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Factors Affecting Length of Stay in Children and Adolescents Admitted with an Eating Disorder to a Large Urban Pediatric Hospital

Adelina Paduraru

ACCEPTANCE

This thesis, FACTORS AFFECTING LENGTH OF STAY IN CHILDREN AND ADOLESCENTS ADMITTED WITH AN EATING DISORDER TO A LARGE URBAN PEDIATRIC HOSPITAL, by Adelina C. Paduraru 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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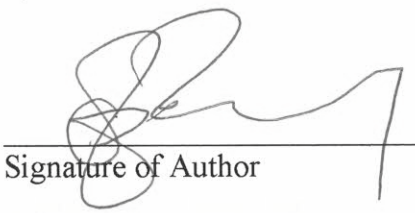

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ABSTRACT

FACTORS AFFECTING LENGTH OF STAY IN CHILDREN AND ADOLESCENTS ADMITTED WITH AN EATING DISORDER TO A LARGE URBAN PEDIATRIC HOSPITAL

by
Adelina C. Paduraru

Background: Hospitalizations including the diagnosis of an eating disorder (ED) have increased significantly in the pediatric population over the past few decades. Patients who are male, who are <13 years of age, who receive an nasogastric (NG) tube, or who require admission to a residential treatment program often remain in the hospital for longer periods of time. Few studies examining LOS exist for children and adolescents with an ED. Longer lengths of stay have previously been associated with factors such as having Medicaid, a reduced body mass index (BMI) upon admission, and a diagnosis of anorexia nervosa (AN).

Objective: The purpose of this study is to examine risk factors related to a longer LOS in children and adolescents admitted to a large urban pediatric hospital with AN or bulimia nervosa (BN).

Participants/setting: A retrospective cohort study was conducted in 65 patients 9-20 years of age who were admitted to Children's Healthcare of Atlanta (CHOA) between January 1, 2014 and December 31, 2015.

Statistical Analysis: Frequency statistics were used to describe the demographic, anthropometric, and clinical characteristics of the population. A Mann Whitney U test or Kruskal-Walllis test was used to examine differences in LOS by demographic characteristics, mode of nutrition therapy, discharge treatment program location, and

admission BMI category. The association between LOS category by demographic and clinical characteristics was determined using a Chi-square statistic.

Results: A total of 65 patients (94% female, 89% Caucasian) with a mean age of 14.6 ± 2.4 years were admitted during the study period. The median LOS was 9 days (IQR; 6, 13) and was significantly longer in those who had an NG tube placed vs. oral diet (11 days (IQR; 7, 21) vs. 8 days (IQR; 5, 9.3), respectively; $p<0.01$) and who were referred to an out of state vs. in state treatment program (10 days (IQR; 8, 21) vs. 8 days (IQR; 5, 11), respectively; $p<0.01$). For patients discharged to an in state treatment program, LOS differed significantly by BMI category/malnutrition status ($p<0.05$).

Conclusion: The characteristics of hospitalized pediatric patients with an ED were consistent with those of other studies. Longer lengths of stay in those who had an NG tube placed may have been due to the patient's lack of compliance, failure to gain weight, and severity of malnutrition since more time is needed for medical recovery. More treatment centers for children and adolescents with an ED are needed in the state of Georgia to potentially reduce LOS. Future studies should include a greater percentage of males and larger population of children and adolescents.

FACTORS AFFECTING LENGTH OF STAY IN CHILDREN AND ADOLESCENTS ADMITTED WITH AN EATING DISORDER TO A LARGE URBAN PEDIATRIC HOSPITAL

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ABBREVIATIONS

AAP	American Academy of Pediatrics
AHRQ	Agency for Healthcare Research and Quality
AN	Anorexia Nervosa
ANAD	National Association for Anorexia Nervosa and Associated Disorders
ANBP	Anorexia Nervosa Bingeing/Purging
ANR	Anorexia Nervosa Restrictive
BED	Binge Eating Disorder
BMI	Body Mass Index
BN	Bulimia Nervosa
CBT	Cognitive Behavior Therapy
cm	centimeter
DISPO	Disposition After Discharge
DSM-5	Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition
ED	Eating Disorder
HER	Electronic Health Record
IBW	Ideal Body Weight
IQR	Interquartile Range
kcals	kilocalories
kg	kilogram
LOS	Length of Stay
m	meter
NG	Nasogastric

