Evaluation of Oral Nutritional Supplement Use in Elderly Patients Admitted with Heart Failure

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DNP Final Project Report

Evaluation of Oral Nutritional Supplement Use in Elderly Patients

Admitted with Heart Failure

Geri L. Sipe, MS, RN, CEN

University of Kentucky

College of Nursing

Spring 2017

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Dedication

It is through God’s grace and guidance alone that this journey has become a reality. Through Him, I have been blessed with an amazing support system of family and friends that has made this day possible! The path to this day has been bumpy. From almost not starting the program after receiving Kaylee’s hemimegalencephaly diagnosis one month before class to having major surgery in my last year, I have been blessed with obstacles that have helped me become a better person and a better healthcare provider!

Jason, thank you for believing in me and for driving all the time while I do homework, and we do “life.” You and Mom can award me the worst co-pilot medal! You’ve always been so supportive of my numerous educational endeavors – in fact, I think I’ve been in school almost our entire marriage. Mom and Dad, thank you for loving and nurturing my babies, often inconveniencing yourselves to make things happen for them. Thank you for NEVER discouraging my desire to learn and for fostering my education through opportunity! Kaden and Kaylee, thank you for bringing me joy and inspiration. You guys have been so patient with Mommy and have loved me unconditionally.

Mommy loves you all! I could not have survived without your hugs and kisses. You all are my drive to keep pushing along and my heart in all I do! Thank you to all my amazing grandparents. Daw and Grandad, thank you so much for your love, support and belief in me. You’ve always been a rock for me. I hate that Grandma and Papaw are missing this moment, but I know they are looking down from above on this joyous occasion and smiling from ear to ear! This journey comes to a close, but new doors open! I did it!
Acknowledgements

Thank you to my advisor and mentor, Dr. Melanie Hardin-Pierce for keeping me grounded and focused in my research aims. You have always been a fierce supporter of my desire to learn and incorporate my love of physiology and nutrition into nursing care. Your encouragement, love and mentorship made this possible. Your belief in me brings both comfort and a feeling of honor. I also thank Dr. Terry Lennie for taking a chance on me after I wrote to him about my project asking for his participation in this journey. Your clinical expertise and mentorship has helped me so much in achieving this degree. You have re-awakened my passion for research and application, and I am so grateful to have met you during my BSN journey. I was so excited when you said, “yes!” It has been a pleasure working with you! Dr. Mark Sloan, thank you for serving as my clinical mentor, but even more importantly being an amazing colleague. From the beginning of my journey even as a bedside nurse, you have provided opportunity to learn and grow at the bedside and challenged my critical thinking. I have the utmost respect for you and consider it an honor to have worked WITH you.

I also thank Frankfort Regional Medical Center (FRMC), Lori Ivy for keeping me sane, Kathy Reynolds for her expertise and the quality staff for their support of this study. Thank you to all of my preceptors for allowing me to grow professionally under their guidance. Another huge thanks to my ER providers who have taught me so much. I am going to miss you all, but I will go away being a better clinician because of your support! Lastly, to Amanda and Alyssa, thank you for keeping me grounded and reminding me to “just keep swimming!” Love you gals, and I cannot wait to make waves with you all in our profession.
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Introduction to Final DNP Project

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Spring 2017
Evaluation of Nutritional Supplement Use in Elderly Patients Admitted with Heart Failure

**Introduction**

Hospitalized acutely ill heart failure (HF) patients are at increased risk for mortality and morbidity, readmission (Gallet et al., 2012; Lee et al., 2012) and are more prone to nutritional deficits and malnourishment (Araújo et al., 2011; Aziz et al., 2011; Colin-Ramirez et al., 2011). Furthermore, physiological changes associated with aging render the elderly patient admitted with heart failure at increased nutritional risk due to imbalanced protein and energy intake (Kubota et al., 2012). Cumulatively, greater energy demands, poorer intake, and further impaired anabolism create an even larger net negative energy balance (Anker, Laviano, Fillipatos, Joh, Paccagnella, & Ponikowski, 2009) for the elderly HF patient, supporting nutritional assessment as a critical need.

Oral nutritional supplements (ONS) are one avenue to address this deficit. Among heart failure patients, ONS improve body weight and increase muscle mass and strength (Baldwin & Weeks, 2011). Historically, ONS provision while inpatient has been at the discretion of the attending providers and dietary recommendations post nutritional assessment. The evolution of electronic health records and computerized order entry coupled with autonomous ONS ordering privileges by registered dieticians (RD) at Frankfort Regional Medical Center provoked inquiry into practice change. The aim of this study is to determine ONS ordering frequency by provider type and assess pre-existing nutritional status as determined by present screening questions upon hospital admission within the inpatient elderly admitted with heart failure. Additionally,
frequency of full nutritional assessment will be determined as well as an evaluation of risk screening outcomes. There are three manuscripts associated with this project:

1. Manuscript 1 investigates the development of a pilot program for interprofessional education (IPE) from the doctoral nursing student perspective. The LEAN process in concert with application of IPE functional components was used for a practice improvement project. Core concepts gained from the IPE process were integral to collaborative efforts necessary for all aspects of the final DNP project.

2. Manuscript 2 is an integrative literature review of screening tools used to assess nutritional risk among the inpatient population as well as the establishment of baseline nutritional risk among the inpatient population with special attention to the elderly patient, the heart failure patient, and collectively, the elderly HF patient. This review was the basis for selected study variables, expected outcomes, determination of need for nutritional assessment and validated assessment tools for the elderly population.

3. Manuscript 3 is the conclusion of a retrospective chart review in a pre-post-implementation evaluation study at Frankfort Regional Medical Center. The primary variables of interest were whether the allowance of registered dieticians (RD) to order oral nutritional supplement (ONS) affected ONS order prevalence and nutritional screening and assessment practices. The results are reported in the following manuscript.
Manuscript 1

Developing Interprofessional Education:

A Nursing Perspective

University of Kentucky

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Abstract

**Background:** Development of an effective interdisciplinary healthcare team requires core components experienced through Interprofessional Education (IPE). In collaboration with University of Kentucky Chandler Medical Center, the University of Kentucky College of Nursing developed a pilot program to introduce resident students to the components of IPE. Skills and content taught were then applied to enhance interdisciplinary team building and problem solving by working together to identify an inefficient process with poor quality outcome potential to improve.

**Participants:** Three adult-gerontology acute care doctorate of nursing practice students, two resident physicians, and one pharmacy resident participated in a joint quality improvement project under the direction of a collective group of faculty from multiple disciplines.

**Method:** Participants were introduced to the concept and application of LEAN process improvement simultaneously by a LEAN expert while becoming acquainted with the core components of IPE. Concepts for improvement were introduced and discussed by all parties with one collectively chosen for process improvement. Didactic coursework focused on emotional intelligence (EQ), conflict resolution, personality profiles, communication, and leadership, each taught by leading experts.

**Conclusion:** IPE should be assimilated into the core curriculum for doctoral nursing students (DNP) to foster the delivery of safe, high quality and efficient healthcare. IPE and LEAN process improvement knowledge positions the DNP to be a team leader in the interdisciplinary approach to patient care.
Developing Interprofessional Education: A Nursing Perspective

Collaborative care teams for the delivery of safe patient care were the motivation behind the Institute of Medicine (Kohn, Corrigan & Donaldson, 2000) recommendations. However, widespread adoption of interprofessional education (IPE) as a means to deliver collaborative care has been slow and often unrealized in academic or patient care environments. Representatives from the American Association of Colleges of Nursing took part in the Interprofessional Education Collaborative Expert Panel (2011) to improve IPE implementation. Core competencies for IPE were established and included: 1) values and ethics for interprofessional practice, 2) roles and responsibilities for collaboration, 3) interprofessional communication and 4) interprofessional teamwork. The Patient Protection and Affordable Care Act (2010) further supported IPE adoption by mandating IPE and interprofessional collaborative practice (IPCP, Zorek & Raehl, 2013), yet the law provided no formal structure for implementation. The adoption of IPE in academic and clinical training programs has been slow because of existing barriers resulting from complex and fragmented health care delivery education systems. The purpose of this paper is to describe the experience of a group of doctor of nursing practice (DNP) acute care nurse practitioner students’ participation in an IPE pilot program.

**What is IPE?**

Preparation for purposeful IPE is necessary for nurse practitioners to approach team-based care (Foret Giddens et al., 2014). However, collaborative, interprofessional care is not intuitive and necessary skills must be taught. Established curricula with formal expectations must be introduced during academic preparation. A major bottleneck in the implementation of IPE and collaborative initiatives occurs within the academic
institutions (Zorek & Raehl, 2013). Specifically, because accrediting bodies lack standards and guidelines regarding the incorporation of IPE, academic institutions are not required to offer structured programs introducing and applying IPE concepts (Zorek & Raehl, 2013). As innovative healthcare institutions and providers, the University of Kentucky’s (UK) colleges of medicine and nursing DNP program developed a pilot program to introduce IPE to their students as an elective course. This pilot program was intended to engage participants in a quality improvement project using the components of IPE and applicable skills to arrive at a collaborative solution for a fractured process.

The UK pilot program consisted of a didactic portion and a group project involving practical application of course concepts for quality improvement. Two resident physicians, one pharmacy resident and three DNP students made up the pilot group. Didactic concepts and skills for effective IPE included: emotional intelligence (EQ), conflict resolution, personality profiles, communication, and leadership. Experts in their respective fields introduced these skills and activities were arranged to supplement and foster learning and application in the quality improvement process. Students identified a problem and utilizing IPE skills, applied the Lean process to develop a solution.

Quality Improvement Process

Lean, an eight-step quality improvement process (Kaplan, 2012), is not new to healthcare (Glasgow, 2011), but its employment within coursework at an academic institution is novel. Students participated in a one day workshop to learn the Lean process. A key component of Lean is that frontline providers, such as physicians, nurses and managers are pivotal when discussing process flow (Kaplan, 2012). Similarly, IPE functions by engaging providers from all disciplines to collectively discuss and provide
care. The pilot group of students unanimously chose turnaround time of laboratory results in obstetrics triage as a process in need of quality improvement.

The group learned to work together to overcome barriers such as scheduling conflicts, division of assigned work, and engaging with various departments within the hospital. Collaboration and communication with other disciplines fostered an appreciation of each person’s role in a project, keeping patient centered care at the forefront. Mutual respect, positive and negative feedback, as well as consensus building were core concepts derived from IPE learning.

**Recommendations**

Recommendations to improve the IPE curriculum would be to incorporate the concepts and skills introduced in the pilot IPE course and to place an emphasis on collaborative care. This pilot project spanned nine months and scheduling meetings was a major barrier. It would be beneficial in the future to have one day per month prearranged by academic faculty so that all students could plan to attend face-to-face meetings. Students learned from this pilot program that even in its early stages, IPE curricula within an academic setting can facilitate the development of mutual exchange and respect among disciplines with a patient-centered focus on improving healthcare system outcomes.

Through this pilot course, students gained an appreciation of necessary skills and expectations required to successfully apply and implement IPE in a university healthcare setting. Competencies in the Lean process and IPE should be required in DNP curricula to promote effective collaboration across disciplines with a focus on quality and efficiency in the delivery of safe patient care. Skills gained through coursework
facilitated these exchanges. These recommendations are consistent with the Interprofessional Education Collaborative Expert Panel’s (2011) needs assessment and help meet provisions under the ACA (2010). Lobbying for IPE mandates by accrediting bodies for academic programs should also be considered (Zorek & Raehl, 2013). What an amazing experience to be at the leading edge in the provision of safe, high quality, efficient and patient-centered care by being a part of the quality improvement process through interprofessional education!

