step screening tool designed for verifying malnutrition risk in adult patients (Stratton et al., 2004). Its variables focus on current weight status, weight changes within the past three to six months, and the presence of acute disease. NRS-2002 was designed to forecast presence and risk of emerging malnutrition within a hospital setting (Elia & Stratton, 2012; Kondrup et al., 2003; Phillips & Zechariah, 2017; Rasmussen et al., 2010). NRS-2002 differs from the other tools because it was created for predicting response to intervention as well as it is the only screening tool with an age adjustment scoring system (Elia & Stratton, 2012; Velasco et al., 2010). Its variables focus on the patient’s current nutrition status (BMI, weight loss, and food intake), the severity of the disease state, and age. MST was designed for acute and sub-acute hospital settings to answer two questions related to appetite and recent unintentional weight change (Charney et al., 2008; Isenring et al., 2012; Isenring et al., 2009; Marshall et al., 2016; Marshall et al 2017; Phillips &

Zechariah, 2017). The two questions are “Have you lost weight recently without trying?” and “Have you been eating poorly because of a decreased appetite (i.e., <75% of usual intake, chewing difficulties, or swallowing problems)?” (Marshall et al., 2017; Phillips & Zechariah, 2017). These provide quick responses and intervention from RD during their evaluation.

Using the OakBend screening tool, the RNs initially screened 20% of OakBend SNF patients as at risk/malnourished. The researcher rescreened the sample using admit data available in the chart utilizing the OakBend screening tool and the four validated tools. The percentage of at risk/malnourished patients varied between 34.0% and 90.5% depending on the screening tool used. The chi-squared analysis revealed a significant differences among screening tools; all produced significantly different numbers except for the OBMC screening tool completed by a RN being compared to MNA-SF, MUST, NRS-2002, and MST. OBMC screening tool completed by the researcher/RD also did not produce significantly different numbers when compared to MNA. These results suggest a crucial need for accurate screening so that early nutrition intervention can occur. Van Venrooiju et al. (2007) showed how up to 50% of malnourished individuals go unrecognized and untreated. This information is indeed possible at OakBend Medical Center. Doner (2010) and Marshall et al. (2016) recommended that RDs have more control over the screening process to avoid patients being potentially inaccurately screened. Results of this study suggest the same. The researcher (registered dietitian) rescreened using the OakBend Medical Center screening tool and the number of patients identified as “at risk/malnourished” was higher (n = 151) than when the screening completed by the RN (n = 40).

MNA-SF screened the highest number of patients as at risk/malnourished (n = 181; 90.5%). Based on the parameters of the screening tools compared to the characteristics of the sample, it is not surprising to see a high percentage of at risk/malnourished patients. A majority of the SNF patients are in the facility because of an acute disease or psychological stress and mobility issues. SNF focuses on patients who need rehabilitation for their mobility issues as well as long-term antibiotic intake for their acute disease. Inadequate intake, weight loss, impaired cognitive function, and BMI are additional factors that have been seen in previous studies as malnutrition risk factors. SNF patients' disease state, lack of mobility, and impaired cognitive function can cause poor intake leading to weight loss and lower BMI.

MUST screened the lowest number of patients as at risk/malnourished. The reason could be because of the variable that addresses acute disease state, "if a patient is acutely ill <u>and</u> there has been or is unlikely to be no nutrition intake > 5 days". The majority of SNF patients were not seen to have the absence of food intake or the likely absence of food for five days, especially when their intake was monitored daily by their RN. SNF patients are normally in their "recovery stage" of their acute disease state. Per SNF protocol if a patient's intake is inadequate or there is no intake for three days, the RD and physician would be notified to see if the patient needs to return to the hospital or needs to receive an alternative form of nutrition (i.e., enteral nutrition).

