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Comparing Early Enteral Nutrition among Medical, Burn, Surgical/Trauma, and Neurocritical Intensive Care Units and its Effect on Length of Stay

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ACCEPTANCE

This thesis, COMPARING EARLY ENTERAL NUTRITION AMONG MEDICAL, BURN, SURGICAL/TRAUMA, AND NEUROCRITICAL INTENSIVE CARE UNITS AND ITS EFFECT ON LENGTH OF STAY, by Kelsey Spinks was prepared under the direction of the Master's Thesis Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree Master of Science in the Byrdine F. Lewis School of Nursing and Health Professions, Georgia State University. The Master's Thesis Advisory Committee, as representatives of the faculty, certify that this thesis has met all standards of excellence and scholarship as determined by the faculty.

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ABSTRACT

COMPARING EARLY ENTERAL NUTRITION AMONG MEDICAL, BURN, SURGICAL/TRAUMA, AND NEUROCRITICAL INTENSIVE CARE UNITS AND ITS EFFECT ON LENGTH OF STAY
By
Kelsey Spinks

Background: Current research supports that early enteral nutrition (EEN), or enteral nutrition delivered within 48 hours of admission, may reduce infection, incidence of pneumonia, mortality, and time that critical care patients spend on the ventilator. EEN may also decrease intensive care unit (ICU) length of stay. With one day in the ICU costing an estimated $14,462, length of stay becomes a financial concern for hospitals that care for uninsured or underinsured patients. Most studies that examine the effect of EEN on length of stay lump all critical care patients into one group or will only examine one ICU population at a time.

Objective: To examine the effect of EEN on length of stay for critical care patients in four adult intensive care units to include: burn, neurocritical, medical, and surgical/trauma ICUs in a large urban teaching hospital.

Methods: A retrospective chart review was conducted for patients admitted between September 2012 and February 2014 in each of the four adult ICUs. Statistical analyses for nonparametric data were conducted using SPSS 21.

Sample Description: The median age of the 89 patients was 55 years. The median BMI was 28. There were 61 males and 28 females. In the surgical/trauma ICU, the median age was 48 years, BMI was 25, and there were 15 males and 8 females. In the medical ICU, the median age was 57 years, BMI was 32, and there were 17 males and 6 females. In the burn ICU, the median age was 40 years, BMI was 28, and there were 14 males and 5 females. In the neurocritical ICU, the median age was 62 years, BMI was 27, and there were 15 males and 9 females.

Results: There was a significant but weak positive correlation between the time to initiation of enteral nutrition (EN) and ICU length of stay in the surgical ICU (p=0.04), medical ICU (p=0.03) and neurocritical ICU (p=0.04). A significant difference (p=0.03) was found in ICU length of stay between the medical ICU patients who were fed early (within 48 hours of admission) versus those who were fed late (after 48 hours of admission). Patients fed late had a longer ICU length of stay than those who were fed early. There was a significantly earlier time in the initiation of EN (p<0.001) between the units who have an RD rounding daily (burn and neurocritical) and the units that did not (surgical and medical).

Conclusions: EEN is significantly associated with shorter ICU lengths of stay in surgical, medical, and neurocritical populations. Even if EEN does not decrease length of stay in a particular population, it could still be beneficial for other patient outcomes, like reduced mortality, lower incidence of pneumonia, and shorter time spent on the ventilator. The ICU dietitian plays an important role in advocating for EEN in those patients who are medically ready for it. In terms of best practice, critical care RDs have a valuable opportunity to establish their niche as the nutrition expert on the interdisciplinary care team by incorporating medical rounds in to their daily practice.

COMPARING EARLY ENTERAL NUTRITION AMONG MEDICAL, BURN, SURGICAL/TRAUMA, AND NEUROCRITICAL INTENSIVE CARE UNITS AND ITS EFFECT ON LENGTH OF STAY

By
Kelsey Spinks

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ABBREVIATIONS

ASPEN	American Society for Parenteral and Enteral Nutrition
EN	Enteral Nutrition
EEN	Early Enteral Nutrition
ICU	Intensive Care Unit
GMH	Grady Memorial Hospital
SCCM	Society of Critical Care Medicine
RD	Registered Dietitian
GI	Gastrointestinal
BMI	Body Mass Index