**Application to Final DNP Project**

Through the IPE process, a collection of communication skills were developed that when applied together facilitated self-awareness and created an avenue to prompt more constructive exchange when each participating discipline had an individual concept of what was most important. By learning to appreciate differences in opinion and how to communicate effectively with those of different personalities, communication becomes more team-focused with a single outcome. An appreciation of each discipline’s contribution to patient care was established. Refocusing attention on collaboration of care across the continuum and each discipline’s integral role for facilitation of the patient’s needs was accomplished. The importance of networking and establishing functional relationships with other disciplines as stressed during this pilot program proved fruitful when discovering the topic for this final DNP project. When brainstorming with the research council sponsor, a unique problem was presented. How do you address nutritional deficits among those that have difficulty breathing? After collaborating with the bedside nurses, dieticians, and some nursing supervisors, a need was identified. However, after speaking further with the RD, it became more apparent
that the foundation to recognize nutritional need could be broken due to many barriers or potential “stops” referencing the LEAN process.

Concepts and ideas for improvement as well as potential fiscal outcomes were presented at our Magnet site visit and received broad and strong support for investigation. I subsequently decided to investigate current practice at Frankfort Regional Medical Center in effort to drive evidence-based intervention and care planning for the future. Communication and personal growth gained from the application of the LEAN process in the pilot program facilitated my investigation as my research inquiry evolved into first evaluating the process prior to implementation. Without these skills, navigation throughout my practice improvement project would have been more difficult.
References


Figure 1. IPE Process Improvement Poster
Manuscript 2

To Screen or Not to Screen: Is Nutritional Assessment Necessary in Hospitalized Geriatric Heart Failure Patients?

Geri L. Sipe, MS, RN, CEN

University of Kentucky
College of Nursing
Spring 2017
Abstract

Purpose: The purpose of this integrative review is to evaluate the literature to determine baseline nutritional risk and malnutrition prevalence among the hospitalized patient population. Tools used to assess risk will be determined as well as implications for nutritional assessment among the elderly patients and those with heart failure who become hospitalized to determine if an evidence-based screening and intervention care planning is needed.

Methods: Comprehensive searches of PubMed and the Cumulative Index to Nursing and Allied Health Literature (CINAHL) were performed as well as a Google scholar search utilizing the same key words to ensure no articles were missed. Key words were consistent to guide searches and established criteria for inclusion set.

Results: Based upon the use of several evaluated, validated tools, the inpatient population has a 30-40% nutritional risk. Factoring in physiological and cognitive changes among the elderly as well as the debilitative heart failure condition, potential for further increased risk exists.

Conclusion: Inpatient nutritional assessment lacks uniform protocol and no consensus exists for the elderly inpatient population or heart failure population. Evidence suggests nutritional risk is associated with patient outcomes and length of stay. Deducing an evidence-based nutritional assessment protocol and then examining patient outcomes is of importance and is in support of a holistic interdisciplinary approach to patient care.
To Screen or Not to Screen: Is Nutritional Assessment Necessary in Hospitalized Geriatric Heart Failure Patients?

Increased risks of mortality and morbidity, high rates of readmission within 30 days leading to reduced reimbursement, and increased risk for future emergency department visits plague the hospitalized acutely ill heart failure patient (Gallet et al., 2012; Lee et al., 2012). When factoring in advanced age, elderly hospitalized patients are at even greater nutritional risk due to imbalanced protein and energy intake (Kubota et al., 2012). Combining all components, an even greater net negative energy balance is created (Anker, Laviano, Fillippatos, Joh, Paccagnella, & Ponikowski, 2009). Therefore, determining nutritional risk and subsequently completing a full nutritional assessment is necessary to evaluate the risk or prevalence of under-nutrition and malnutrition among hospitalized elderly patients with heart failure. The purpose of this integrative review is to explore the assessment tools utilized in hospitalized patients, with a specific focus on those used in the geriatric population to answer the question, among hospitalized elderly patients with heart failure, is there a standardized nutritional screening tool? Knowledge gained can assist in the identification of other risk factors among elderly heart failure patients for future means of intervention.

Methods

Data Sources and Extraction

Comprehensive searches of PubMed and the Cumulative Index to Nursing and Allied Health Literature (CINAHL) were performed utilizing the following key word combinations: nutritional assessment, acute heart failure, heart failure, elderly, inpatient, hospitalized, nutritional risk index, malnutrition, undernutrition, under nutrition,
nutritional assessment, nutritional status, decompensated heart failure, malnourished, geriatric, and nutritional risk. In effort to ensure no articles were missed, a Google scholar search was performed utilizing the same key words.

Search limitations included articles that were available in the English language, published since 2005, studied participants over the age of 18 years, and those articles focusing on nutritional assessment of hospitalized populations, hospitalized geriatrics, and hospitalized heart failure patients. An exception was made for a study by Persson, Brismar, Katzarski, Nordenstrom, & Cederholm (2002), which included a three-year follow-up study and was particularly relevant to the topic. Exclusion criteria included non-English language articles, studies with patients under the age of 18 years, and those including maternity or psychiatric patients. Reference lists were searched for potentially useful articles and reviews identified from searches were analyzed for potentially useful seminal works. Studies were selected for inclusion when relevant content for the identified population (inpatient elderly), disease (heart failure), problem (nutritional status) and intervention (nutritional assessment) was presented.

**Literature Critique and Synthesis**

**Hospitalized Patients**

Among hospitalized patients, the Nutritional Risk Screening tool (NRS 2002), Nutritional Risk Index (NRI), Malnutrition Universal Screening Tool (MUST), Subjective Global Assessment (SGA), body mass index (BMI), Subjective Nutritional Assessment Questionnaire (SNAQ), Mini Nutritional Assessment Short Form (MNA-SF), Mini Nutritional Assessment (MNA), Malnutrition Screening Tool (MST), and Geriatric Nutritional Risk Index (GNRI) are utilized to assess nutritional status. In a
cross-sectional study (N=275), five common malnutrition screening tools (MST, SNAQ, MUST, NRS2002, MNA-SF) were compared, identifying the MST and SNAQ as most suitable for the inpatient setting and determining that the MNA-SF lacked specificity (Neelemaat et al., 2011). One caveat to their evaluation is that they had a high rate of missing values and therefore could not effectively apply the MUST (Neelemaat et al., 2011).

Kyle, Kossovsky, Karsegard, and Pichard (2006) compared the SGA, NRI, MUST, and NRS2002 among hospitalized medical or surgical patients (N=995) in a population study. Unlike Neelemaat et al. (2011), Kyle et al. (2006) did not evaluate the application of the MST, SNAQ or MNA-SF to support or rebut their findings. However, limitations in NRI application based upon inability to accommodate for recent changes in diet and disease effect were determined (Kyle et al., 2006). Study limitations included lack of control for chronic disease; patients were not classified by diagnosis or hospital service and lack of assessment at admission (Kyle et al., 2006). Through tight exclusion criteria including effects of disease status (NRS2002 and MUST), Kyle et al. (2006) accounted for potential confounding. Most applicable to hospitalized patients was their determination that all tools examined are appropriate for determining nutritional risk (Kyle et al., 2006). Furthermore, LOS and nutritional status or medium and high-risk parameters as assessed by all five tools are significantly related (P<0.001; Kyle et al., 2006). In earlier works, Kyle, Pirlich, Schuetz, Lochs, and Pichard (2005) employed the NRI in a prospective study (N=995) among medical and surgical patients. NRI increased throughout hospitalization indicating greater risk of malnutrition with duration of admission (Kyle et al., 2005).
Bauer et al. (2011) identified a malnutrition prevalence of 42.5% using the SGA in an observational study (N=926) with tight inclusion and exclusion criteria. Like Kyle et al. (2005), malnutrition incidence increased as LOS increased to greater than or equal to 28 days. A one and a half times greater LOS was found among malnourished (SGA) patients (Bauer et al., 2011), similar to Lim et al. (2012) who used the SGA and also had 60% increased risk of readmission within fifteen days despite missing data on several patients. The most important finding was the need for serial nutritional assessments throughout hospitalization (Bauer et al., 2011).

Fang et al. (2013) evaluated nutritional risk with the NRS2002 in a prospective study (N=2550) identifying that 47.6% of the population was at risk of malnutrition and age greater than 70 years associated with greater malnutrition risk (P<0.001). Giryes et al. (2012) also utilized the NRS2002 in a cross-sectional study (N=504) of medical and surgical adult patients. A 31.5% rate of malnutrition was found along with a higher prevalence of malnutrition among internal medicine patients (P<0.001). In agreement with Fang et al. (2013), those deemed at high malnutrition risk were also significantly older (P<0.001; Giryes et al., 2012) supporting a need for full nutritional assessment as a standard of care among the inpatient elderly.

**Elderly Patients**

Rasheed and Woods (2013) utilized the MUST tool to determine malnutrition prevalence and evaluated clinical outcomes in a prospective observational study (N=126) among those greater than 60 years. Outcomes measured included mortality, LOS and discharge destination as a retrospective analysis. In agreement with Fang et al. (2013), 43% were at medium to high risk of malnourishment. Like Kyle et al. (2005, 2006),
being malnourished increased LOS versus being low risk (P=0.026) and increased the incidence of discharge to long-term care. Being low risk for malnutrition was also associated with reduced in hospital mortality and risk of discharge to long-term care (Rasheed & Woods, 2013). Perhaps representing antecedents to the established risk of malnutrition, poor appetite was reported in 56% of patients and 44% reported less intake than normal due to hospitalization (Rasheed & Woods, 2013); whereas, being female (P<0.05) and history of weight loss over the past year was associated with poor appetite (P<0.01; Hanisah, Suzana, & Lee, 2012). Qualitative inquiry has identified poor mealtime ambience, lack of necessary assistance, lack of monitoring of nutrient intake and absence of accountability in nutritional care as core factors affecting intake among older hospitalized patients (Moynihan, Macdonald, Teal, Methven, Heaven, & Bamford, 2012). Other factors further contribute to malnutrition among the elderly including swallowing difficulties, taste difficulties and an association with admission from a nursing home (Vanderwee, Clays, Bocquaert, Gobert, Folens, & Defloor, 2010).

Similar to Kyle et al. (2006), Young, Kidston, Banks, Mudge, and Isenrig (2013) evaluated the SGA, MNA, MST, and NRS2002 among hospitalized elderly patients. MNA was determined to identify those at risk and those with existing malnutrition; whereas, the SGA was found to identify those with existing malnutrition only and not potential risk. Limits to this study include the lack of serial follow-up to truly assess risk potential of the various tools. Drescher et al., (2010) compared the MNA and NRS2002 and found that the NRS2002 was superior to the MNA in predicting malnutrition among the elderly population. Among the elderly (N=2329), MNA yielded a 33% malnutrition incidence and 43% at risk of malnutrition (Vanderwee et al., 2010). In agreement with
Kyle et al. (2006), all tools were found to be accurate at identifying existing malnutrition among the elderly. However, building upon the notion that serial assessments are necessary (Bauer et al., 2011) and that malnutrition increases with LOS (Kyle et al., 2005), this population is particularly at risk of poorer outcome without nutritional assessment and intervention (Holyday et al., 2012).