NRS-2002 screened about two-thirds (n =132; 66.0%) of the patients as at risk/malnourished. NRS-2002 is the only screening tool that factors in age (>70 years old) by adding one point to their total score; the researcher noticed many patients went from no risk to at risk because of this additional factor. NRS-2002 is also the only screening tool to categorize the patient's severity of disease state into their appropriate risk category. The disease state is based on the question, "Is the patient severely ill? (e.g., in intensive therapy)". This question is answered based on clinical judgment. However, it can be presumed that any patient who needs SNF settings for continuation of care will receive an automatic "yes" to the question. In this study, the response was "yes" for all patients. The researcher used the patient's average dietary intake during admission to determine their impaired nutritional status instead of the week requirement.

MST screened the second lowest (n = 95; 47.5%) number of patients as at risk/malnourished. The researcher found the weight loss section to be unusual because there could be a risk for false-positives. If a patient loses weight due to their disease state and not because of poor dietary intake, then they can be considered no risk unless they lose 14+ pounds. Losing >2% of body weight within a few weeks to months can be considered "severe" weight loss depending on the person's previous weight vs. their new current weight. Another concern that can arise is if the patient says they are eating "good" (>75%) in their opinion but their intake could be less than their actual needs. In this study, the researcher used the patient's average intake to determine if he or she had a decreased appetite.

It is imperative that malnutrition be adequately documented and coded in order for the appropriate Medicare severity diagnosis-related group (MS-DRG) to be determined by the physician, thus influencing reimbursement for SNF. The *International Classifications of Disease,* 10th Revision (ICD-10) was designed to be more precise and have more codes than ICD-9, allowing better flexibility as new diseases and technologies arise (Giannopoulos et al., 2013). Regarding reimbursement, ICD-10 allows more accurate service payments in addition to improved medical evaluation and outcomes (Giannopoulos et al., 2013). The analysis of cost for each nutritional screening tool has provided more information on the theoretical dollar value for the reimbursement to the facility for treatment of at risk/malnourished SNF patients. Chi-squared analysis revealed a significant difference in the theoretical dollars that the hospital is being reimbursed based on a diagnosis of malnutrition between the initial nutrition screening tool and the four alternative malnutrition screening tools. MNA-SF, MUST, NRS-2002, and MST, all of which produced a higher theoretical reimbursement value than the initial OakBend Medical Center screening tool. The researcher used the OakBend Medical Center screening tool and rescreened the patients to reveal how much of a difference would exist between a registered dietitian (RD) and a RN screening. The overall theoretical dollar reimbursement difference between the researcher and nursing screening was $127,088.48. The total at risk/malnourished reimbursement difference between the researcher and nursing screening was $857,576.70. These results can be used for management decision-making for SNF nutritional care. The additional funding to SNF could allow the facility to improve patient care.

The strength of this study starts with the size of the sample of 200 patients throughout the study. A single individual did the rescreening of each patient, so there is continuity in methodology. The OakBend Medical Center Health Information Management manager provided actual MS-DRG numbers so the theoretical dollar value can be more realistic to what actual reimbursement might potentially be. There were a few limitations seen in this study. Initial screening was completed by a variety of RNs, which could show inconsistency with screening. Another limitation is the possibility nursing staff has limited opportunity to oversee accurate documentation of patients' intakes and weights. Also, it is possible the patient could have provided an inaccurate weight if the RN was unable to obtain the weight on a bed or standing scale. While screening was designed based on admission data for the intake portion of the screening tool, the researcher used data from the SNF medical record stay. Therefore, the researcher could not determine if the weight and intake were accurate since the researcher was not present during the time of admission.

SNFs or any other healthcare facility should consider the previous limitations of this study to prevent any issues before releasing their malnutrition screening guidelines. Although guidelines can produce benefits, some limitations can have detrimental effects. Based on this study, it is recommended that RD screen for malnutrition during patients' SNF admissions to ensure accurate screening results as well as anthropometrics and intake. If it not possible, then the RD should educate RNs on how to properly screen for malnutrition.

In conclusion, this study shows that malnutrition continues to go undiagnosed or unrecognized even in SNF setting. For this study, MNA-SF and NRS-2002 showed to be the most appropriate screening tools for SNF setting. Not accurately screening and diagnosing malnutrition can present a high risk to patients and is a lost opportunity for financial reimbursement for the increased costs associated with the care of these SNF patients. Even having a RD screen SNF patients during admission could potentially increase identification of those who are already at risk/malnourished. Additionally, the RD could provide timely intervention leading to lowering healthcare cost. The reimbursement could benefit and provide better care for SNF patients and the facility.