CHAPTER I: INTRODUCTION

The recommendations[1] from the American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.) define enteral nutrition (EN) as “nutrition provided through the gastrointestinal tract via a tube, catheter or stoma that delivers nutrients distal to the oral cavity.” EN, also known as tube feeding, is not a new concept. Over 3,500 years ago, the ancient Egyptians and Greeks used nutrient infusions in the rectum as a way to treat bowel disorders[2]. Over time, experimentation and research have paved the way for modern tube feedings, an efficient delivery of macronutrients, vitamins, minerals, and water that are needed to sustain life in patients with a compromised ability to eat. Some of the reasons why a person cannot eat include: sedation, tracheal intubation, impaired consciousness, anorexia, and nausea[3]. Early enteral nutrition (EEN) is generally defined as EN delivered within 24-48 hours of admission. Indications for EEN include: major head trauma, second or third degree burns, major torso and/or abdominal trauma, major surgery that prolongs oral intake greater than five days, chronically malnourished patients who are anticipated to be without oral intake for more than 5 days, and significant comorbid diseases, such as diabetes and end stage renal disease[4]. This list shows the wide range of critically ill patients who are candidates for EEN. Research supports that EEN decreases intensive care unit (ICU) length of stay[5]. However, most studies put all critical care patients into one group or will only examine one ICU population at a time[6]. When only one population of critical care patients is examined, it potentially reduces the amount of external validity EN recommendations have because it decreases how generalizable the findings of the studies could be to other ICU populations; however studies that do not separate the ICU groups potentially forfeit some internal validity because there is an introduction of another variable (the nature of the patients' injuries). To our knowledge, no study has stratified the populations based on the patient's nature of injury, with the intent to examine if EEN is more effective among certain critical care populations. To make up for this gap in the literature, this study examined the effect of EEN on length of stay for critical care patients in each of Grady Memorial Hospital's (GMH) adult intensive care units: burn, neurocritical, medical, and surgical/trauma. We evaluated whether a patient in the neurocritical ICU responded differently to EEN than a patient in the burn ICU because they did not present with the same injury. Additionally, current Society for Critical Care Medicine (SCCM)/A.S.P.E.N. guidelines for EN are "intended for the adult medical and surgical critically ill patient populations," meaning that there are guidelines that are lacking in some areas of critical care EN (i.e. burn and neurocritical). This study will add to the growing body of literature that is needed to support such recommendations[7]. The research question is: does early enteral nutrition decrease length of stay in patients in each adult ICU when compared to those who do not receive EEN? Additionally, when early enteral nutrition is provided, does a decrease in length of stay depend on the type of critical care patient? We hypothesized that there would be a significant difference in length of stay for patients in each of the four ICU units who receive EEN, with the most significant decrease being in the burn ICU. This information will add to the growing body of literature that EEN decreases hospital length of stay, improves patient outcomes, and decreases hospital costs. A second aim of this study is to examine the impact of having a registered dietitian (RD) round daily with the multidisciplinary critical care team. Current research on critical care work environment advocates for interprofessional collaboration and communication to help meet clinical practice guidelines[8]. To our knowledge, no studies have investigated whether having a registered dietitian round daily as part of a multidisciplinary care team impacts the time of initiation of tube feeding in the adult ICU population. The proposed study aims to close this gap. It is hypothesized that having an RD as part of a multidisciplinary care team will lead to a decrease in hospital length of stay because of RD intervention and earlier implementation of EEN guidelines. This data will contribute to a growing body of literature that supports greater compliance with implementation of RD guidelines when an RD is an integral part of the multidisciplinary care team[9].

CHAPTER II: REVIEW OF LITERATURE

Justification for Early Enteral Nutrition

The goal of nutrition therapy for critical care patients has many components: to prevent the loss of lean muscle mass, to buffer the inflammatory response to injury, and to maintain normal functioning of the gastrointestinal (GI) tract[4]. The GI tract is the largest immune organ in the body, with lymphocytes making up about 20% of intestinal mucosa[3,10]. EN is not just a means to support a patient's energy, micronutrient, and water needs; it is also an important intervention in maintaining the integrity and function of the intestinal lining. EN stimulates blood flow to the GI tract, reduces stress ulcerations, promotes gallbladder emptying and stimulates intestinal contractibility, keeping gut bacteria from overgrowing or translocating[3,6,10,11,12]. McClave and Heyland (2009) note that EN in ICU patients serves to suppress systemic immune response, decrease oxidative stress, and promote favorable patient outcomes, such as reduced incidence of bacterial infections, decrease in hospital length of stay, and reduced mortality[10]. EEN was associated with a significant 24% reduction in infectious disease complications ($p=0.04$). There was a 32% reduction in mortality, but it was not statistically significant. Failure to provide EN actually increases oxidative stress and worsens the systemic inflammatory response. The authors reviewed several studies that reported patients who had a cumulative calorie deficit had longer ICU length of stay and more time spent on the ventilator. Jensen et al. (2010) justify the rationale for EN by recognizing the roles of malnutrition, inflammation, and appropriate feeding in critical care patient outcomes[13]. The researchers describe how the acute inflammatory response creates a catabolic environment, which increases resting energy expenditure and promotes loss of lean muscle mass. Energy and protein requirements are higher in critical care patients because of this catabolic effect. The inflammation associated with acute injury can limit nutrition interventions. However, when comparing injury related malnutrition between patients who receive EN and those who do not, those who are treated with EN have a much less significant and much more gradual lean body mass loss than those who do not receive EN[13].

Because of EN's effects on the physiological response to critical injury or illness, the benefits of enteral nutrition are far-reaching. Heyland, et al. (2011), concluded that increased energy and protein intake via tube feeding was associated with a reduction in infection after 96 hours for patients in a mixed medical and surgical ICU sample[12]. Similarly, EEN has been shown to significantly reduce the incidence of pneumonia in ICU patients[14]. Mortality is significantly decreased in critical care patients who receive EEN[14]. In fact, patients not meeting energy requirements are associated with higher odds of mortality[15,16]. Early enteral nutrition, or EEN administered within 24-48 hours of admission, also significantly decreased the time patients spent on a ventilator[17].