Although not examined on an inpatient basis, Baumeister et al. (2011) examined the GNRI in a cross-sectional and longitudinal study (N=1999) in a community-based setting to determine if GNRI was associated with total costs, probability of hospitalization, inpatient costs, and pharmaceutical costs at baseline and follow-up after adjustments. Similar to Rasheed and Woods (2013), lower GNRI was found to be a suitable predictor for future healthcare costs and risk of hospitalization among independent living older adults indicating relationship between decreased nutritional risk (MUST) and reduced long-term care discharges (Poulia et al., 2012). When comparing the NRI, GNRI, SGA, MNA-SF, MUST, and NRS2002 among elderly inpatients, MUST was the most valid tool in their population predicting hospital admission and elderly nutritional risk was overestimated by NRS2002 (Poulia et al., 2012). The GNRI was successfully applied by Bouillanne et al. (2005) and found greater nutritional risk was associated with increased risk of mortality.

In a randomized controlled study, the MNA was applied in the elderly inpatient population with a malnourished or risk of malnutrition prevalence of 119/143 patients (Holyday et al., 2012), a percentage echoed by Hanisah et al. (2012) who used the SGA. In their cross-sectional study (N=240), Marques de Oliveira and Leandro-Merhi (2010) found that 37.1% were at risk of malnutrition (MNA) and 29.1% were malnourished.
Only 33.8% of the hospitalized elderly had proper nutrition (Marques de Oliveira & Leandro-Merhi, 2010), leaving a huge gap in terms of risk at nearly 70%, a risk that equates to dollars. Malnutrition care plans implemented upon admission resulted in decreased LOS (P=0.013). Although short in duration, findings suggest malnutrition risk exists among the elderly inpatient population and that mandated nutritional intervention significantly reduces LOS (Marques de Oliveira & Leandro-Merhi, 2010). This becomes particularly relevant when evaluating The Joint Commission’s (2008) lack of requirement for full nutritional assessment, only requiring assessment of risk. However, there is not a standardized requirement for either component, leaving much objectivity in the individual facility’s hands. Among the hospitalized elderly, approximately 40 to 80% are found to be at risk of malnutrition or are malnourished as assessed by a variety of tools. Associated with this prevalence is the significant increase in mortality over three years among identified patients (Persson et al., 2002). Clearly there is justification for a screening protocol and implementation of an individualized care plan.

**Heart Failure Patients**

Among pulmonology patients, under-nutrition (28.2%) and nutritional risk (55.9%) rates are high (Fang et al., 2013), similar to the deduced 70% risk above. In many ways, heart failure patients become pulmonology patients when gas exchange is impaired upon fluid buildup. Another high-risk population with associated fluid build up is patients with obstructive jaundice (N = 60) where NRI < 83.5 (severe) was associated with increased in-hospital mortality (P=0.044) and length of stay (LOS; P=0.001; Clugston, Paterson, Yuill, Garden, and Parks, 2006). In this same population, MUST high risk did not correlate with in-hospital mortality (P=0.575), but did with increased LOS.
Extrapolating the risks among other high-risk populations further supports inquiry into nutritional assessment and management of hospitalized elderly heart failure patients as a means to improve nutrition and decrease LOS.

Although body mass index (BMI) is a commonly used indicator for nutritional status, Collin-Ramirez et al. (2011) established the potential lack of relevance for heart failure patients. In support, Giryes et al. (2012) found normal BMI among those deemed at high risk for malnutrition further indicating lack of relevance as a single predictor.

Putatively, weights can be increased secondary to fluid accumulation. However, BMI was significantly higher among those with no malnutrition risk compared to those at mild, moderate and severe risk (P=0.001; Aziz et al., 2011) suggestive of a relationship.

Specifically, nutritional status (NRI) among hospitalized heart failure patients (N = 1110, Mean age 72±14 years) was examined retrospectively, where NRI = [1.519 x serum albumin (g/dL)] + [41.7 x present weight (kg)/ideal body weight (kg)]. Patients were classified as being at no risk, or mild, moderate or severe nutritional risk. Thirty-four percent were deemed to be at moderate or severe nutritional risk (Aziz et al., 2011). This prevalence is similar to rates found by previously discussed authors. No studies reviewed discuss nutritional risk related to LOS or benefits of nutritional intervention among our target population.

**Discussion**

In consensus reviews, Lee et al. (2011) and Hauptman et al. (2008) establish the need for nutritional assessment and intervention among patients diagnosed with heart failure; however, no assessment or screening tool is recommended. The Joint
Commission (2008) guidelines for nutritional assessment are not standardized and leave the patient at risk for not being fully assessed without stringent facility-driven protocols using a validated screening tool. Even in the presence of an experimental 24-hour observation period among retrospectively analyzed charts (N=3278), only 24% of patients were screened. Although the majority (65%) of mandatory assessments were completed within the 24-hour time period, only half of the screenings were accurate therefore underestimating nutritional need. An additional 46% required secondary screening, with 30% being deemed at risk upon the second analysis (Geiker, Larsen, Stender, & Astrup, 2012). Increased nutritional risk coupled with decreased food intake among hospitalized patients (N=16290) has been found to be an independent risk factor for hospital mortality (Hiesmayr et al., 2009). In studies where nutritional assessment has been mandatory, problems still exist as evidenced by approximately half of the screenings being inaccurate (Geiker et al., 2012) leaving much room for improvement.

Additional benefits of incorporating nutritional assessment among hospitalized patients (N=1637) is the correlation Schneider et al. (2004) found among nosocomial infection presence in non-malnourished, moderately malnourished, and severely malnourished patients (4.4%, 7.6%, & 14.6%, P=0.0009). Because lower NRI scores are strong predictors of length of stay (HR 1.7, P=0.005), readmission rates (P<0.001), all cause mortality (P<0.001) and five-times greater simulated hospital costs, it is prudent to address nutritional deficits among hospitalized patients with heart failure (Aziz et al., 2011). Additionally, higher BNP levels were found among those deemed moderate to severe nutritional risk (P=0.001) providing a potentially useful correlation between a commonly examined laboratory finding and nutritional status (Aziz et al., 2011).
Cumulatively, evaluating nutritional status and considering nutritional intervention has the capacity to impact patient outcome and hospital financials by addressing cellular need.

**Recommendations**

In critiquing reviewed articles, most studies evaluating nutritional status among the inpatient population were conducted outside of the United States. Although The Joint Commission (2008) requires that nutritional screening be “performed when warranted by the patient’s needs or condition,” there is no mandate for parameters indicating need, nor is there a required or suggested tool to assess nutritional need if deemed necessary. Leaving assessment at the discretion of each individual facility (The Joint Commission, 2008) permits the chance for a nursing initiative to improve patient care. As the malnourished elderly continue to take in less energy and nutrients when hospitalized, existing deficits are compounded (Marques de Oliveira & Leandro-Merhi, 2010; Portero-McLellan et al., 2010). Reviewed literature addressing nutritional needs among the elderly hospitalized patient indicates significant need for an initial and serial nutritional assessment. Recognizing this deficit prioritizes the need for evidence-based interventions to close the gaps. Based upon the literature, a serial nutritional assessment protocol using a standardized validated tool would be useful in identifying the prevalence of malnutrition and nutritional risk among elderly patients admitted with heart failure and meet recommendations by Lee et al. (2011) and Hauptman et al. (2008).

Future studies should be aimed at utilization of a standardized tool in the elderly patient with heart failure domestically, paying attention to outcomes such as LOS and in-hospital mortality. Enteral or parenteral nutritional supplementation as recommended by
Mechanick and Chiolero (2008) could then be implemented and outcomes and nutritional status serially assessed during hospitalization. Eliminating the “gray” areas surrounding The Joint Commission (2008) requirements and variety in hospital procedures to establish a protocol for nutritional assessment is not only proactive, but could prove to be a patient-centered initiative and a fiscally smart decision as value-based healthcare continues to come to the forefront.


<table>
<thead>
<tr>
<th>Authors, Year</th>
<th>Title, Journal, reference info</th>
<th>Sample</th>
<th>Method/Study Design</th>
<th>Outcomes Measured</th>
<th>Findings</th>
<th>Level</th>
<th>Nutritional Tool</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rasheed, S., &amp; Woods, R.T. (2013)</td>
<td>Malnutrition and associated clinical outcomes in hospitalized patients aged 60 and older: An observational study in rural Wales, Journal of Nutrition in Gerontology and Geriatrics, 3291), 71-80</td>
<td>N=126 patients mean age 78.9 years, 50/50 M:F from 5 medical and 4 surgical wards in rural Wales, collected on one day from all patients aged 60+ years in the hospital median 5 days</td>
<td>Prospective observational study</td>
<td>Clinical: in hospital mortality, LOS, &amp; DC destination (retrospectively assessed)</td>
<td>MUST tool to assess nutritional status</td>
<td>22% patients were medium risk malnourishment, 21% high risk – MUST tool</td>
<td>II-2</td>
<td>MUST</td>
</tr>
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</table>

**Limitations**

Population-specific studies/references'
<table>
<thead>
<tr>
<th>Study</th>
<th>Research Question/Method</th>
<th>Sample Size</th>
<th>Outcomes</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holyday, M., Danielle, S., Bare, M., Caplan, G.A., Petocz, P., &amp; Bolin, T. (2012)</td>
<td>Malnutrition screening and early nutrition intervention in hospitalised patients in acute aged care: a randomised controlled trial</td>
<td>N=143 patients, geriatric ward in Wales, LOS at least 72h</td>
<td>Randomized controlled prospective study</td>
<td>LOS, Nutritional status via MNA tool, weight, readmission</td>
</tr>
<tr>
<td>Hanisah, R., Suzana, S., &amp; Lee, F.S. (2012)</td>
<td>Validation of screening tools to assess appetite among geriatric patients</td>
<td>145 patients, 75.9% inpatient, 68.3% women, most common diagnoses: hypertension, diabetes mellitus, and heart problems</td>
<td>Cross-sectional</td>
<td>Anthropometry, nutritional status, dietary intake, appetite assessment</td>
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<tr>
<td>Study</td>
<td>Design</td>
<td>Methodology</td>
<td>Findings</td>
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<tr>
<td>Marques de Oliveira, M.R. &amp; Leandro-Merhi, V.A. (2010)</td>
<td>Cross sectional</td>
<td>N=240 inpatient Brazil Age 60+ Patient or caregiver responses taken</td>
<td>33.8% adequate nutrition, 37.1% at risk of malnutrition, and 29.1% malnourished Malnourished = less energy and nutrient intake than those at risk or without (p=0.0001)</td>
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<tr>
<td>Marques de Oliveira, M.R. &amp; Leandro-Merhi, V.A. (2010)</td>
<td>Food intake and nutritional status of hospitalised older people, International Journal of Older People Nursing, 6(3), 196-200</td>
<td>N=240 inpatient Brazil Age 60+ Patient or caregiver responses taken</td>
<td>Per SGA, 50.4% population identified as mild to moderately malnourished, normal (38.6%), and severe (11%)</td>
<td></td>
</tr>
<tr>
<td>Portero-McLellan, K.C., Staudt, C., Silva, F.R.F., Delbue Bernardi, J.L., Baston Frenhani, P., &amp; Leandro Mehri, V.A. (2010)</td>
<td>The use of calf circumference measurement as an anthropometric tool to monitor nutritional status in elderly inpatients, The Journal of Nutrition, Health, &amp; Aging</td>
<td>N=170, Average age 79M, 91F, 60+yo from larger pool of 2239 Brazil</td>
<td>No statistical difference between genders Energy and protein intake among elderly decline with age Positive correlation between calf circumference and nutritional status – BMI (p&lt;0.0001), arm circumference (p=0.0001), triceps skinfold (p=0.0001), mid arm muscle circumference</td>
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<tr>
<td>Authors</td>
<td>Study Title</td>
<td>Methods</td>
<td>Results</td>
<td>Star Rating</td>
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<tr>
<td>Persson, M.D., Brismar, K.E., Katzarski, K.S., Nordenstrom, J., Cederholm, T.E. (2002)</td>
<td>Nutritional status using mini nutritional assessment and subjective global assessment predict mortality in geriatric patients, J Am Geriatr Soc, 50(12), 1996-2002</td>
<td>N=83 consecutive ACUTE GERIATRIC patients (hospitalized) SWEDEN</td>
<td>Prospective follow-up study</td>
<td>Protein-energy malnutrition (SGA-20% &amp; MNA 26%), moderate protein-energy malnutrition (43% SGA, 56% MNA) Mortality higher for malnourished – 40% @ 1 year and 80% after 3 years vs 20% after 1 year (p=0.3-0.17) and 50% after 3 years (p&lt;0.01 in the well-nourished)</td>
</tr>
<tr>
<td>Young, A.M., Kidston, S., Banks, M.D., Mudge, A.M., &amp; Isenrig, E.A. (2013)</td>
<td>Malnutrition screening tools: comparison against two validated nutrition assessment methods in older medical inpatients. Nutrition, 29(1),101-106.</td>
<td>N=134 65+ yo inpatients chosen consecutively Inclusion: &gt;2d hospitalization Australia</td>
<td>Prospective cohort study</td>
<td>Nutritional status via SGA &amp; MNA Energy intake via observation during a single day during first week of hospitalization Fair agreement between SGA &amp; MNA in identifying malnutrition No tool accurately predicted patients with inadequate energy intake in the hospital More identified as at risk or malnourished with MNA (68%) vs SGA (47%) MNA determines those at risk and with existing malnutrition SGA identifies existing malnutrition only Most patients have inadequate intake</td>
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<tr>
<td>energy intake</td>
<td>Important to rescreen and monitor food intake for early identification and prevention of nutritional decline during hospitalization</td>
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<tr>
<td>All tools accurate at identifying existing malnutrition and can be used in the elderly population</td>
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</table>