APPENDIX A

NUTRITION SCREENING TOOLS

APPENDIX A-1: OAKBEND MEDICAL CENTER NUTRITION SCREEN SECTION

Nutrition Screen- Dietary Consult placed for score 2 or more

☐	2	New enteral feeding orders
☐	2	New TPN orders
☐	2	New Oral Supplement orders
☐	2	Established enteral feeding (PTA)
☐	2	BMI less than or equal to 18.5
☐	2	BMI greater than or equal to 50
☐	2	BMI 18.6-19.5
☐	2	NPO greater than or equal to 3 days
☐	2	Malnutrition
☐	2	Decubitus Ulcer, Stage 3 or 4
☐	2	Decubitus Ulcer, Stage 1 or 2
☐	2	CVA / TIA
☐	2	Ventilator Dependent
☐	1	Recent unexplained weight gain more than 5%in 1 month
☐	1	Recent unexplained weight loss more than 5%in 1 month
☐	1	Patient taking insulin
☐	1	Diabetic
☐	1	Unable To Eat
☐	1	Difficulty Chewing
☐	1	Diarrhea For More Than 5 Days
☐	0	No risks identified at present

Total Score: 0

APPENDIX A-2: MALNUTRITION SCREENING TOOL (MST) FORM

Malnutrition Screening Tool (MST)

STEP 1: Screen with the MST

1 Have you recently lost weight without trying?

No	0
Unsure	2

If yes, how much weight have you lost?

2-13 lb	1
14-23 lb	2
24-33 lb	3
34 lb or more	4
Unsure	2

Weight loss score:

2 Have you been eating poorly because of a decreased appetite?

No	0
Yes	1

Appetite score:

Add weight loss and appetite scores

MST SCORE:

STEP 2: Score to determine risk

MST = 0 OR 1
NOT AT RISK
Eating well with little or no weight loss

If length of stay exceeds 7 days, then rescreen, repeating weekly as needed.

MST = 2 OR MORE
AT RISK
Eating poorly and/or recent weight loss

Rapidly implement nutrition interventions. Perform nutrition consult within 24-72 hrs, depending on risk.

STEP 3: Intervene with nutritional support for your patients at risk of malnutrition.

Notes:

APPENDIX A-3: MINI MALNUTRITION ASSESSMENT (MNA) FORM

Nestlé Nutrition Institute

Mini Nutritional Assessment MNA®

Last name: First name:

Sex: Age: Weight, kg: Height, cm: Date:

Complete the screen by filling in the boxes with the appropriate numbers. Total the numbers for the final screening score.

Screening

A Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?
0 = severe decrease in food intake
1 = moderate decrease in food intake
2 = no decrease in food intake ☐

B Weight loss during the last 3 months
0 = weight loss greater than 3 kg (6.6 lbs)
1 = does not know
2 = weight loss between 1 and 3 kg (2.2 and 6.6 lbs)
3 = no weight loss ☐

C Mobility
0 = bed or chair bound
1 = able to get out of bed / chair but does not go out
2 = goes out ☐

D Has suffered psychological stress or acute disease in the past 3 months?
0 = yes 2 = no ☐

E Neuropsychological problems
0 = severe dementia or depression
1 = mild dementia
2 = no psychological problems ☐

F1 Body Mass Index (BMI) (weight in kg) / (height in m^2)
0 = BMI less than 19
1 = BMI 19 to less than 21
2 = BMI 21 to less than 23
3 = BMI 23 or greater ☐

IF BMI IS NOT AVAILABLE, REPLACE QUESTION F1 WITH QUESTION F2.
DO NOT ANSWER QUESTION F2 IF QUESTION F1 IS ALREADY COMPLETED.