Besides the favorable outcomes for patients, the cost of caring for critical care patients can also be reduced with EEN. Some studies have shown that EEN is associated with decreased intensive care unit length of stay[5,17]. Decrease in length of stay can have a huge financial impact for hospitals. It has been estimated that approximately $14,462 in hospital costs are reduced per critical care patient receiving EEN in the United States[18]. For taxpayer funded GMH, this type of decrease in costs can mean even more. In 2010, GMH spent $220 million dollars on indigent and charity care[19]. Early enteral nutrition for critical care patients could help a hospital such as GMH care for more patients.

Current Guidelines and Protocols for Enteral Nutrition

Based on the benefits of EN and EEN detailed above, many critical care medicine organizations developed guidelines that reflect the current knowledge on EN. The SCCM and A.S.P.E.N. are two leading organizations that collaborate on evidenced based critical care practice. In a combined set of guidelines based on robust literature, both organizations advocate for EEN, within the first 24 to 48 hours after admission[7]. The American Burn Association states that tube feedings should be started as soon as possible[20]. One group of researchers[20] studied how well their burn ICU matched up with this guideline. They defined EEN as initiation of the tube feeding within 24 hours of admission. Patients who were fed EEN had a significantly decreased ICU length of stay (40.7 vs 52.5 days, p=0.03) and decreased wound infection rates (54.5% vs 80%, p=0.01). Thus, the literature demonstrates that compliances with guidelines for EEN will help improve patient outcomes for critical care populations.

Professional practice guidelines are one way to consolidate the best available information for practitioners, but applying these recommendations on the actual ICU floor can be a challenge. Medical professionals come from different backgrounds, where time of schooling, geography, education institution, emphasis of school program, etc. can impact how they make clinical decisions regarding EEN. Also, the culture of the hospital in which they are making these decisions can impact how quickly a patient gets fed. The development of nutrition screening assessments and enteral feeding protocols may be able to divert some of these barriers. A study conducted by members of A.S.P.E.N. demonstrated that patient outcomes, such as hospital length of stay and mortality, could be predicted by a nutrition screening assessment that focused on malnourishment risks[21]. Heyland et al. (2011) established that not all critical care patients have the same nutrition risk, and that those with a higher risk are more likely to benefit from more aggressive nutrition therapy[22]. The researchers determined that the assessment used to score this nutrition risk could also help predict 28-day mortality and patient duration on the ventilator.

Besides assessing for nutritional risk, protocols for enteral feeding have an impact on how quickly critical care patients get fed. A multicenter study showed that sites with feeding protocols had significantly more patients started on EN (70.4% of patients versus 63.6%, P=0.0036), and a significantly earlier initiation time than those who did not (41.2 hours from admission to ICU versus 57.1 hours, P=0.0003)[23]. One surgical intensive care unit examined the differences in the start of EN before and after implementing a feeding protocol[24]. A multidisciplinary team of nurses, dietitians, surgeons, and intensive care doctors worked together to develop a protocol that was implemented in multiple staff education sessions. The EN guidelines included initiating EN within 24 hours of ICU admission, consulting a dietitian within 24 hours, and monitoring the patient for bowel movements, nausea, vomiting, and gastric residuals. In that surgical critical care unit, the EN initiation time was significantly shorter after the ICU adopted an EN protocol (1 vs 2 days, $p<0.001$).

Early Enteral Nutrition in Single Critical Care Populations

Some studies have looked at the effects of EN in single critical care populations. Kutrz et al. (2011) examined the differences in critical care patients with a neurocritical primary diagnosis and general ICU patients[25]. The multicenter study found many differences between the two populations. Patients in the neurocritical ICU had a longer ICU length of stay such that 40% stayed longer than 10 days, compared to only 10% in general ICU, who had a length of stay longer than 10 days ($P<0.0001$). In addition, neurocritical ICU patients had a greater amount of nutrition support than those patients in general ICU (67% versus 39%, $P=0.001$). Chourdakis et al. (2011) concluded that EEN in patients with traumatic brain injury may contribute to better patient outcomes because of the effects on endocrine function and the resulting hormonal profile.[26] Patients with delayed EN had a pronounced decrease in thyroid-stimulating hormone, free thyroxine, free triiodothyronine, and testosterone (in males) after 3 days in the ICU from admission; this decrease was less pronounced in EEN patients. The number of deaths was two (out of 34 patients) for EEN and three (out of 25 patients) for delayed EN. These numbers become clinically significant because decreases in these values are correlated with poorer outcomes in critically ill patients[27]. Minard et al. (2000), however, did not find a significant difference in length of stay or infection in EEN severe brain injury patients[28]. Instead, it was the severity of the head trauma, as assessed by the Glasgow Coma Scale, which was closely associated with significant infection. Dvorak et al. (2004) also failed to show a significant difference in infection, nutritional status, feeding complications, number of hours on a ventilator, or length of stay in patients with acute cervical spinal cord injuries who were fed EEN versus late EN[29]. However, the authors did point out that only 17 patients were included in the pilot study. Thus, a larger sample size may provide data with more significance and more positive outcomes.