<p>| Baumeister, S.E., Fischer, B., Doring, A., Koenig, W., Zierer, A., John, J., | The Geriatric Nutritional Risk Index predicts increased | N=1999 subjects at baseline and 1002 with | Cross-sectional and longitudinal | Mortality, demographics/social economic characteristics, | Low baseline GNRI associated with increased total costs, probability of hospitalization, inpatient costs, and | II-3 | GNRI |</p>
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title</th>
<th>Year</th>
<th>Methods</th>
<th>Outcomes</th>
<th>Conclusions</th>
</tr>
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<tbody>
<tr>
<td>Bouillanne, O., Morineau, G., Dupont, C., Coulombel, I.,</td>
<td>Geriatric Nutritional Risk Index: a new index for elderly</td>
<td>2012</td>
<td>N=181 hospitalized elderly</td>
<td>Lorentz formula to calculate ideal weight – based upon NRI but</td>
<td>Severity score correlated with albumin and GNRI. 12.2%, 31.4%, 29.4%, and 27%</td>
</tr>
<tr>
<td><strong>Vincent, J.P., Nicolis, I., Benazeth, S., Cynober, L., Aussel, C. (2005)</strong></td>
<td>evaluating at-risk elderly medical patients, Am J Clin Nutr, 82(4), 777-783</td>
<td>patients N=2474 patients admitted to geriatric rehab care unit over 3 year period</td>
<td>adapted for elderly BMI, prealbumin, albumin, GNRI</td>
<td>of 2474 patients had major, moderate, low, and no malnutrition risk Increased risk of mortality with greater nutritional risk</td>
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</table>

**Problem-specific studies/references**

<table>
<thead>
<tr>
<th><strong>Fang, S., Long, J., Tan, R., Mai, H., Lu, W., Yan, F., &amp; Peng, J. (2013)</strong></th>
<th>A multicenter assessment of malnutrition, nutritional risk, and application of nutritional support among hospitalized patients in Guangzhou hospitals, Asian Pacific Journal of Clinical Nutrition</th>
<th>N=2550, 1487 male, 1063 female Mean age: 56.9 +/- 17.2 years (M), 55.8 +/- 17.8 years (F) Inclusion: 18-80 yo, LOS&gt;1d, no surgery within 24h after admit, alert &amp; oriented, speak/understand Chinese, written</th>
<th>Prospective study NRS2002 Nutritional assessment BMI</th>
<th>Nutritional risk patients at least 70 year old greater than &lt;70 year old (P&lt;0.001) No gender difference among prevalence of nutritional risk 47.6 “at risk” and 19.4% “not at risk” Parenteral nutrition = 88.8% of nutritional support in those getting support Pulmonology had highest prevalence of undernutrition (28.2%) and nutritional risk (55.9%)</th>
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II-2 Nutritional Risk Screening (NRS2002)
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title</th>
<th>Study Details</th>
<th>Methods</th>
<th>Results</th>
<th>Risk Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clugston, A., Paterson, H.M., Yuill, K., Garden, O.J. &amp; Parks, R.W. (2006)</td>
<td>Nutritional risk index predicts a high-risk population in patients with obstructive jaundice, Clinical Nutrition, 25, 949-954</td>
<td>All patients admitted to hepatopancreaticobiliary surgical unit with obstructive jaundice N=60 39 inpatients with obstructive jaundice &amp; 21 control Median age 69yoM:68y oF – no statistical difference United Kingdom</td>
<td>Prospective case-control NRI, BMI, mid-arm muscle circumference Malnutrition = BMI&lt;20 NRI malnutrition mild =97.5-100, moderate 83.5-97.5; severe &lt;83.5 MUST – low, medium, high risk</td>
<td>NRI&lt;83.5 (severe) = increased mortality rate Median hospital state after intervention 10 days in malnourished vs 3 days in non-malnourished for triceps skinfold (p=0.045). Mid arm circumference (p=0.048); NRI &lt;83.5 (p=0.001), MUST high risk (p=0.008)</td>
<td>II-2 NRI MUST</td>
</tr>
<tr>
<td>Burden, S.T., Stoppard, E., Shaffer, J., Makin, A., &amp; Todd, C.</td>
<td>Can we use mid upper arm anthropometry to detect</td>
<td>N=158 consecutive admissions United</td>
<td>Prospective SGA &amp; BMI, mid upper arm anthropometry (MUAA) MUAA can be reliably measured but has poor validity and therefore a poor predictor of clinical outcome</td>
<td></td>
<td>II-2 SGA</td>
</tr>
<tr>
<td>Year</td>
<td>Study Title</td>
<td>Methodology</td>
<td>Study Design</td>
<td>Malnutrition Screening Tool</td>
<td>Country</td>
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<tr>
<td>2005</td>
<td>Malnutrition in medical inpatients? A validation study, J Hum Nutr Diet, 18(4),287-294</td>
<td>Kingdom</td>
<td>Observational study</td>
<td>Malnutrition presence by SGA, LOS, gender, date of birth</td>
<td>Australia</td>
</tr>
<tr>
<td>2011</td>
<td>Nutritional status of long-term patients in the acute care setting</td>
<td>Australia</td>
<td>Observational study</td>
<td>Malnutrition presence by SGA, LOS, gender, date of birth</td>
<td>Australia</td>
</tr>
<tr>
<td>2011</td>
<td>Comparison of five malnutrition screening tools in one hospital inpatient sample, J Clin Nurs, 20(15-16),2144-</td>
<td>The Netherlands</td>
<td>Cross-sectional</td>
<td>Malnutrition</td>
<td>The Netherlands</td>
</tr>
<tr>
<td>Study</td>
<td>Design</td>
<td>Participants</td>
<td>Methods</td>
<td>Findings</td>
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</table>

MUST less applicable b/c high rate missing values
| Kyle, U.G., Pirlich, M., Schuetz, T., Lochs, H., & Pichard, C. (2004) | Is nutritional depletion by Nutritional Risk Index associated with increased length of hospital stay? A population-based study, J Parenter Enteral Nutr, 28(2),99-104 | All adult patients - one in every 10 patients meeting entry criteria were included
N=995 Switzerland, Germany, | Prospective study
Anthropometric, albumin, NRI
Assessed NRI during hospital stay | LOS and moderate/severe nutritional risk per NRI associated
Severe risk in medical patients associated with increased LOS (OR 2.6, CI 1.4-4.8) but not surgical patients
Nutritional risk( NRI) increases during hospitalization and therefore pt evaluated later are at increased risk
NRI
Didn’t classify patients by dx or hospital service
No control for presence of chronic disease effect
SGA is a clinical assessment tool and NRI is an objective screening tool; whereas NRS 2002 and MUST include objective input and disease effect
All can be used to determine nutritional risk or nutritional status inpatient
LOS and nutritional risk assessed by NRS 2002, MUST and NRI and nutritional status via SGA associated with increased LOS
NRS 2002 higher sensitivity and specificity than MUST and NRI versus SGA | II-2 NRI
________
Didn’t classify patients by dx or hospital service
No control for presence of chronic
<table>
<thead>
<tr>
<th>France</th>
<th>measuring nutrition risk in hospitalized patients: menu, a hospital-based prevalence study.</th>
<th>cross-sectional study</th>
<th>demographics, medical history, laboratory values, anthropometric measures</th>
<th>31.5% @ high risk of malnutrition</th>
<th>ii-2</th>
<th>nrs 2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>giryes, s., leibovitz, e., matas, z., fridman, s., gavish, d., shalev, b., ziv-nir, z., berlovitz, y., &amp; boaz, m. (2012)</td>
<td>n=504 newly hospitalized adult patients</td>
<td>nrs 2002 screening tool to identify nutritional risk</td>
<td>malnutrition more prevalent in internal medicine versus surgical (p&lt;0.001)</td>
<td>bmi normal for those deemed at high risk for malnutrition</td>
<td>nrs 2002 found high incidence of hospitalized population @ high risk for malnutrition and therefore should be implemented system-</td>
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</table>

N=405
Inclusion: 18 yo+ w/confirmed diagnosis of heart failure and with 3 year follow up data at location.
Exclusion: uncontrolled dysthyroidism, hepatic failure, suspicion of tumoral activity or limb amputations
MEXICO

Retrospective

Height, weight, BMI, body composition, Functional class (NY heart association), nutritional status (fasting plasma Hgb, handgrip strength), all-cause mortality, survival status after 3 years follow up

Lower BMI does not predict all-cause mortality or mortality associated with chronic heart failure, independently from other parameters assessed.