NRP	Nutrition Rehabilitation Protocol
OSFED	Other Specified Feeding and Eating Disorder
SD	Standard Deviation
U.S.	United States of America

CHAPTER I

INTRODUCTION

The American Academy of Pediatrics (AAP) has reported that the prevalence of eating disorders including anorexia nervosa (AN) and bulimia nervosa (BN) has increased in the United States since the 1950s.[1] Though eating disorders are more common in females, approximately 5-15% of males are affected by eating disorders such as AN or BN.[1,2] The National Association for Anorexia Nervosa and Associated Disorders (ANAD) reported that 95% of those with eating disorders are between the ages of 12-25 years.[2] However, younger children can also be affected by this illness. Given the rise of childhood obesity, children as young as 6 years of age may develop concerns about weight and exhibit signs of restrictive intake.[3,4] Over time, this behavior could develop into an eating disorder (ED) that causes detrimental complications such as growth delay, cardiac failure, electrolyte disturbances, reduced bone mass, and severe malnutrition, which is especially concerning for children and adolescents who are at various stages of development.[4,5] Depending upon the severity of an ED, hospitalizations may be frequent and the length of stay (LOS) may be lengthy.[6]

According to the U.S. Agency for Healthcare Research and Quality (AHRQ), the number of hospitalizations involving eating disorders have increased by 72% for children under 12 years of age and by 6% for ages 12-19 years between 1999 and 2009.[7] It is important to identify the presence of an ED and factors affecting duration of hospital stay early during admission in order to provide optimal medical and behavioral care.[8] Studies examining LOS for children and adolescents with ED are limited and differ in the

population age groups and factors affecting LOS that were examined. Previous studies have reported longer LOS for patients who are insured under Medicaid, experiencing slower weight gains, diagnosed with anorexia nervosa (AN), admitted to hospital psychiatric units, placed on lower caloric prescriptions, given low calorie bolus feedings and who have a reduced body mass index (BMI) upon admission.[6,9–14] Additionally, other factors that may influence LOS are prolonged admissions of malnourished patients and the absence of a hospital refeeding or treatment protocol for eating disorders.[5,15] Recognizing factors that reduce LOS is beneficial for the patient and family not only financially but also psychologically.[16] A shorter LOS can result in a swift return to the home environment or an appropriate outpatient facility providing the patient with better outcomes such as stability, improved social relationships, familiarity, and uninterrupted education.[12,15]

Children's Healthcare of Atlanta (CHOA) encompasses several pediatric hospitals and facilities that provide tertiary care and a wide array of medical services in the metro Atlanta area. In 2012, CHOA implemented an inpatient ED clinical practice protocol in an effort to provide standardized treatment and discharge criteria (Appendix A). The inpatient ED protocol was designed specifically for children and adolescents with AN or bulimia nervosa (BN) since these patients are afraid to gain weight, are medically compromised, and require further specialized psychiatric treatment after discharge more so than any other ED diagnoses. In 2015, CHOA revised the protocol and added an emergency department component that includes guidelines for possible admission for medical stabilization as well as potential symptoms for patients presenting with an undiagnosed ED.

Leslie Cox, MS, RD, CSP, LD, clinical dietitian in the Department of Clinical Nutrition at CHOA, reported that the current average LOS under the new protocol is 9 days, which is beneficial as previous stays had been too short to ensure proper recovery (personal communication, September 3, 2015). However, some patients remained in the hospital for a longer period of time, occasionally for reasons unrelated to the protocol set by the hospital. Patients who do not gain adequate weight, are severely malnourished, or are noncompliant with their meal plan may receive an NG tube, as per hospital protocol, which could result in a longer LOS due to increased time needed for medical recovery. Also, patients discharged from CHOA are placed into treatment programs with different levels of care (outpatient, intensive outpatient, partial hospitalization, residential, or inpatient hospitalization) depending upon criteria including medical status, suicidality risk, weight, motivation to recover, and environmental stress.[17] Patients who are male or less than 13 years of age are more difficult to place into these treatment facilities as many do not accept males or are not licensed for a child ED program. Also, there are no residential treatment programs in Georgia and it is more difficult to place patients into residential treatment programs out-of-state due to financial constraints, willingness, and logistics. The factors that are associated with LOS in hospitalized children and adolescents who are placed on an inpatient ED protocol are unknown. The purpose of this study is to examine risk factors related to a longer LOS in an urban population of children and adolescents with AN or BN who presented at CHOA between January 1, 2014 and December 31, 2015.