In a review by Joseph et al. (2010), the researchers specifically point out how surgical/trauma patients are a unique subgroup of critical care patients because of the hypercatabolism associated with their conditions, as evidenced by increased metabolic rate and utilization and mobilization of fatty acids, amino acids, and glucose[30]. If the increased energy and protein needs are not met, it leads to increased muscle loss and subsequent debility. A meta-analysis of three randomized control trials showed that EEN in trauma intensive care patients significantly reduced mortality (OR=0.20, 95% confidence interval 0.04-0.91, $I^2=0$)[31].

Similarly, researchers in a study conducted in medical ICU patients concluded that patients who were delayed in meeting the target rate of EN had a higher mortality rate than those who were not delayed (73.3% delayed versus 26.1%)[16]. Woo et al. (2010) found that medical ICU patients receiving EEN spent significantly less time on the ventilator (3.0 +/- 4.2 versus 6.0 +/- 9.2 days), had lower hospital mortality (1 versus 7 deaths) and a significantly shorter ICU length of stay (4.7 +/- 3.5 days versus 8.5 +/- 8.3 days, p=0.02) [17].

Like the surgical/trauma study mentioned earlier, burn patients also have a hypermetabolic response with severe catabolism[32]. When Mace et al. (2012), compared 67 burn trauma patients to 112 non-burn trauma patients, burn patients had greater and more sustained inflammatory responses than did non-burn patients[33]. Interleukin 6 and 8 were significantly more elevated during the first week of admission in burn patients than non-burn patients ($p<0.05$). Also, burn patients had a significantly higher rate of mortality (37% vs 10%, p<0.001), higher prevalence of multiple organs dysfunction syndrome (42% vs 14%, p<0.001), and had a longer hospital length of stay (40 +/- 38.9 vs 25 +/-24.8, p<0.001). Chiarelli et al. (1990) showed that very early enteral nutrition (within 5 hours of injury) helped burn patients reach a positive nitrogen balance significantly faster than delayed EN counterparts[34]. The numbers were staggering, 8.8 +/- 4.1 days in the very early enteral nutrition group versus 24.1 +/- 6.9 days in the delayed group (p<0.05). Another multicenter study conducted in burn patients discovered that patients fed within 24 hours of admission had a significantly shorter length of stay in the ICU (40.7 vs 52.2 days, p=0.03) and a significant reduction in wound infection (54.5% vs 80%, p=0.01) than those who were not fed early[20]. These significant results remained after adjusting for age, % total burn surface area, inhalation injury, and participating burn center.

Literature that looks at EEN in multiple critical care populations and compares its effect between them is limited. To our knowledge, no studies have compared hospital length of stay among burn, neurocritical, surgical/trauma, and medical ICUs. The proposed study will close this gap in the literature.

Registered Dietitian as Part of the Critical Care Team

Another facet of EEN that will be examined in this study is the role of the registered dietitian functioning as part of a multidisciplinary care team and advocating timely and appropriate feeding for patients. It is important to recognize that clinical nutrition guidelines are only as useful as the professional environment in which they are implemented. Professional collaboration is what drives this initiative. One review of how to change the professional environment to lead to greater adherence to clinical nutrition guidelines listed these important components of hospitals who practice professional collaboration: multidisciplinary team, leadership support, collaborative decision making, and a patient-centered approach[8]. The benefits of having an RD serve on a multidisciplinary care team in the neonatal and pediatric ICUs have been examined in a small number of studies[9,35]. One study compared patient outcomes in a neonatal ICU before and after implementing a multidisciplinary care team that consisted of an RD, speech therapist, physical therapist, nurses, social workers, case managers, and pharmacy team members[9]. These members participated in daily clinical rounds and weekly meetings. Weight at discharge, total weight gain, total weight gain/day, weight gain/day from birth to start of enteral feeds, and weight gain/day from birth to full feeds were significantly greater in the neonates after the implementation of a multidisciplinary team with an RD than before. A review of the impact of a nutrition support team in the pediatric ICU population recommends a nutrition support team with the RD acting not just as a consultant, but as a supervisor of patients on nutrition therapy[35]. It is proposed that this suggestion will lead to significant improvements in nutrition management in the pediatric ICU[35]. These same benefits have not been extensively studied in adult critical care populations.

Summary of Literature Review

EN is multifaceted, with numerous benefits to the patient. It is not just a means to support a patient's energy, micronutrient, and water needs; it is also an important intervention in maintaining the integrity and function of the intestinal lining. Current research supports that EEN may reduce infection, incidence of pneumonia, mortality, and time critical care patients spend on the ventilator. EEN may also decrease ICU length of stay. With one day in the ICU costing an estimated $14,462, length of stay becomes a financial concern for hospitals that care for uninsured or underinsured patients. Most studies that examine the effect of EEN on length of stay lump all critical care patients into one group or will only examine one ICU population at a time. Also, the impact of the ICU dietitian is still an emerging area of research.

CHAPTER III: METHODS AND PROCEDURES

Currently, no studies have been conducted that compare EN initiation times among burn, neurocritical, medical, and surgical/trauma ICUs and its effect on length of stay. To close this gap in the literature, the researcher conducted a retrospective chart review study at Grady Memorial Hospital (GMH), an urban hospital in downtown Atlanta. Data from the four ICUs were collected during the same time period and under the same nutrition intervention protocol. Because this study pooled information from the same large, urban teaching hospital, it increased the internal validity of the subject by maintaining a similar patient demographic, a similar time period, and similar nutrition intervention strategies by RDs who work together.