II-3

Limitations:
Definition BMI underweight adjusted (not validated) to fit population, indicators of inflammatory status not assessed, other malnutrition markers not available so not analyzed, type II error due to insufficient number in Cox equation
Inclusion: admit for acute decompensated heart failure
Exclusion: acute MI, valvular abnormalities, hemodynamic instability, laxative intake or weight loss medications, pregnancy | Retrospective | Serum albumins, lymphocyte count, LOS, BNP, creatinine, NRI, weight, height, BMI
Serial prospective follow-up via telehealth
Readmissions
Cardiac death | Lower NRI scores = moderate/severe risk (malnourished) predictors of extended LOS (p=0.005) and readmission (p<0.001)
Simulated hospital costs increased significantly with moderate/severe nutritional risk
Nutritional risk associated with worse outcome in patients admitted with acute decompensated heart failure
Recommendation to utilize NRI to further risk stratify this population
34% patients at moderate or severe nutritional risk per NRI | II-2 | NRI |

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>17(12),614-621</th>
<th>Study Title</th>
<th>Study Design</th>
<th>Incidence of screening during 24h time period</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geiker, N.R., Horup Larsen, S.M., Stender, S., &amp; Astrup, A. (2012)</td>
<td>Poor performance of mandatory nutritional screening of in-hospital patients, Clinical Nutrition, 31(6),862-867</td>
<td>Retrospective</td>
<td>N=3,278 from different medical specialties Inpatient population Denmark</td>
<td>Only 24% screened at all, and 65% of the 24% screened were done w/in 24h time frame Half of the screenings performed were inaccurate Most common error = underestimation of nutritional status</td>
<td>II-2</td>
</tr>
<tr>
<td>Lim, S.L., Ong, K.C.B., Chan, Y.H., Loke, W.C., Ferguson, M., &amp; Daniels, L. (2012)</td>
<td>Malnutrition and its impact on cost of hospitalization, length of stay, readmission and 3-year mortality, Clinical Nutrition, 31, 345-350</td>
<td>Prospective cohort study w/matched case control study</td>
<td>Single dietician performed SGA Malnutrition prevalence LOS, readmission, 3-year mortality and cost of hospitalization</td>
<td>Malnourished patients (25% moderate, 4% severe) had 1.5x longer LOS 60% increased risk for readmission w/in 15 d for malnourished patients versus well-nourished patients</td>
<td>II-2</td>
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* SGAs did not have data on several study patients referred for treatment of malnutrition or outcome of treatment Access to inpatient dietetic services for assessment and treatment of malnutrition only via medical
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<tbody>
<tr>
<td>Zapatero, A., Barba, R., Gonzalez, N., Losa, J.E., Plaza, S., Canora, J., Marco, J. (2012)</td>
<td>Influence of obesity and malnutrition on acute heart failure. Rev Esp Cardiol (Engl. Ed.), 65(5), 421-426</td>
<td>N=370.983 heart failure admissions</td>
<td>Mortality, readmission, nutritional status identified as malnourished or obese in chart review</td>
<td>Obese patients had lower in-hospital mortality risk (OR: 0.65, 95% CI, 0.62-0.68) and early readmission risk (OR: 0.81, 95% CI, 0.78-0.83) than nonobese patients</td>
<td>Malnourished patients had higher risk of dying while in hospital OR 1.83, 95% CI 1.69-1.97) or of being readmitted within 30 days after discharge (OR 1.39, 95% CI 1.29-1.51) after adjustment for potentially confounding factors</td>
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<tr>
<td>Study</td>
<td>Title</td>
<td>Authors</td>
<td>Year</td>
<td>Design</td>
<td>Setting</td>
<td>Patient Characteristics</td>
<td>Findings</td>
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<tr>
<td>Schneider, S.M., Veyres, P., Pivot, X., Soummer, A., Jambou, P., Filippi, J., van Obberghen, E., &amp; Hebuterne, X. (2004)</td>
<td>Malnutrition is an independent factor associated with nosocomial infections.</td>
<td>British Journal of Nutrition, 92, 105-111</td>
<td>N=1637 France</td>
<td>Prospective study</td>
<td>Nosocomial infection prevalence</td>
<td>Prevalence of nosocomial infection 4.4% in non-malnourished patients and 7.6% in moderately malnourished patients and 14.6% in severely malnourished patients (Chi square, p=0.0009)</td>
<td>NRI considers semi-starvation and systemic inflammatory response Malnutrition present in 68% population – 46% moderate and 22% severe</td>
</tr>
<tr>
<td>Holst, M., Rasmussen, H.H., &amp; Laursen, B.S. (2011)</td>
<td>Can the patient perspective contribute to quality of nutritional care?</td>
<td>Scand J Caring Sci, 25(1),176-184</td>
<td>N=12 hospitalized patients deemed at severe nutritional risk Denmark</td>
<td>Qualitative study</td>
<td>Gain knowledge about hospitalized patient experiences of being undernourished and understand implications for quality of nursing care</td>
<td>Pain, no appetite, bad taste, medication side effects reasons for poor eating Subdivided patient population into ‘passive group’ – attended to systematically and often requiring artificial nutrition ‘active group’ cared for with individual, active involvement from nursing staff Up to nurses to distinguish where</td>
<td>III</td>
</tr>
</tbody>
</table>
Mechanick, J.L. & Chiolero, R. (2008) | Special commentary: a call for intensive metabolic support | Special commentary nutrition and metabolic support within critical care settings | Review | Propose intensive metabolic support to be implemented in ICU, including insulin/glucose management, nutritional risk assessment, early and if needed a combined enteral/parenteral nutrition program with nutritional and metabolic monitoring | III |

U.S. Prevention Services Task Force. Quality of Evidence: I.-Evidence obtained from at least one properly randomized controlled trial, II-1.-Evidence obtained from well-designed controlled trials without randomization, II-2.-Evidence obtained from well-designed cohort or case control analytic studies preferably from more than one center or research group, II-3.-Evidence obtained from multiple time series with or without the intervention. Dramatic results in uncontrolled experiments could also be regarded as this type of evidence, III- Opinions of respected authorities, based on clinical experience; descriptive studies, and case reports; or reports of expert committees (U.S. Preventive Services Task Force, 1996).
Final DNP Project Report

Evaluation of Oral Nutritional Supplement Use in Elderly Patients Admitted with Heart Failure

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University of Kentucky
College of Nursing
Spring 2017

Melanie Hardin-Pierce, DNP, RN, APRN, ACNP-BC – Committee Chair
Terry Lennie, PhD, RN, FAHA, FAAN – Committee Member
Mark Sloan, MD, FACEP – Committee Member/Clinical Mentor
Abstract

**PURPOSE:** The purpose of this study is to evaluate the effects of enhanced ordering privileges among registered dieticians (RD) on oral nutritional supplement (ONS) ordering frequency and prevalence of oral nutritional supplement use among elderly patients admitted with heart failure (HF).

**METHODS:** This study was a single facility, retrospective pre-post implementation evaluation of the impact of expanded ONS ordering privileges among elderly patients (age ≥ 65 years old) hospitalized with heart failure at Frankfort Regional Medical Center (FRMC). The sample consisted of 105 patients for the pre-evaluation period and 259 for the post-evaluation period.

**RESULTS:** There were no differences among groups in age, sex, ethnicity, total comorbidity burden, LOS or BMI. Post group patients received more nutritional assessments (P=.05), but not more ONS. ONS ordering did not differ by provider. Nutritional risk did not predict ONS ordering, but receiving full nutritional assessment did predict ONS ordering.

**CONCLUSION:** Expanded dietary ONS ordering privileges are consistent with the literature, but it was not effective at improving the use of ONS. The nutritional risk screening and process for full nutritional assessment remains open for improvement. An interdisciplinary team including the advance practice nurse to champion the development of a nutritional risk screening process using a validated assessment tool and then subsequent evidence-based interventions is needed. Nutritional assessment must determine nutritional risk to facilitate ONS ordering, not risk determining assessment.
Evaluation of Oral Nutritional Supplement Use in Elderly Patients Admitted with Heart Failure

**Background**

Heart failure encompasses a set of symptoms, risk factors, congenital anomalies, associated comorbidities, and varied outcomes depending on the gravity and etiology of disease (Pecini, Møller, Torp-Pedersen, Hassager, & Køber, 2011). Elderly hospitalized HF patients are often faced with insurmountable opportunity for negative nutritional outcome. There are many reasons why patients do not receive goal calories. A few of these reasons include hypermetabolism (Campillo et al., 1992), poor mealtime ambience, swallowing and taste difficulties, lack of necessary assistance and insufficient nutrient intake documentation (Vanderwee, Clays, Bocquaert, Gobert, Folens, & Defloor, 2010; Moynihan, Macdonald, Teal, Methven, Heaven, & Bamford, 2012). Nutritional risk rescreening in combination with accurate monitoring food intake best identifies and prevents nutritional decline (Young et al., 2013).

The Joint Commission requires malnutrition risk screening, but no single standardized assessment or tool is recommended. The net result of hypermetabolism and poor intake among hospitalized patients offers great opportunity for net negative energy and protein balance called disease-related malnutrition (Anker, Laviano, Fillippatos, Joh, Paccagnella, & Ponikowski, 2009). The need for nutritional assessment among patients diagnosed with heart failure is established (Hauptman et al., 2008; Lee et al., 2011), with approximately 34% deemed to be at moderate or severe nutritional risk (Aziz et al., 2011). Additionally, less than one-third of newly admitted geriatric patients have normal
nutritional status regardless of diagnosis (Persson et al., 2002), with those considered at high malnutrition risk being significantly older (Giryes et al., 2012; Fang et al., 2013). Cumulatively, it is critical to assess and intervene to provide nutritional support for the elderly patients admitted with heart failure because approximately 66% of them are already malnourished or at risk.

Focus upon dietary influence on drug absorption, metabolic functioning and immune status is of importance in the acute care advanced practice nurse role. Physiological and clinical knowledge application, and an awareness of associated treatment modalities must be given priority when considering the scope for potential problems in this population. Evidence-based interventions must be identified and implemented by the interdisciplinary team including attending providers, RD, pharmacy, nurses and ancillary staff to recognize, identify and address nutritional deficits. All stakeholders must buy in for effective outcome (Tappenden et al., 2013).

Many factors contribute to adult hospital malnutrition. As reimbursement continues to be tied to outcome, it is critical that nutritional intervention becomes a standard of care, meaning the patient must be treated as a whole, not just a diagnosis. FRMC acknowledged this need when ordering privileges were given to RD in June 2013. Expanded ordering privileges like steps taken by FRMC are proven to address nutritional need (Tappenden et al., 2013).

**Purpose**

Collectively, evaluating nutritional status and considering early nutritional intervention has the capacity to impact patient outcomes and hospital reimbursement. The purpose of this retrospective study is to determine if ONS was ordered at a higher rate
among older patients admitted with heart failure to Frankfort Regional Medical Center after RDs were given expanded ordering privileges. Additionally, the prevalence of nutritional risk as determined by existing screening methods and frequency of ONS use will be assessed. Full nutritional assessment frequency will also be determined. Prior to expanded ONS ordering ability, the questions to be assessed are:

1. Who orders ONS among inpatients?
2. How many patients are determined to have nutritional risk based upon existing screening questions?
3. How many patients receive full nutritional assessment by registered dieticians?
4. Is there a relationship among those admitted and common laboratory values?

Methods

This study was a single facility, retrospective pre-post implementation evaluation study of electronic health records from patients admitted to Frankfort Regional Medical Center (FRMC) between July 2012 to June 2013 (pre) and July 2014 to June 2015 (post) for ONS use among elderly patients diagnosed with heart failure. Prior to July 2013, ONS ordering privileges were given to attending providers only (MD/DO/advance practice providers). The post-evaluation period encompasses patients admitted after order expansion.

Setting

Frankfort Regional Medical Center (FRMC), located in Frankfort, KY, is a 173-bed regional medical center that provides service to residents of seven surrounding counties. In 2013, the facility began examining methods to supplement patients with
existing or potential for nutritional risk. During the pre-evaluation phase, family, physicians, or other staff members could request nutritional screening completed by a registered dietician. Full nutritional assessment is mandatory for oncology and palliative care patients, NPO greater than five days, admitted greater than seven days, ventilated, or stage two or greater wounds. Extended inquiry into nutritional practices led to expanded RD ordering privileges. In July 2013, a decision was made to allow a RD to order a nutritional supplement. Oral supplements are provided by the hospital as part of their dietary services within dietary order constraints after order is placed. A variety of supplement options exist to meet patient needs. Orders may be placed within the attending provider’s diet order or as a stand-alone order.