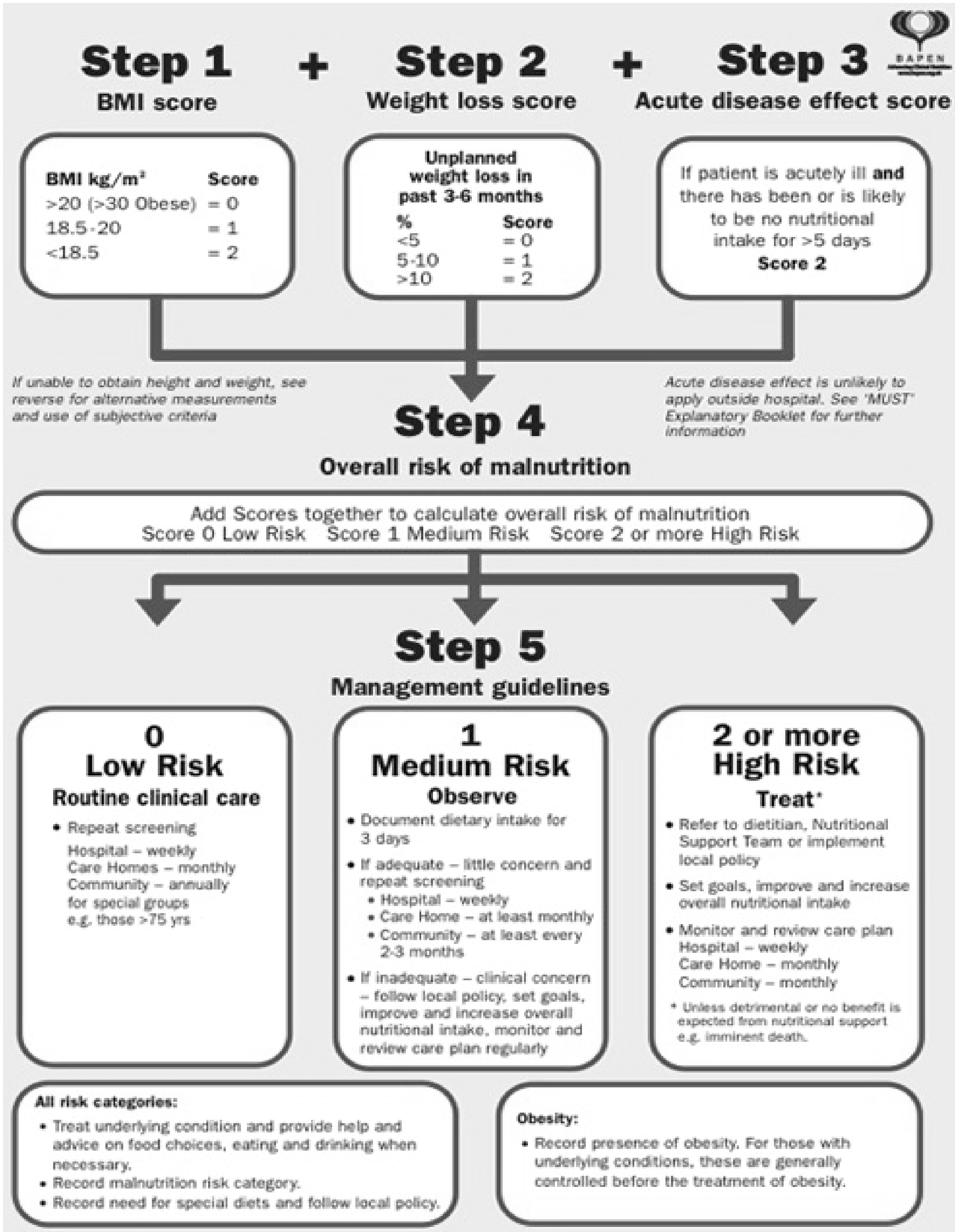
F2 Calf circumference (CC) in cm
0 = CC less than 31
3 = CC 31 or greater ☐

Screening score
(max. 14 points) ☐☐

12-14 points:	Normal nutritional status
8-11 points:	At risk of malnutrition
0-7 points:	Malnourished

APPENDIX A-4: MALNUTRITION UNIVERSAL SCREENING TOOL (MUST)

FORM



APPENDIX A-5: NUTRITIONAL RISK SCREENING (NRS-2002) FORM

	Step 1: Initial screening	Yes	No
1	Is BMI <20.5?		
2	Has the patient lost weight within the last 3 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 screening in Step 2 is performed.
No: If the answer is 'No' to all questions, the patient is re-screened at weekly intervals. If the patient e.g. is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.