Patients admitted to the ICU are placed in the appropriate unit by the nature of their disease or injury. Burn, surgery/trauma, and neurocritical units care for patients with injuries for which they are named. The medical ICU has a large mix of patients. At GMH, the medical ICU cares for many chronic disease states (such as end stage renal disease and congestive heart failure), end of life, and drug-related conditions.

Inclusion and Exclusion Criteria

The researcher looked at the charts of critical care patients who were admitted between September 2012 through February 2014. The patients had to be intubated and on the ventilator prior to or within 24 hours of admission to the hospital, on the ventilator for at least 72 hours, and over 18 years of age. Patients were excluded if comfort measures (otherwise known as withdrawal of care) were made within 96 hours of admission, if they were extubated within 72 hours of admission, if hospice care was pursued at any point in the length of stay, and if the patient was less than 18 years of age. Based on the search criteria, 23 patients were randomly selected in the surgical and medical units, and 24 patients in the neurocritical unit. The burn ICU only had 19 patients who met the study criteria during the time period. There were a total of 89 patients in the sample.

Data Collection and Analysis

Pertinent data were entered in a secure Excel spreadsheet including: patient name, MRN, age, gender, body mass index (BMI), admission date, the type of patient (burn, neurocritical, medical, or surgical/trauma), initiation of tube feeding date, ICU discharge date, hospital discharge date, length of stay in the ICU, and length of stay in the hospital. The patient name and MRN were only used while gathering data. They were excluded in the data analysis and publishing of the results.

The data were analyzed using SPSS 21 and tested for normality. The data were not normal; therefore nonparametric tests were used in the analysis. Descriptive statistics were run on the entire data set, as well as for each ICU unit.

Correlations between the time to initiation of EN and both the ICU and hospital length of stay were run for each of the ICU units using Spearman's rho rank correlation coefficient. The correlation between the time to initiation of EN and both the ICU and hospital length of stay were run for the total sample, also using Spearman's rank correlation coefficient.

Mann-Whitney tests were used to determine significance differences in ICU and hospital length of stay between the patients who were fed early versus those who were fed late, in the entire sample and in each ICU. A Kruskal-Wallis test was conducted to determine if there was a significant difference in ICU length of stay between the patients receiving EEN in each of the critical units. A Kruskal-Wallis Test was also conducted to determine if there was a significant difference in the ICU or hospital length of stay among underweight, normal weight, overweight and obese patients. The time of initiation of enteral nutrition for patients in the two intensive care units that currently have a dietitian rounding with the multidisciplinary care team (burn ICU and neurocritical ICU) were compared to the time of initiation of EN for the two units who do not have a dietitian rounding daily using the Mann-Whitney Test.

CHAPTER IV: RESULTS

Sample Descriptions

Table 1. Median Sample Demographics (ranges included)

	Surgical n=23	**Medical** n=23	**Burn*** n=19	**Neurocritical*** n=24	**All** n=89
Age (years)	48 (18-87)	57 (30-81)	40 (19-76)	62 (43-89)	55 (18-89)
Gender (%)					
Male	65.2	73.9	73.7	62.5	68.5
Female	34.8	26.1	26.3	37.5	31.5
Body Mass Index	25 (17-61)	32 (20-55)	28 (19-35)	27 (22-51)	28 (17-100)
Time to Initiation of EN (hrs)	72 (24-168)	72 (0-168)	24 (0-120)	24 (0-72)	48 (0-168)
Early vs Late EN (%)					
Early	52.2	43.5	84.2	91.7	67.4
Late	47.8	56.5	15.8	8.3	32.6
ICU Length of Stay (days)	16 (4-41)	9 (2-27)	22 (7-115)	12 (3-21)	14 (2-115)
Hospital Length of Stay (days)	30 (7-52)	21 (5-57)	30 (17-120)	18 (7-79)	24 (5-120)

*units have RD who rounds daily with the interdisciplinary care team

Table 2. Median Sample Demographics (with ranges)

	Surgical & Medical	Burn and Neurocritical*
Age (years)	53 (18-87)	57 (19-89)
Gender (%) *Male* *Female*	 69.6 30.4	 67.4 32.6
BMI	29 (17-61)	28 (19-51)
Time to Initiation of EN (hrs)	72 (0-168)	24 (0-120)
Early vs Late EN (%) *Early* *Late*	 47.8 52.2	 88.4 11.6
ICU Length of Stay (days)	13 (2-41)	16 (3-115)
Hospital Length of Stay (days)	26 (5-57)	23 (7-120)

*units have RD who rounds daily with the interdisciplinary care team

Table 3. BMI Classifications

Class	Frequency	Percent (%)
Underweight	1	1.1
Normal Weight	17	19.1
Overweight	36	40.4
Obese Class I	17	19.1
Obese Class II	8	9.0
Obese Class III	9	10.1

There were significant but weak positive correlations between the time to initiation of EN and ICU length of stay in the surgical ICU (r=0.434, p=0.038), medical ICU (r=0.430, p=0.041), and neurocritical ICU (r=0.429, p=0.036). There was not a significant association between time of EN initiation and ICU length of stay for the burn unit.