Specific Aim 1: To examine the relationship between demographic factors and LOS in children and adolescents placed on the inpatient ED protocol at CHOA.

Hypothesis 1A: Patients who experienced a longer LOS will be predominantly male.

Null Hypothesis 1A: Length of stay will not differ by gender.

Hypothesis 1B: Patients under the age of 13 will have a longer LOS vs. those who are ≥13 years of age.

Null Hypothesis 1B: Length of stay will not differ in patients who are younger than 13 years of age vs. older patients.

Hypothesis 1C: Patients who have Medicaid or who are uninsured will have a longer LOS vs. patients with private health insurance.

Null Hypothesis 1C: Length of stay will not differ by insurance status.

Specific Aim 2: To examine the relationship between anthropometric and clinical factors and LOS in children and adolescents placed on the inpatient ED protocol at CHOA.

Hypothesis 2A: Patients who were categorized upon admission as having severe malnutrition (BMI z score of -3) will have a longer LOS vs. those with mild or moderate malnutrition (BMI z score of -1 or -2).

Null Hypothesis 2A: Length of stay will not differ by BMI category.

Hypothesis 2B: Patients who had a nasogastric (NG) feeding tube placed during admission will have a longer LOS than those receiving an oral diet only.

Null Hypothesis 2B: Length of stay will not differ by mode of nutrition therapy.

Hypothesis 2C: Patients who were placed into an out-of-state treatment programs will have a longer LOS than those placed in-state.

Null Hypothesis 2C: Length of stay will not differ by discharge placement location.

CHAPTER II

LITERATURE REVIEW

Eating Disorders

An ED is defined as an abnormal and unhealthy relationship with food that interferes with an individual's health and life.[18,19] The major categories of EDs include AN, BN, binge eating disorder (BED), and other specified feeding and eating disorder (OSFED).[20] As an ED progresses, a person experiences worsening disturbed thoughts about body image and sets unrealistic expectations for themselves. Consequently, certain coping mechanisms are adopted with various degrees of food restriction, purging, or uncontrollable consumption of food. Over time, an ED can lead to psychological, physical, and social disturbances such as depression, suicidal thoughts, evident weight loss, brittle hair and nails, enamel erosions, muscle wasting, and social withdrawal.[21] If medical treatment is avoided or prolonged, EDs can become difficult to treat and could result in a significant increased risk of mortality.[18,21,22]

EDs are diagnosed based on criteria established by the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5).[20,21,23–25] For AN, one of those criteria is exhibiting behaviors that limit weight gain or having extreme fear of weight gain, even though the person may be classified as underweight.[23–26] Some individuals may also have a distorted body image, lack recognition of the severity of the medical illness, and have an excessive preoccupation or control over weight. Additionally, they may restrict energy intake, which leads to a body weight that is lower than what's expected for their age, sex,

and developmental status. In adults, the severity of low body weight is based upon current BMI (kg/m2) using the World Health Organization categories of thinness: BMI ≥17 (Mild), 16-16.99 (Moderate), 15-15.99 (Severe) and <15 (Extreme).[23] For children and adolescents, the DSM-5 criteria recommend that corresponding BMI percentiles be used. The two types of AN include bingeing/purging type, classified as loss of control over eating followed by episodes of self-induced vomiting or use of laxatives and diuretics, and restrictive type, which involves limiting energy intake over the past 3 months. It is important to recognize AN early because it has mortality rate of 5-6%, which is highest amongst all EDs and increases with duration of AN and age.[24,25]

Many individuals with BN experience similar signs as AN but are characterized by episodes of binge eating followed by purging, fasting, or hyperexercising occurring ≥1 times/week for at least 3 months.[23–25] These compensatory behaviors are often concealed to prevent weight gain; however, weight is maintained at a normal range. The severity of BN is classified based on frequency of these behaviors: 1-3 episodes (mild), 4-7 (moderate), 8-13 (severe), or ≥14 (extreme).[23] Although BN has a lower mortality rate than AN (approximately 2%), the lifetime suicidality risk is much greater.[25]