**Sample**

During the study period, there were a total of 7,182 heart failure admissions with 2,936 during the pre-evaluation period and 4,246 during the post-evaluation period. All elderly (≥ 65 years of age) patients admitted with heart failure as an ICD-9 diagnosis and meeting inclusion criteria from July 2012 to June 2013 (pre) and July 2014 to June 2015 (post) were retrospectively evaluated. Medical records of 105 patients for the pre-evaluation period and 259 for the post-evaluation period remained after inclusion and exclusion criteria were met. Charts were examined for provider and RD ONS ordering practices as well as secondary diagnoses, BNP and albumin levels. Additionally, nutritional risk based upon screening questions as well as receipt of full nutritional assessment was recorded.

Inclusion criteria are patients of both genders, 65 years or older with an admission or discharge diagnosis of heart failure, ICD-9 code 428. Patients must have been
hospitalized for at least 24 hours to allot time for provider assessment and chart review. Only the first admission meeting criteria was used for those patients readmitted during the study. Exclusion criteria included NPO status, hospitalizations < 24 hours and death during hospitalization. Given the responsibilities of attending providers, enhanced oral supplement ordering privileges place the patient’s needs at the forefront and allow for more holistic care.

Features

**Determination of Nutritional Risk and Inpatient Assessment.** Nutritional risk was defined as the potential of over- or under- nutrition as well as potential swallowing difficulties based upon the screening questions. Specifically, these questions address unexplained weight loss or gain and coughing or choking with eating or drinking. Risk was further stratified into individual or coexisting risk factors from answers above.

There are presently three RDs at FRMC, one full time and two part-time. Each day notifications for patients meeting nutritional risk criteria from screening questions completed in the Emergency Department and inpatient admission documentation screens are sent to RD status boards. Other than previously discussed parameters for mandatory nutritional assessments that prompt dietary, these are the primary prompts for nutritional risk and potential RD intervention. A great amount of manual investigation is required to evaluate the inpatient population for risk when mandatory assessment parameters are not met. Despite responding positively to screening questions, all patients are not required by policy to receive nutritional assessment.

**Ordering ONS.** Any attending provider may order ONS at his or her discretion without the requirement of nutritional assessment. RD privilege for ONS ordering
requires the screening prompts as described above. After assessment, orders are placed if need is determined and the RD chooses to place order. Conversely, recommendations within the nutritional assessment by the RD can be left at the discretion of the attending provider to place the ONS order, leaving room for missed opportunity to intervene if recommendations are overlooked.

**Evaluation Duration.** Charts were evaluated during the same time frame for both evaluation periods to control for seasonal variability, starting and ending in the same months. Pre-evaluation time period was from July 2012 to June 2013. The post-evaluation time period began one calendar year (July 2014 to June 2015) post implementation of expanded ordering privileges.

**Data Collection**

Approvals from the University of Kentucky Institutional Review Board and Frankfort Regional Medical Center were obtained prior to beginning data collection. As a retrospective chart review, patient lists were obtained for patients meeting age ≥ 65 years of age and admission or discharge for ICD-9 code beginning 428 for heart failure. Patient charts were abstracted using medical record numbers provided from the query and placed into an electronic spreadsheet on a password-protected server at FRMC. Records were evaluated first for length of stay (LOS) less than 24 hours as well as readmission during the study period, retaining the first record meeting inclusion criteria. Demographic variables (age, ethnicity, sex, comorbidity, secondary diagnoses), outcome variables (nutritional risk, ONS order, ONS ordering provider, brain natriuretic peptide and albumin; Table 1) were collected on remaining charts. Charts were further excluded
based upon NPO status and death during hospitalization and then de-identified for statistical analysis.

**Data Analysis**

All data was analyzed using SPSS version 22 with an alpha level of .05 for statistical significance. Demographic variables were described by descriptive statistics including frequency distributions, means and standard deviations (SD). Continuous variables were compared utilizing the independent sample t-tests. Chi-squared test for independent samples was used to evaluate categorical variables and logistic regression was utilized to determine independent predictors for outcomes.

**Results**

**Sample Characteristics**

A total of 364 patient charts were reviewed, with 105 patients reviewed prior to extended privileges and 259 patients reviewed post privilege expansion. The mean age for both groups was 79 years old, with the majority of patients being Caucasian. Over half the population was female (56%) with equal distribution between groups (P=.84). Average BMI was 28, with no difference between groups. LOS did not differ (average of 5 days), but trended towards longer LOS in the post-evaluation group (P=.06). Additionally, the post-evaluation group had thirteen observations with presence of non-heart failure chief complaints (shortness of breath, chest pain, edema, arrhythmia); however, upon discharge heart failure was included as a diagnosis. Demographic characteristics are presented in Table 1 and did not statistically differ, illustrating group similarity.
Comorbidities and secondary diagnoses were individually assessed in addition to comorbidity and secondary diagnosis burden to compare acuity between groups. Total Comorbidity Burden did not differ (P=.5; Table 3). The only statistical difference between groups was in the presence of chronic kidney disease (Pre 52.4%, Post 64.2% P=.04). There was no difference between groups for comorbidities that placed patients at risk for nutritional deficits including diabetes mellitus, dementia, hypothyroidism, and mental health issues. However, Total Comorbidity was a positive predictor for nutritional assessment (Table 5) and oral supplement (Table 6). Specifically, each additional comorbidity was associated with a 20% greater likelihood of receiving oral supplement and nutritional assessment. Total Nutritional Comorbidity was also not significant (P=.43). Cumulatively, this illustrates similar acuity among groups with respect to pre-existing burden. Secondary diagnoses were recorded to consider contributors to patient outcomes. Total Secondary Diagnosis burden was greater in the post-evaluation population (Table 3; P=.009) indicative of a greater number of episodic coincident diagnoses during admission.

**Nutritional Risk and Nutritional Assessment**

Full nutritional assessment prevalence (Figure 1) differed between groups (Pre 38.1, Post 49.4 P=.05), but examination across each period within groups exhibited much variation (Figure 2). Average time to nutritional assessment completion was three days and did not differ (P=.7) between groups. Based upon screening questions and as defined above for nutritional risk, there was no statistical difference between those deemed at risk (P=.41). However, when analyzed within risk strata (Table 4), there was a trend in difference between groups (P=.08). The increase in the number of patients assessed did
not correspond to an increased number of patients deemed at risk (Figure 1) and vice versa.

Interestingly, being admitted during the post group was a positive independent predictor (OR 2.47, CI 1.39–4.39, P=.002) for receiving both nutritional assessment (Table 5) and oral supplement (Table 6). Nutritional risk as indicated with present screening questions was a positive independent predictor for nutritional assessment (OR 2.7, CI 1.6 – 4.66, P=.00). However, those not receiving nutritional assessment were 94% less likely to receive oral supplement (CI .02 -.16, P=.00).

**Oral Supplement Use and Ordering Provider**

Oral supplement ordering did not differ between groups (Pre 19% Post 23.2% P=.39). However, oral supplement ordering among quarters was significantly associated (P=.01) with quarter and ordering habits (Figure 3), but it did not correspond with assessment. There was no difference between groups for ordering provider (P=.42) between groups and quarters (P=.70).

**Laboratory Values and BMI**

Although there was no statistical difference between groups for BNP, Albumin levels were greater in the post group (P=.001). Pre-albumin, transferrin, ferritin were present in insufficient quantity for statistical determination. This is likely secondary to the need for sending samples out for determination. The 48 hour and five day values for BNP and albumin were largely unavailable and therefore would lack robustness. Albumin was a negative independent indicator for nutritional assessment (Table 5, P=.001) and ONS order (Table 6, P=.002). Specifically, for every 1 g/dL increase in
serum albumin, patients were 70% less likely to receive oral supplement and 64% less likely to receive full nutritional assessment.

BMI was not an independent predictor for nutritional assessment (Table 5) although BMI < 18.5 is an automatic assessment. BMI was a negative predictor for oral supplement ordering (Table 6, P=.005). Patients were 8% less likely to receive oral supplement for every one kg/m² increase in BMI.

**Discussion**

This study focused on determining the prevalence of ONS use among elderly heart failure patients, evaluating effects of RD ONS ordering privileges and establishing the prevalence of nutritional risk as presently determined and prevalence of nutritional assessment among the hospitalized elderly with heart failure. Overall, both pre and post-evaluation groups were similar in composition (Table 1). Common trends among data include an overall improvement in the volume of patients assessed for nutritional intervention, yet the impact of RD enhanced privileges is not apparent. Perhaps complicating outcomes is the reliance on subjective risk screening and manual risk abstraction to prompt full nutritional assessment instead of standardized, mandatory nutritional assessment protocol.

**Nutritional Risk, Assessment and Intervention**

**Elderly Inpatients.** The average age for this study was 79 years old (Table 1). The highest malnutrition risk is associated with increased age (Giryes et al., 2012; Fang et al., 2013). Poor appetite can be attributed to social isolation, early satiety secondary to bowel edema and venous backpressure, nausea, depression, difficulty with shopping and preparing food, odors, dietary restrictions, difficulty breathing, constipation, diarrhea, and
decrease of smell and taste with age (Shepherd, 2011), all things exacerbated with increased age. Malnutrition risk increases with LOS (Kyle, Pirlich, Schuetz, Lochs, and Pichard, 2005) emphasizing the need for serial nutritional assessments (Bauer et al., 2011). Those receiving assessments had reassessments as required per policy; however “rescreening” as defined by the initial screening questions did not occur again during hospitalization. Potential for missed opportunity given lack of family presence or knowledgeable caregiver as well as admissions from skilled nursing facilities become concerning with respect to response accuracy to subjective questions. Capturing the data is also not a hard stop, meaning subjective screening questions can be skipped and not prompted again. Thus the importance of recognizing, addressing and re-evaluating elderly hospitalized patients with heart failure falls into the hands of those who advocate.

Among our exclusively elderly population hospitalized with heart failure, only 3.3% coded out at discharge as malnourished and 1.1% failure to thrive. An additional 11% were considered to have debility. This is much less than the 42% of the population described by Bauer et al. (2011). Based upon screening questions, 34.9% had nutritional risk, which is similar to the 37.1% risk found by Marques de Oliveira and Leandro-Merhi (2010); however, study data is subject to accuracy as discussed above. The gap lies in the identification, discharge coding and nutritional care planning implemented upon admission and continued past discharge.

**BMI.** BMI use in clinical practice as a driver for determination of nutritional risk is limited due to the risk of masking weight changes. Rapid weight changes not captured or assessed could lead to poor recognition of nutritional deficits while inpatient. In lieu, weight change over a period of time in the setting of clinical judgment is a more reliable
indicator of undernutrition (Cook, Kirk, Lawrenson, & Sanford, 2005). Average BMI for this study was 28.3±7.5 kg/m² (overweight) with a range of 14.5 to 64.6. Changes in volume status coupled with disease-related malnutrition exacerbate the need for specific, focused nutritional assessment and intervention among heart failure patients. Although BMI was a negative independent predictor for ONS, it was not a predictor for assessment, and assessment must occur prior to RD ONS intervention.