Figure 1

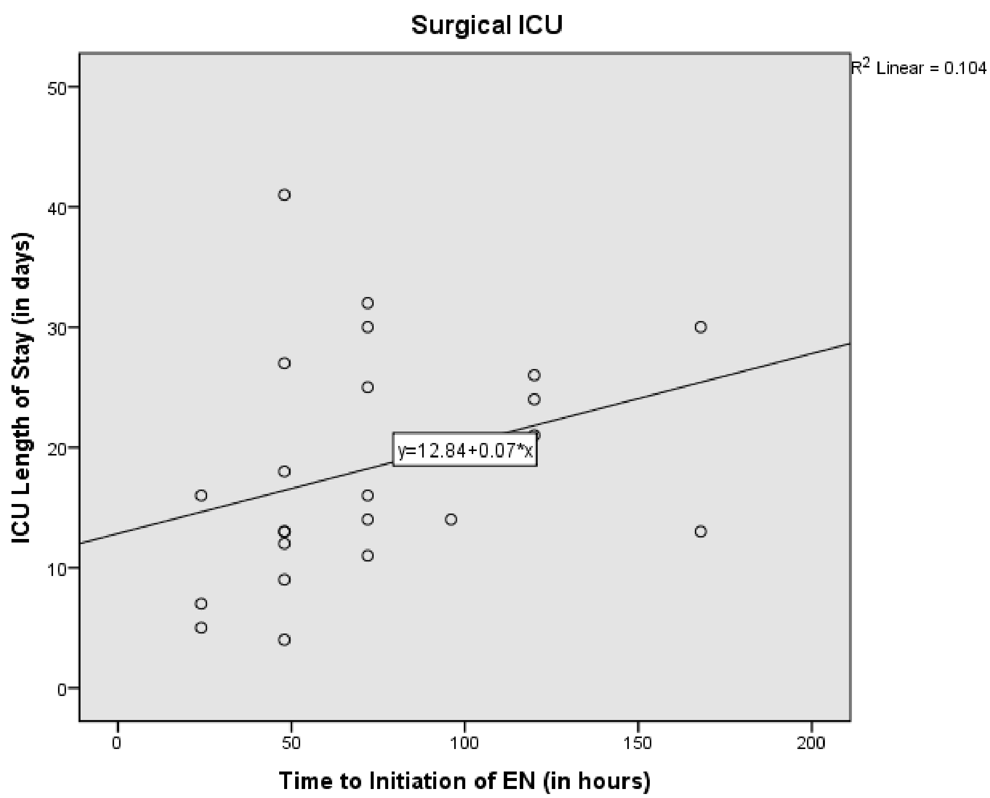


Figure 2

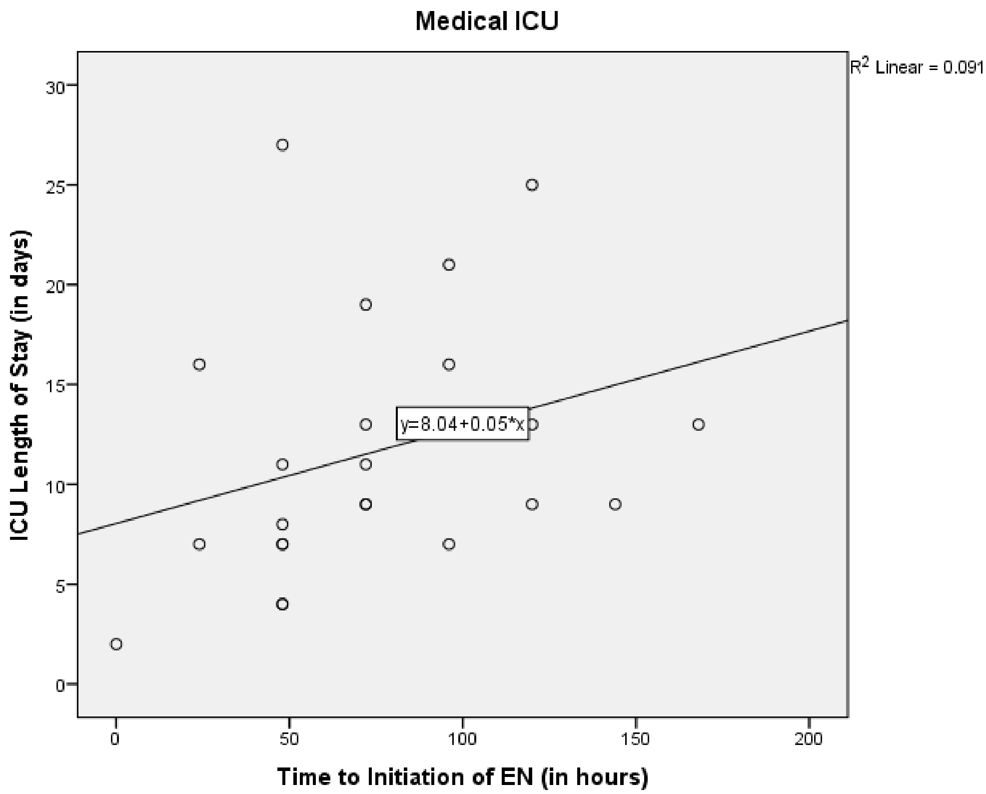
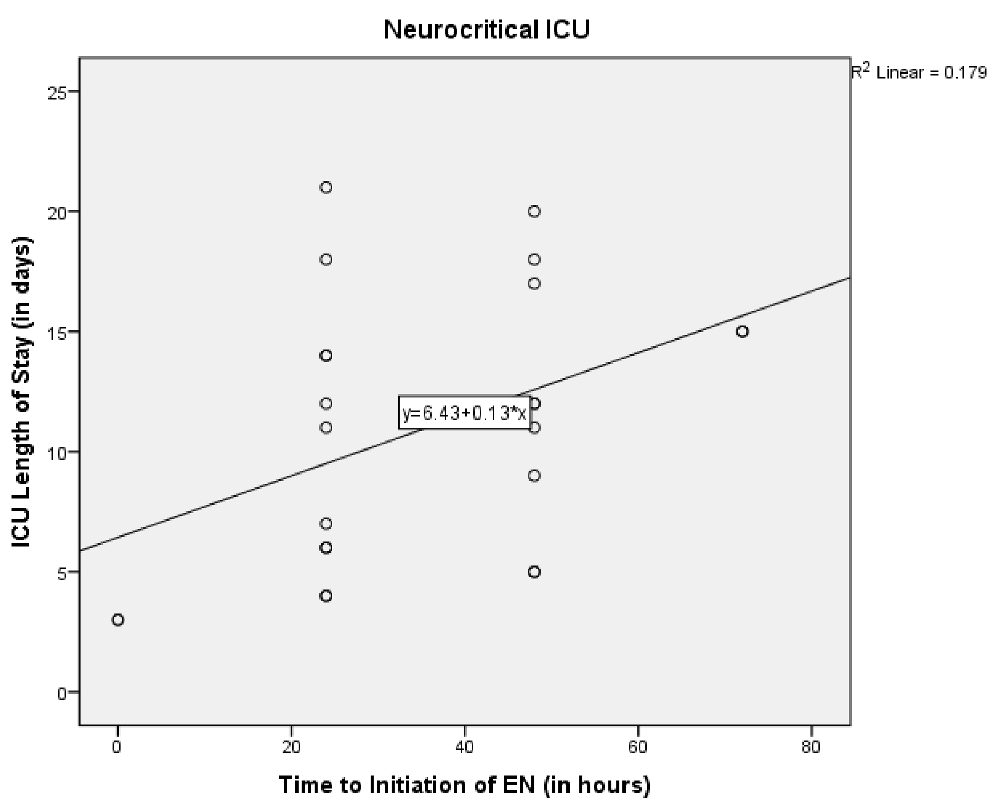


Figure 3



There was not a significant difference in the ICU or hospital length of stay for the total sample (all four ICU units combined). There was a near significant ($p=0.08$) difference in the ICU length of stay between the patients who were fed early in the surgical ICU than those who were fed late. There was a significant difference ($p=0.03$) in ICU length of stay between the medical ICU patients who were fed early versus those who were fed late. When the medical and surgical ICUs (the two units without an RD rounding daily) were combined, there was a significant difference in the ICU length of stay between the patients who were fed early versus those who were fed late ($p=0.03$). The combined burn and neurocritical units showed no significance.

There was a significant difference ($p<0.001$) in the time to initiation of EN between the units who have an RD rounding daily (burn and neurocritical; median 24 hours) and the units that did not (surgical and medical; median 72 hours).

CHAPTER V: DISCUSSION AND CONCLUSIONS

Discussion

The main objective of this study was to determine the relationship between early versus late EN and its impact on ICU and/or hospital length of stay in four adult critical care units at GMH. The researcher hypothesized that there would be a significant difference in length of stay between patients who receive EEN and those who do not in all four units, with the most significant difference being in the burn ICU. Although there were significant positive correlations between the time of initiation of EN and ICU length of