Binge eating disorder encompasses features such as those seen in BN; however, individuals binge eat at least 1 times/week for ≥3 months without engaging in compensatory behaviors and severity is categorized based on binge eating episodes.[23–25] In addition, those with BED tend to have behaviors or emotions such as feelings of guilt or disgust after eating, absence of hunger during consumption, or they eat quickly. Finally, OSFED is a diagnostic category that involves subcategories that do not meet the criteria for either AN, BN, or BED.[23,26] For example, it may include atypical AN (normal

weight), BN with low frequency and duration, or purging disorder. Unspecified feeding or eating disorder, on the other hand, encompasses EDs that don't fully meet criteria; however, the clinician is unable to specify exactly why that is.[23] Other EDs mentioned in the DSM-5 were originally referred to as childhood and infancy disorders. These include pica and rumination disorder, the consumption of non-nutritive substances or regurgitation for ≥1 month.[23,24] Also, avoidant/restrictive food intake disorder which involves poor energy intake resulting in unintended weight loss without a preoccupation with body image.[23,26]

Treatment strategies for EDs involve a multidisciplinary approach that encompasses a variety of psychological, behavioral, medical, and familial therapies that strive to prevent or correct complications associated with the disorder.[21,25,27–29] For example, individuals may receive cognitive behavior therapy (CBT), family and/or group psychotherapy, motivational-based therapies, nutrition counseling, and medical care. Additionally, some may need treatment with antidepressants or antipsychotic medications, which have shown to improve symptoms of the ED.

Factors Affecting Length of Stay

Studies examining factors affecting LOS in children and adolescents hospitalized with an ED are scarce. Of the studies solely focusing on LOS as their primary outcome, the majority describe demographic characteristics, clinical conditions, type of insurance, psychiatric disorders, and/or type of ED as factors potentially affecting LOS. According to Zhao and Encinosa (2011), national estimates for hospitalizations related to eating disorders report the average LOS to be 8.1 days and 88% of patients to be female.[7]

Additionally, 19% of patients are between the ages of 12-19 while 3% are under 12 years old. Insurance companies for these type of patients are distributed as follows: private insurance (50%), Medicaid (19%), Medicare (20%), and self-pay (6%).

A descriptive study by Calderon et al. (2007) aimed to evaluate demographic, clinical, and treatment characteristics pertaining to patients between the ages of 10 to 27 years with an ED.[6] The study sample was drawn from 1,713 admissions from 32 pediatric hospitals in the United States between 2001 and 2004. The researchers determined that the majority of patients were female, white/non-Hispanic, an average of 15.3 years old, and diagnosed with AN and comorbid depression. Patients without private insurance vs. those with private insurance had an increased probability of being diagnosed with depression and/or disruptive behavior disorders and of being admitted to the psychiatric unit. Additionally, the average LOS was between 1 to 260 days with an average of 15.7 days. Of the many factors examined, of particular significance was that the mean LOS was twice as long for patients on a psychiatric unit vs. those either on an intensive care unit or medical unit (20.2 days vs.10.5 days; $p<0.001$).

A cross-sectional study by Robergeau et al. (2006) evaluated 352 hospitalizations in patients between the age of 9-17 years with an ED.[10] In this report, the researchers examined variables such as LOS, demographics, cost, and insurance status for those admitted to any New York hospital in 1995. The researchers reported that the majority of patients were female, an average of 14.6 years, Caucasian, diagnosed with AN, and privately insured. Average LOS was 18.43 ± 29.1 days with a median of 7 days with an average hospitalization cost of $10,019 (median of $3,817). In order to determine predictors of LOS, factors such as age, ethnicity, gender, and payer were analyzed using a

multivariate model. The main factor influencing LOS was the type of insurance, with Medicaid predominately resulting in a longer LOS ($p<0.0001$). A retrospective study by Lopez-de-Andres et al. (2010) was conducted to evaluate demographic and clinical characteristics of 10,569 hospitalized pediatric patients admitted with an ED between 1998 and 2007 in Spain.[9] The factors analyzed were LOS, mortality, psychiatric comorbidities, and medical conditions among patients between 10 and 18 years of age. The researchers found that the median LOS was 13 days and was influenced by the type of ED (anorexia = 14 days vs. bulimia = 9 days). Psychiatric comorbidities and clinical factors were not shown to affect LOS. However, this finding may have been due to limitations in the database system used to extract patient characteristics.