Step 2: Final screening

Impaired nutritional status		**Severity of disease** (≈ increase in requirements)	
Absent **Score 0**	Normal nutritional statusA	Absent **Score 0**	Normal nutritional requirements
Mild **Score 1**	Wt loss >5% in 3 months or Food intake below 50–75% of normal requirement in preceding week.	Mild **Score 1**	Hip fracture* Chronic patients, in particular with acute complications: cirrhosis*, COPD*. ***Chronic hemodialysis, diabetes, oncology.***
Moderate **Score 2**	Wt loss >5% in 2 months or BMI 18.5 – 20.5 + impairedgen. condition or Food intake 25–50% of normal requirement in preceding week	Moderate **Score 2**	Major abdominal surgery* Stroke* ***Severe pneumonia, hematologic malignancy.***
Severe **Score 3**	Wt loss >5% in 1 months (>15% in 3 months) or BMI <18.5 + impaired general condition or Food intake 0–25% of normal requirement in preceding week in preceding week.	Severe **Score 3**	Head injury* Bone marrow transplantation* ***Intensive care patients (APACHE>10).***
Score:	+	**Score:**	**= Total score:**
Age	if ≥ 70 years: add 1 to total score above		**= age-adjusted total score:**

Score ≥3: the patient is nutritionally at-risk and a nutritional care plan is initiated

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

NRS-2002 is based on an interpretation of available randomized clinical trials. *indicates that a trial directly supports the categorization of patients with that diagnosis. Diagnoses shown in *italics* are based on the prototypes given below.

Nutritional risk is defined by the present **nutritional status** and risk of impairment of present status, due to **increased requirements** caused by stress metabolism of the clinical condition.

A nutritional care plan is indicated in all patients who are
1) severely undernourished (score = 3), or
2) severely ill (score = 3), or
3) moderately undernourished + mildly ill (score 2 +1), or
4) mildly undernourished + moderately ill (score 1 + 2).

Prototypes for severity of disease
Score = 1: a patient with chronic disease, admitted to hospital due to complications. The patient is weak but out of bed regularly. Protein requirement is increased, but can be covered by oral diet or supplements in most cases.
Score = 2: a patient confined to bed due to illness, e.g. following major abdominal surgery. Protein requirement is substantially increased, but can be covered, although artificial feeding is required in many cases.
Score = 3: a patient in intensive care with assisted ventilation etc. Protein requirement is increased and cannot be covered even by artificial feeding. Protein breakdown and nitrogen loss can be significantly attenuated.

APPENDIX A-6: DEMOGRAPHIC COLLECTION TOOL

Age (years): ____________________

Gender:
- ☐ Male
- ☐ Female

Length of Stay (days): ____________

Reason for Admission: ___________

Cultural Background:
- ☐ Caucasian
- ☐ African American
- ☐ Hispanic
- ☐ Other: __________

Intake recorded per RN throughout patient's admission (determined by daily nurse documentation)
- ☐ Good (>75%)
- ☐ Fair (50-75%)
- ☐ Poor (0-50%)

Impaired Cognitive Functions
- ☐ Dementia
- ☐ Depression
- ☐ Parkinson's disease
- ☐ Alzheimer's disease
- ☐ None

Medication
- ☐ No medication
- ☐ 1-4 medication
- ☐ 5+ medications

Chewing Issues
- ☐ Missing teeth
- ☐ Ill-fitted dentures
- ☐ Edentulous
- ☐ None

Current Type of Diet
- ☐ Regular
- ☐ Diabetic
- ☐ Renal
- ☐ Cardiac
- ☐ Other: __________