stay in surgical, medical and neurocritical units, there was only a significant difference ($p=0.03$) in ICU length of stay between the surgical ICU patients who were fed early versus those who were fed late. Although this finding is contrary to the researcher's hypothesis, there are several reasons why this could be the case. One thing that could have contributed to the lack of significant finding was that the researcher did not control for the how sick the patients truly were, as not all ICU patients are created equally. By calculating an Acute Physiology and Chronic Health Evaluation II (APACHE II) or Simplified Acute Physiology Score II (SAPS II), which are estimators of ICU mortality based on the patient's acute and chronic disease state, it would have given the researcher the ability to examine if EEN was more or less beneficial in the patients with high APACHE II or SAPS scores than their less sick counterparts. Huang et al. (2012)[36] conducted a retrospective observational study looking at early and late EN, which is similar in design to this study, and used an APACHE II score to account for the patient illness variability. The authors found no significant differences in measured outcomes between early and late patients who were less sick, but in the severely sick, they found significant improvements in serum albumin and prealbumin in the early fed group, but prolonged ICU length of stay (p=0.005). The authors concluded that there was a significant association between the severity of illness and the timing of enteral feeding initiation. Therefore, in this study, collecting this parameter would have given the researchers a way to control for the variation in the degree of patients' illnesses.