A retrospective study by Fraga et al. (2015) evaluated seasonal differences in body weight upon admission between AN subtypes, restrictive (ANR) or bingeing/purging (ANBP), for 86 female patients hospitalized in Spain during 2007 and 2011.[14] Seasons were divided warm (May to October) and cold semesters (November to April). Factors examined were baseline characteristics (age, sex, BMI, duration of illness, and previous hospitalizations), admission and discharge dates, LOS, and BMI at discharge for pediatric patients ages 12 to 18. Although more patients were diagnosed with ANR than ANBP, those with ANBP had a greater number of previous hospitalizations and longer periods of illness. Patients with ANR had a lower BMI upon admission and longer LOS than those with ANBP during the cold semester but not in the warmer months. Also, patients with ANR had a significantly lower BMI upon admission and longer LOS in the cold vs. warm semester.

Hospital Protocols and Length of Stay

Several studies have examined the effects of hospital refeeding and treatment protocols applied to children and adolescents with an ED. The variables investigated include but are not limited to weight gain, calorie prescription, and LOS. Leclerc et al. (2013) implemented a Nutrition Rehabilitation Protocol (NRP) in order to evaluate rate of weight gain, medical stability, and nutrition composition of prescribed diets for hospitalized adolescents diagnosed with ED.[15] This study included 29 patients that were over 70% of their ideal body weight (IBW) and were initially prescribed a diet that included 1,500 kcals/day. The researchers then slowly advanced the diet to a goal of 2,500 kcals/day by adding an additional 250 kcals/day on the first and second days of admission and then every other day until day 7. The implementation of the NRP resulted in a safe and significant weight gain of 0.24 kg/day ($p<0.0001$). The average LOS was 35.8 days and medical stabilization was accomplished in approximately 14 days. The researchers concluded that a NRP promotes shorter hospital LOS, which is cost effective and results in better quality of life.

Kalisvaart et al. (2007) investigated an inpatient treatment protocol and reimbursement for services provided to adolescents with ED.[5] The protocol consisted of prescribed caloric levels, behavioral modifications, psychotherapy, family therapy, nutritional assessments, and medical evaluations. Researchers reviewed patient charts obtained from a children's hospital between 2001 and 2003. Of the 39 participants included in this study, most were female (n=38) ages 12.6-22.2 (mean 16.1 ± 1.9) and had anorexia (n=28) vs. eating disorder not otherwise specified (n=11). Results indicated that estimated ideal body weight at admission were statistically significant when

comparing the two ED groups ($p<0.004$). However, the mean LOS (50.8 days) and daily weight gain (100 ± 60 g) for either ED group were not significant when controlling for admission weight. Additionally, though there was a greater hospital cost for anorexia vs. eating disorder not otherwise specified ($120,337 ± $67,135 vs. $68,981 ± $33,510, respectively), this disparity was not significant when controlling for LOS. The authors determined that earlier admissions of malnourished adolescents could result in lower costs, shortened LOS, and better prognosis.

A retrospective study by Agostino et al. (2013) aimed to establish if a high calorie continuous NG refeeding protocol vs. lower calorie bolus meals results in a faster weight gain and shorter LOS for hospitalized children and adolescents with AN.[11] Researchers reviewed charts from patients admitted between 2003 and 2011 at a children's hospital. The subjects were split into a bolus-fed group (n=134: 1,069 ± 212 kcals/day) and a NG group (n=31; 1,617 ± 276 kcals/day). Variables including age, gender, BMI, IBW, caloric prescription, rate of weight gain, complications after admission, and LOS were analyzed in order to detect significant difference between groups. No significant differences were found with regard to demographic and anthropometric characteristics or complications. However, caloric prescription ($p<0.001$) and rate of weight gain was significantly higher in children who received the NG vs. bolus feedings during the first week of admission (1.22 kg and 0.08 kg; $p<0.0001$) and the second week (1.06 kg and 0.69 kg; $p<0.004$). In addition, LOS was significantly shorter in the NG vs. bolus fed group (33.8 days vs. 50.9 days, respectively; $p<0.0002$).

Another retrospective study conducted by Golden et al. (2013) examined the effects of a high calorie diet on weight gain, LOS, and rates of hypokalemia,

hypophosphatemia, and hypomagnesemia in pediatric patients with AN.[12] The report consisted of 310 participants between the age of 10 to 21 years who were admitted to a children's hospital between 2007 and 2011. The children were divided into a low calorie group (n=88; 1,163 ± 107 kcal/day) and a high calorie group (n=222; 1,557 ± 265 kcal/day). The reason for such a discrepancy in prescribed caloric levels was because, prior to 2008, a lower caloric prescription was thought to decrease the risk of refeeding syndrome. Thus, the hospital adjusted their refeeding protocol from an initial 1,000-1,200 kcals to 1,400-2,000 kcals based on the patient's 24-hour dietary recall prior to admission. Calories were increased by 200 kcals every 1-2 days to promote a 0.2-0.5 kg/day weight gain goal. Once patients were medically stable for 24 hours and had a mean BMI >75%, they were discharged. Results indicated a significantly shorter LOS in the higher calorie group vs. the lower calorie group (13.0 ± 7.3 days vs. 16.6 ± 9.0 days; $p<0.0001$) without increased rates of hypokalemia, hypophosphatemia, and hypomagnesemia.