**Labs.** Patients with moderate to severe nutritional risk have higher BNP levels, providing a useful correlation between a commonly examined laboratory finding and nutritional status (Aziz et al., 2011). However, in this study, there is no difference in admission BNP (P=.85) between groups in further support for uniformity between groups and deductively equal nutritional risk. However, without mandatory assessment, exact comparisons cannot be made. Broad variety exists within groups, however, with large standard deviations for BNP. Serum albumin (Table 1) was greater in the post group (P=.001) and was also a negative independent predictor for assessment and ONS ordering. However, serum albumin does not trigger assessment at this time.

**Malnutrition and Nutritional Risk.** In order for weight to remain stable, energy intake must match energy output. When alterations in resting energy expenditure and physical activity occur, imbalance ensues (Kasper et al, 2015). Physiological changes in the elderly coupled with disease-related malnutrition in the inpatient setting equate to opportunity for a negative synergistic effect. Knowing that poor appetite and poor intake are attributed to hospitalization (Rasheed & Woods, 2013) and objectivity of oral intake as well as inconsistent documentation practices are an issue, there is much room for “missed” opportunity to report concern for patient caloric intake.
The baseline risk of malnutrition and malnourishment (Marques de Oliveira and Leandro-Merhi, 2010) and the presence of the risks mentioned above associated with hospitalization, leads to the deduction that elderly patients must be assessed. Among elderly patients, the Subjective Global Assessment (SGA) and Mini-Nutritional Assessment (MNA) are equally sound in identifying those at risk of and suffering with malnutrition (Young, Kidston, Banks, Mudge, & Isenring et al., 2013). Only 33.8% of admitted elderly patients had proper nutrition (Marques de Oliveira & Leandro-Merhi, 2010). Considering our baseline risk of 34.9% as determined loosely from admission screening questions and not considering other comorbidities and concurrent diagnoses, the need for full nutritional assessment and intervention is apparent. In the literature, when the MNA indicated nutritional risk, the average BMI was 25.9 ± 5 kg/m², much lower than our overall BMI average (Stratton et al., 2013); however, recall BMI is not good indicator in our population given the risk for fluid shifts.

In this study, complete nutritional assessment was 46.2% of patients, similar to rates assessed among elderly inpatients (Sharma, Miller, Shahi, Hakendorf, Horwood, & Thompson, 2016). There was a statistically significant increase in assessment in the post-evaluation group (Pre 38.1, post 49.4 P=.05). Days until full nutritional assessment was three days and days until ONS order was placed, three and a half. There was no difference between groups (Table 4). This is concerning given the half day delay to ONS order. Patients deemed to have nutritional risk were more likely to have nutritional assessments completed (OR 2.73, CI 1.6 – 4.66, P=.00), but not more likely to have oral supplement ordered. It would be expected that risk and assessment would be
independently associated with oral supplement ordering when all processes work together.

**Length of Stay.** Malnutrition care plans and nutritional intervention implemented upon admission lead to decreased LOS (Marques de Oliveira & Leandro-Merhi, 2010). Average LOS for this study was five days, and average days until nutritional assessment approximately three days (Table 1). The caveat to this retrospective study is that less than half of the admitted population was assessed. When nutritional assessment was mandatory upon admission (Tappenden et al. 2013), the average LOS and days to nutritional assessment was five days creating concern for missing assessment of many patients. In our study, although the average number days to nutritional assessment was three days, less than half of the admitted population received nutritional consult. Malnourished patients have longer hospital stays, increased mortality and are more likely to be readmitted within 15 to 30 days (Kyle et al. 2005, 2006; Lim et al., 2012; Zapatero et al., 2012). Unfortunately, without assessing all patients for nutritional risk or status, associations cannot be made from this study.

**Oral Supplement.** Early nutritional intervention has been examined and deemed important for hospitalized patients (A.S.P.E.N., 2009). Decreased food intake among hospitalized patients has been found to be an independent risk factor for hospital mortality (Hiesmayr et al., 2009). Enteral nutritional supplementation with ONS is one avenue to improve caloric intake and is recommended when needs are not met over 24 to 48 hours in the critically ill patient who cannot maintain proper energy intake (A.S.P.E.N., 2016). The elderly population is already at increased risk due to physiological changes without considering comorbidities and acute illness.
ONS provides high density, high impact nutrition for those in need with established gains in weight, muscle mass and strength (Baldwin & Weeks, 2011). Effects span from decreased LOS and readmission rates to reduced episodic hospitalization costs (Phillipson et al., 2013). Furthermore, at a low per incidence cost, ONS is of fiscal importance to the facility and more importantly, patient outcomes. Although there was a statistically significant increase in the prevalence of ONS ordering between groups, the overall supplementation rate was 22%. The shift in providers ordering, although not statistically associated with group, is visible upon examination of raw data. Although it was anticipated that the RD rate of ordering would increase post privilege expansion, RD ordering decreased from 75% of the orders to 52.1% and MD/DO ordering increased from 25% to 33.3%. Gross examination of charts revealed numerous orders placed by nephrology providers perhaps inflating the ordering provider statistics without the dietician’s assessment. ONS intervention in a standardized nutritional approach is associated with decreased 90-day mortality rate and improved odds of better nutritional status (Deutz et al., 2016) supporting not only ONS intervention, but also continued nutritional care planning upon discharge. Clearly we have a gap in identifying risk, intervention with nutritional assessment and providing ONS. It is concerning that there is no independent association between risk and oral supplement ordering (Table 5). The positive effects of supplementation warrant consideration in this at risk population.

Limitations

The design of this study limits generalizability of data given the collection from one community facility. Due to the retrospective nature of this study, the ability to verify weights and reported data is not possible. Manual entry of weights into the electronic
health record introduces potential for erroneous data. Additionally, two direct admissions lacked admission weighs required to calculate BMI. Nutritional screening questions are asked in the Emergency Department detailed assessment as well as the inpatient intake screens. If inpatient documentation was not present, the Emergency Department documentation was utilized. In the presence of both areas having documentation, results were compared and then recorded for data completion. Any positive was included as a risk since dietary receives all prompts.

Another potential limitation was provider change and exponential hospital growth. In July 2012, the Emergency Department expanded their bed capacity from 14 to 28 beds. In May 2013, the Emergency Department received Trauma III designation, accepting trauma transfers and increasing services offered to the surrounding counties. On July 2013, inpatient and emergency department provider teams changed, resulting in the employment of many temporary providers and new full-time staff, and in August of 2013, the percutaneous coronary intervention program began. Cumulatively, this led to an influx of new admissions and greater inpatient census with increased acuity.

There was no direct method to assess malnutrition prevalence in this study given the lack of standardized mandatory nutritional assessment. Malnutrition and other associated nutritional deficits diagnosis codes were driven by the provider during preparation of the inpatient plan of care and discharge summary. Although risk assessment and policies exist, a standardized nutritional assessment upon admission does not occur.
Recommendations for Future Studies

Malnutrition discovered upon admission is known to have detrimental effects on LOS (Allard et al., 2016) without considering the progressive wasting that can occur during hospitalization. Given the prevalence of malnutrition and nutritional risk among inpatients with heart failure and putative increased risk of exaggeration when factoring in elderly age, an understanding of the most effective evidence-based interventions to improve patient outcomes is needed. Standardized employment of a tool such as the SGA or MNA as well as others discussed previously should be initiated by RDs or other specialty trained personnel. There must also be a sufficient number of those qualified to assess patients. Aware that costs and LOS increases as the degree of malnourishment increases (Curtis et al., 2016), other protocols could be developed for high-risk patients with potential for improved patient outcome. Fiscal costs are both tangible (money) and intangible (associated morbidity and mortality).

ONS should be considered as an adjunct in the management of admitted elderly patients with heart failure. Nutritional risk should be determined with valid assessment tools and outcomes tracked. Additionally, improving documentation of ONS ingestion specifically would be beneficial when assessing patient compliance with recommendations as well as determining total nutritional intake. Consideration should be given to ameliorate ONS delivery with simultaneous medication administration and a variety of flavor options (van den Berg, Lindeboom, & van der Zwet, 2015) given reported increased consumption with increased choice. Future studies should include home-based nutritional care planning. As discussed previously, the impact of ONS
extends beyond hospitalization time. Therefore, longitudinal follow-up among this high-risk patient population to grasp full fiscal and physiological effects would be of interest.
Conclusion to Final DNP Project Report

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University of Kentucky
Conclusion

Despite advances in medical and surgical management of heart failure patients, mortality remains high and nutritional risk problematic long term (Tevik, Thürmer, Husby, de Soysa, & Helvik, 2016). Early nutritional intervention has been established as being important (A.S.P.E.N., 2009) and a well-coordinated approach to establishing nutritional risk is recommended (Tappenden et al., 2013). Expanded ordering privileges for dietary staff has not increased the use of ONS among the elderly patient hospitalized with heart failure. These privileges are an integral component of a much-needed evidence-based nutritional overhaul for admitted patients, but alone it is not enough. Evaluating current practice towards a goal of using the LEAN process could be useful with multiple disciplines at the table to find the best solution. The brunt of inpatient assessment cannot fall on the RD shoulders. We must advocate for our patients as a whole, not as just a system.

The development of an interdisciplinary team to oversee standards of care as well as the establishment of nutrition champions would help facilitate buy-in and ensure compliance. Collectively, components of IPE would prove useful in the exploration of existing deficits in nutritional assessment of the elderly inpatient with heart failure, but could broadly be adapted to other at risk or preferably the entire population. Electronic health records should be designed to capture valuable screening data and malnutrition criteria to promote triggers internally for further investigation (Tappenden et al., 2013). Weight fluctuations, decreased oral intake and specific documentation areas for ONS should be easily accessed and available to an RD via automated prompts or nutritional dashboards generated from electronic health record input. Potential comorbidities or
diagnoses that could contribute to poor intake (Lee et al., 2011; Hauptman et al., 2008) should be available to the RD to support team efforts and streamline identification of patient needs. Collectively, the intervention can be patient focused and not labor intensive facilitating the needs of everyone involved in patient care. Even when assessment has been mandatory, gaps exist (Geiker et al., 2012) as evidenced by a 50% assessment inaccuracy rate. This magnifies the importance of an interdisciplinary effort to ensure success of such a program with impact not only for the patient but the facility as well. Collaboration and cooperation among those at the bedside, leadership and management, dietary, RDs, technology and operations must be brought together to evaluate practice and potential outcomes with the implementation of an evidence-based process.

Although more patients received full nutritional assessment in the post evaluation group, the volume remains insufficient to characterize the risk within Frankfort Regional Medical Center. High rates of malnutrition have been reported among elderly hospitalized patients screened with the Mini Nutritional Assessment tool (Holyday, Danielle, Bare, Caplan, Petocz, & Bolin, 2012), Malnutrition Universal Screening Tool (MUST; Rasheed & Woods, 2013), Nutritional Risk Screening 2002 tool (Fang, Long, Tan, Mai, Lu, Yan, & Peng, 2013), and Nutritional Risk Index (NRI; Aziz et al., 2011) and the Academy of Nutrition and Dietetics recommends assessment with one of the these standardized validated tools for all patients hospitalized to begin an individualized nutritional care plan. Repeat assessment should be done at a minimum weekly (Tappenden et al., 2013). Not only is overlooking nutritional risk a healthcare quality issue, a five-times greater inpatient cost is associated with nutritional risk (Aziz et al.,
Proactive nutritional assessment and intervention has the potential to not only improve patient care, but also to reduce costs associated with care despite additional costs incurred with ONS. In this study, ONS order was predictive of receiving nutritional assessment; however, nutritional risk was predictive of nutritional assessment but not ONS order. Present screening questions determine risk, not actual assessment. Thus, evidence-based ONS intervention must result from risk as determined by full nutritional assessment.
Final DNP Project Report Bibliography

Evaluation of Oral Nutritional Supplement Use in Elderly Patients

Admitted with Heart Failure

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A.S.P.E.N. Board of Directors and The Clinical Guidelines Task Force. (2002). Guidelines for the use of parenteral and enteral nutrition in adult and pediatric patients [erratum in *Journal of Parenteral and Enteral Nutrition, 26*(2), 144], 26(1 suppl), 1SA-138SA.