Other parameters that would have given the researcher more information would have been the time that the patient spent on the mechanical ventilator, the amount of energy provided each day during the stay, the 28 day mortality, incidence of sepsis, and the reasons for delaying or disrupting the enteral feeds. In future research, these data would be helpful in giving a broader picture as to why EEN is or is not appropriate for each situation.

When looking at the early versus late EN among the four ICU units, it should be noted that in the neurocritical and burn units, only two and three patients were fed late, respectively, while 16 and 22 patients were fed early. Based on the differences in the early and late groups, it is likely that there was not enough statistical power to generate significant results in the burn and neurocritical units. Significant results between early/late EN and ICU length of stay were found in the medical unit, where the groups were more evenly matched (ten were fed early and 13 were fed late). Had this been a prospective randomized control trial, the researcher could have divided the patients and randomly assigned each group to receive a treatment, which in this case would have been early or late EN. This could be a design for future studies.

Although there was not enough power to generate statistical significance between early/late EN and length of stay, this information about the burn and neurocritical care units does lend clinical significance. The burn and neurocritical units each have an RD rounding daily with the care team, which consists of attending physicians, residents, nurses, pharmacists, and others who are involved in caring for the patient. The RDs advocate for the best nutrition invention possible. In this study, there was a significant difference in the time to initiation of EN between the units that have RDs rounding daily and the units that did not. The difference was a median of 24 hours versus a median of 72 hours to initiation of EN. Therefore, in critical care units where the RD rounds daily, the patients are fed significantly faster than those units where an RD does not round daily. Taylor et al. (2005)[37] help define the role of the ICU dietitian with special emphasis on the importance of the ICU RD to a teaching hospital setting, like GMH. They acknowledge dietitians as the nutrition expert, and advocate for RDs working as part of a multidisciplinary care team to help improve patient outcomes and cut costs. RDs in the ICU train interns, residents, and fellows from many disciplines on critical care nutrition. They participate and implement research design, as well as multidisciplinary quality improvement projects in the care of the ICU patients. Soguel et al. (2012)[38] also researched the value of having an RD participate in a multidisciplinary care team. The researchers looked at the impact of a feeding protocol on patients' energy balance during their stay in either a medical or surgical ICU. They gathered data from three time periods: before the implementation of a feeding protocol (period A), after the implementation of a feeding protocol (period B), and then after an RD was added to the unit in addition to the feeding protocol (period C). There was a significant difference in the energy balance between time period A and time period C, but not between period A and B. The addition of the RD made an improvement in the patients' energy balance. Additionally, there was a significant decrease in the patients' hospital length of stay during the time period C. The authors concluded that the addition of an ICU dietitian does make the difference.

One last point for discussion is to remember the dynamics of a multidisciplinary care team in the adult ICU setting. At GMH, there are currently residents from two medical schools, Morehouse School of Medicine and Emory School of Medicine, who are for patients and complete rounds in the medical ICU. This dual-care makes coordinating multidisciplinary rounds more challenging when other team members have to align schedules with both groups of residents. The burn and neurocritical ICUs operate a little differently, partly because residents are only from Emory School of Medicine and the attending physicians are constant. Also, in the neurocritical ICU, nurse practitioners care for the patients around the clock. All of this helps with continuity of care, which is important in meeting practice guidelines and achieving the best patient outcomes.

Areas of Future Research

To better answer the question of the impact of EEN on length of stay, future researchers should conduct a prospective research study with a detailed protocol, collecting information such as an APACHE II score, time spent on the ventilator, 28 mortality, incidence of infection, and other patient outcomes that may not be readily available in a retrospective chart review. Participants should be randomly divided to receive either early or late EN. Also, to determine the effect of the ICU dietitian, a randomized control trial that divides participants into those whose RD does round daily with the care team and those who's RD does not. It would be ideal to use a mix of participants from each ICU unit to minimize the influence of the participants' disease states.

A last area of future research could examine at the impact of having a nutrition screening tool specifically for patients in the ICU. Looking at a person's chronic and acute disease states, as well as nutrition history and malnutrition criteria, can help dietitians determine which patients are most appropriate for early nutrition intervention. It is also a way to build relationships with other disciplines, such as nursing, to help in the screening. It could be a valuable way to help build to the professional relationships needed for dietitians to act as the patients best advocate in terms of nutrition.

Conclusions

Looking at all of the results, it appears as though EEN is significantly associated with shorter ICU lengths of stay in most critical care populations. For some populations, such as burn patients, the nature of their illness may prolong their ICU and hospital length of stay, and EEN may not be able to influence that. However, even if EEN does not decrease length of stay, it could still be beneficial for other patient outcomes, like reduced mortality, lower incidence of pneumonia, and shorter time spent on the ventilator[10,14,17]. The ICU dietitian plays an important role in advocating for EEN in those patients who are medically ready for it. In terms of best practice, critical care RDs have a valuable opportunity to establish their niche as the nutrition expert on the interdisciplinary care team by incorporating medical rounds into their daily practice.

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