Living Arrangements
- ☐ Home (alone)
- ☐ Home (with individuals)
- ☐ Group home/assisted living
- ☐ Nursing home

Initial Classification of Malnutrition
- ☐ No risk
- ☐ At-risk

Swallowing Issues
- ☐ Yes
- ☐ No

Amount of wounds patients have during admission
- ☐ None
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6

RD Consultation Upon Admission
- ☐ Yes
- ☐ No

APPENDIX B

HUMAN USE APPROVALS

APPENDIX B-1: LOUISIANA TECH UNIVERSITY HUMAN SUBJECTS

COMMITTEE APPROVAL LETTER

LOUISIANA TECH UNIVERSITY

MEMORANDUM

OFFICE OF SPONSORED PROJECTS

TO: Ms. Emily Salas-Groves and Dr. Janet Pope

FROM: Dr. Richard Kordal, Director of Intellectual Property & Commercialization (OIPC)
rkordal@latech.edu

SUBJECT: HUMAN USE COMMITTEE REVIEW

DATE: February 20, 2018

In order to facilitate your project, an EXPEDITED REVIEW has been done for your proposed study entitled:

"Development and Cost-Effectiveness of Malnutrition Screening Program in a Skilled Nursing Facility (SNF)"

HUC 18-096

The proposed study's revised procedures were found to provide reasonable and adequate safeguards against possible risks involving human subjects. The information to be collected may be personal in nature or implication. Therefore, diligent care needs to be taken to protect the privacy of the participants and to assure that the data are kept confidential. Informed consent is a critical part of the research process. The subjects must be informed that their participation is voluntary. It is important that consent materials be presented in a language understandable to every participant. If you have participants in your study whose first language is not English, be sure that informed consent materials are adequately explained or translated. Since your reviewed project appears to do no damage to the participants, the Human Use Committee grants approval of the involvement of human subjects as outlined.

Projects should be renewed annually. ***This approval was finalized on February 20, 2018 and this project will need to receive a continuation review by the IRB if the project continues beyond February 20, 2019.*** **ANY CHANGES** to your protocol procedures, including minor changes, should be reported immediately to the IRB for approval before implementation. Projects involving NIH funds require annual education training to be documented. For more information regarding this, contact the Office of Sponsored Projects.

You are requested to maintain written records of your procedures, data collected, and subjects involved. These records will need to be available upon request during the conduct of the study and retained by the university for three years after the conclusion of the study. If changes occur in recruiting of subjects, informed consent process or in your research protocol, or if unanticipated problems should arise it is the Researchers responsibility to notify the Office of Sponsored Projects or IRB in writing. The project should be discontinued until modifications can be reviewed and approved.

Please be aware that you are responsible for reporting any adverse events or unanticipated problems.

A MEMBER OF THE UNIVERSITY OF LOUISIANA SYSTEM

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B-2 ADMINISTRATION OF OAKBEND MEDICAL CENTER APPROVAL LETTER

OAKBEND
MEDICAL CENTER

02/02/2018

Dear Dr. Janet Pope,

The Administration of OakBend Medical Center has reviewed the study entitled "Development And Cost-Effectiveness Of Malnutrition Screening Program In A Skilled Nursing Setting" submitted by Ms. Emily Salas-Groves of Louisiana Tech University. We are aware that the study will utilize the following instruments:

- OakBend Medical Center Nutrition Screening Tool
- Mini Nutrition Assessment-Short Form (MNA-SF)
- Malnutrition Universal Screening Tool (MUST)
- Nutrition Risk Screening 2002 (NRS-2002)
- Malnutrition Screening Tool (MST)
- OakBend Medical Center EMR

Ms. Emily Salas-Groves will collect data from at least 100 patients admitted at our Facility during the period of 3/1/16 to 3/1/18. HHS Guidelines for confidentiality, de-identifications, and security of data will be followed as indicated by the Office of Human Research Protections. On 2/3/18, the Administration of OakBend Medical Center approved the study as presented.

Signed,

S McCarty

Sue McCarty
Vice President/Administrator

1705 Jackson Street
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