Aziz, E., Javed, F., Pratap, B., Musat, D., Nader, A., Pulimi, S…Kukin, M.L. (2011). Malnutrition as assessed by nutritional risk index is associated with worse outcome in
patients admitted with acute decompensated heart failure on ACAP-HF data analysis. 
*Heart International, 6*(2), 3-8.

Baldasseroni, S., Urso, R., Maggioni, A.P., Orso, F., Fabbri, G., Marchionni, N., & Tavazzi, L. (2012). Prognostic significance of serum uric acid in outpatients with chronic heart failure is complex and related to body mass index: Data from the IN-CHF Registry. *Nutrition, Metabolism, and Cardiovascular Diseases, 22*(5), 442-448. Doi: 10.1016/j.numeccd.2010.08.007


natriuretic peptide in acutely decompensated heart failure (GALLANT) trial. European Journal of Heart Failure, 13(8), 846-851. doi: 10.1093/eurjhf/hfr087


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<tr>
<th>Characteristic</th>
<th>All Patients (n=364)</th>
<th>Pre- (n=105)</th>
<th>Post- (n=259)</th>
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<td>Length of Stay, days</td>
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<td>BNP on Admission, pg/mL</td>
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Data are presented as mean ± SD or frequency (percent).

* Albumin Pre (n=101) Post (n=269); BNP Pre (104), Post (228)
Table 2

Secondary Diagnoses and Comorbidity

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<th>Post- (n=259)</th>
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<td>MI during admission</td>
<td>22 (6)</td>
<td>1 (1)</td>
<td>21 (8.1)</td>
</tr>
<tr>
<td>Sepsis</td>
<td>14 (3.8)</td>
<td>0 (0)</td>
<td>14 (5.4)</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>67 (18.4)</td>
<td>14 (13.3)</td>
<td>53 (20.5)</td>
</tr>
<tr>
<td>Malnutrition</td>
<td>12 (3.3)</td>
<td>4 (3.8)</td>
<td>8 (3.1)</td>
</tr>
<tr>
<td>Fall</td>
<td>16 (4.4)</td>
<td>3 (2.9)</td>
<td>13 (5)</td>
</tr>
<tr>
<td>Cancer</td>
<td>17 (4.7)</td>
<td>4 (3.8)</td>
<td>13 (5)</td>
</tr>
<tr>
<td>Obesity</td>
<td>41 (11.3)</td>
<td>15 (14.3)</td>
<td>26 (10)</td>
</tr>
<tr>
<td>Failure to Thrive</td>
<td>4 (1.1)</td>
<td>1 (1)</td>
<td>3 (1.2)</td>
</tr>
<tr>
<td>Fracture</td>
<td>10 (2.7)</td>
<td>0 (0)</td>
<td>10 (3.9)</td>
</tr>
<tr>
<td>Anorexia</td>
<td>5 (1.4)</td>
<td>1 (1.0)</td>
<td>4 (1.5)</td>
</tr>
<tr>
<td>Debility</td>
<td>11 (3)</td>
<td>3 (2.9)</td>
<td>8 (3.1)</td>
</tr>
<tr>
<td>Altered Mental Status</td>
<td>19 (5.2)</td>
<td>1 (1)</td>
<td>18 (7)</td>
</tr>
<tr>
<td>Other Respiratory Diagnoses</td>
<td>62 (17.1)</td>
<td>13 (12.4)</td>
<td>49 (19)</td>
</tr>
<tr>
<td>Ulcer</td>
<td>31 (8.5)</td>
<td>12 (11.4)</td>
<td>19 (7.3)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Comorbidities</th>
<th>All Patients (n=364)</th>
<th>Pre- (n=105)</th>
<th>Post- (n=259)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronary Artery Disease</td>
<td>201 (55.2)</td>
<td>62 (59)</td>
<td>139 (53.7)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>280 (76.9)</td>
<td>83 (79)</td>
<td>197 (76.1)</td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>218 (60.1)</td>
<td>58 (55.2)</td>
<td>160 (62)</td>
</tr>
<tr>
<td>Dementia</td>
<td>315 (86.5)</td>
<td>93 (88.6)</td>
<td>222 (85.7)</td>
</tr>
<tr>
<td>Hypothyroid</td>
<td>285 (78.3)</td>
<td>80 (76.2)</td>
<td>205 (79.2)</td>
</tr>
<tr>
<td>Mental Health</td>
<td>316 (87.1)</td>
<td>95 (91.3)</td>
<td>221 (85.3)</td>
</tr>
<tr>
<td>Chronic Kidney Disease</td>
<td>221 (60.7)</td>
<td>55 (52.4)</td>
<td>166 (64.1)</td>
</tr>
</tbody>
</table>

Data are presented as mean ± SD or frequency (percent)
Table 3

*Total Comorbidity and Secondary Diagnosis Burden*

<table>
<thead>
<tr>
<th></th>
<th>Pre (n = 105)</th>
<th>Post (n=258)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Comorbidity</td>
<td>5.5 ± 2</td>
<td>5.5 ± 2.1</td>
<td>.07</td>
</tr>
<tr>
<td>Total Secondary Diagnosis Burden</td>
<td>1.3 ± 1.1</td>
<td>1.9 ± 1.5</td>
<td>.009</td>
</tr>
</tbody>
</table>

Data are presented as mean ± SD or frequency (percent)
Table 4

**Nutritional Data**

<table>
<thead>
<tr>
<th></th>
<th>All (n=364)</th>
<th>Pre (n = 105)</th>
<th>Post (n = 259)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nutritional Assessment</strong></td>
<td>168 (46.2)</td>
<td>40 (38.1)</td>
<td>128 (49.4)</td>
<td>.05</td>
</tr>
<tr>
<td><strong>Days to Nutritional Assessment</strong></td>
<td>3.1 ± 2.4</td>
<td>3 ± 2.5</td>
<td>3.1 ± 2.4</td>
<td>.70</td>
</tr>
<tr>
<td>ONS, n (%)</td>
<td>80 (22)</td>
<td>20 (19)</td>
<td>60 (23.2)</td>
<td>.39</td>
</tr>
<tr>
<td>Order</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>80 (22)</td>
<td>20 (19)</td>
<td>60 (23.2)</td>
<td></td>
</tr>
<tr>
<td>Not Ordered</td>
<td>85 (81)</td>
<td>60 (23.2)</td>
<td>199 (76.8)</td>
<td></td>
</tr>
<tr>
<td><strong>Ordering Provider</strong></td>
<td>80 (22)</td>
<td>20 (19)</td>
<td>60 (23.2)</td>
<td>.42</td>
</tr>
<tr>
<td>Total Orders</td>
<td>0 (0)</td>
<td>3 (4.2)</td>
<td>3 (4.2)</td>
<td></td>
</tr>
<tr>
<td>APRN</td>
<td>15 (75)</td>
<td>37 (52.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RD</td>
<td>5 (25)</td>
<td>20 (33.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MD/DO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Days to ONS order</strong></td>
<td>3.5 ± 3.2</td>
<td>2.9 ± 2.8</td>
<td>3.7 ± 3.3</td>
<td>.42</td>
</tr>
<tr>
<td><strong>Nutritional Risk on admission, n (%)</strong></td>
<td>127 (34.9)</td>
<td>65 (61.9)</td>
<td>172 (66.4)</td>
<td>.41</td>
</tr>
<tr>
<td>No Risk</td>
<td></td>
<td>65 (61.9)</td>
<td>172 (66.4)</td>
<td></td>
</tr>
<tr>
<td>At Risk for Over/Undernutrition</td>
<td>40 (38.1)</td>
<td>87 (33.6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Nutritional Risk Strata Data, n (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td>.08</td>
</tr>
<tr>
<td>No Risk</td>
<td>70 (66.7)</td>
<td>174 (67.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unexplained Weight Loss</td>
<td>6 (5.7)</td>
<td>29 (11.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unexplained Weight Gain</td>
<td>13 (12.4)</td>
<td>23 (8.9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cough/Choke with eat/drink</td>
<td>6 (5.7)</td>
<td>18 (6.9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight gain + cough/choke with eat/drink</td>
<td>5 (4.8)</td>
<td>5 (1.9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight loss + cough/choke with eat/drink</td>
<td>0 (0)</td>
<td>6 (2.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>5 (4.8)</td>
<td>4 (1.5)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data are presented as mean ± SD or frequency (percent)
Table 5

*Independent Predictors of Nutritional Assessment*

<table>
<thead>
<tr>
<th></th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.1</td>
<td>.99-1.05</td>
<td>.27</td>
</tr>
<tr>
<td>Female</td>
<td>1.32</td>
<td>.77-2.23</td>
<td>.31</td>
</tr>
<tr>
<td>Admission Albumin, g/dL</td>
<td>.36</td>
<td>.2-.64</td>
<td>.001</td>
</tr>
<tr>
<td>Admission BNP, pg/dL</td>
<td>1</td>
<td>1-1</td>
<td>.29</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>.98</td>
<td>.942-1.02</td>
<td>.281</td>
</tr>
<tr>
<td>Total Comorbidity</td>
<td>1.21</td>
<td>1.06-1.38</td>
<td>.004</td>
</tr>
<tr>
<td>Nutritional Risk Presence</td>
<td>2.73</td>
<td>1.6-4.66</td>
<td>.00</td>
</tr>
<tr>
<td>Post group</td>
<td>2.47</td>
<td>1.39-4.39</td>
<td>.002</td>
</tr>
</tbody>
</table>
### Table 6

*Independent Predictors of Oral Supplement Ordering*

<table>
<thead>
<tr>
<th></th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.02</td>
<td>.98-.108</td>
<td>.34</td>
</tr>
<tr>
<td>Female</td>
<td>1.05</td>
<td>.49-2.23</td>
<td>.91</td>
</tr>
<tr>
<td>Admission Albumin, g/dL</td>
<td>.3</td>
<td>.14-.65</td>
<td>.002</td>
</tr>
<tr>
<td>Admission BNP, pg/dL</td>
<td>1</td>
<td>1-1</td>
<td>.89</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>.92</td>
<td>.86-.97</td>
<td>.005</td>
</tr>
<tr>
<td>Total Comorbidity</td>
<td>1.21</td>
<td>1.02-1.43</td>
<td>.03</td>
</tr>
<tr>
<td>Nutritional Risk Presence</td>
<td>.53</td>
<td>.25-1.14</td>
<td>.11</td>
</tr>
<tr>
<td>No Nutritional Risk</td>
<td>.06</td>
<td>.02-.16</td>
<td>.00</td>
</tr>
<tr>
<td>Post group</td>
<td>2.47</td>
<td>1.39-4.39</td>
<td>.002</td>
</tr>
</tbody>
</table>
Figure 1. Comparison of nutritional risk and full nutritional assessment before and after implementation of expanded RD ONS ordering privileges. *P<.05
Figure 2. Comparison of nutritional assessment completion across quarters
Figure 3. Comparison of ONS order and nutritional assessment by quarter