Finally, Garber et al. (2013) sought to compare a higher vs. lower calorie refeeding protocol and examine the effect of calorie prescription on weight gain and LOS in pediatric patients with AN.[13] This prospective observational study included 56 participants between the age of 9 to 20 years who were hospitalized between 2002 and 2012. The participants were divided into 2 equal groups and labeled as high calorie (1,764 kcals) or low calorie (1,093 kcals). Like the study by Golden et al., caloric prescriptions before 2008 were much lower due to the concern for refeeding syndrome. Since then, evidence has shown that an increased initial caloric intake doesn't pose as much of a risk as previously thought. The variables analyzed were demographic and

anthropometric characteristics, vital signs, hydrations status, caloric prescription, and LOS. The authors reported that a higher caloric intake resulted in a shorter LOS (11.9± 1.0 days vs. 17.6 ± 1.2 days; $p<0.001$). This was due to the faster weight gain seen in participants in the higher calorie group (0.27 ± .03 vs. 0.14 ± .02 kg per day; $p<0.001$).

CHAPTER III

METHODS

Patient Population

The study sample included children and adolescents between the ages of 9 and 20 who were admitted to CHOA for clinical treatment of AN or BN. All patients were clinically diagnosed using the American Psychiatric Association's diagnostic classification under DSM-5 criteria. Patients with pica, rumination disorder, avoidant/restrictive food intake disorder, BED, OSFED, or unspecified feeding or eating disorder were excluded. Race was self-identified upon registration for hospital admission. The sample population consisted of children and adolescents with AN or BN who were seen between January 1, 2014 and December 31, 2015.

CHOA Inpatient Protocol for Eating Disorders

The protocol for treating patients with AN or BN upon admission at CHOA begins with initiating an oral diet to promote weight restoration >90g per day for a minimum of four days (0.9-1.4 kg/week) (Appendix A). The diet order is a Regular Diet with no diet products, no caffeine and no food labels. If a patient does not achieve any weight gain within 48 hours of admission, is experiencing continued bradycardia or unstable vital signs (e.g., orthostatic blood pressure) or is unable to meet minimum meal plan requirements, then an NG tube feeding should be administered. In the case of severe malnutrition, an NG tube will be placed upon admission. For patients between the ages of

≤13 years of age, Pediasure Enteral formula is generally used and for patients ≥14 years old, Osmolite is used. NG caloric prescription is usually initiated at 30-40 kcals/kg taking age and percent of ideal body weight into consideration. Caloric requirements and the enteral feeding rate (mL/hour) are determined by a Registered Dietitian. Initially, caloric administration is started lower than the recommended hourly rate and increased by 10 mL/hr every 4 hours until the goal rate is reached. Caloric intake is increased over time based on the dietitian's clinical judgment.

Study Design

The present study is a retrospective cohort study. Data was extracted from the CHOA electronic health record (EHR). Variables that were examined included demographic characteristics (diagnosis (AN or BN), age in years, gender, and race), LOS (days), mode of nutrition therapy (NG tube vs. oral diet only), disposition after discharge, and discharge treatment program location. Other variables collected included type of insurance, anthropometric measures (admission height in cm, admission weight in kg), calculated admission BMI (kg/m^2), BMI z score and admission BMI category/malnutrition status. Admission BMI z score was categorized using the Academy of Nutrition and Dietetics and American Society for Parenteral and Enteral Nutrition recommended indicators for the identification of malnutrition in pediatric populations: No risk (0), Mild (-1), Moderate (-2) or Severe (-3) which correspond to the >16, 2.4 – 15.9, 0.2 – 2.3, and <0.2 growth percentiles, respectively.[30] De-identified patient data were recorded onto a Microsoft Excel spreadsheet and each patient was assigned a

numeric identification code chosen at random. Exempt approvals from the IRB at Georgia State University and CHOA were requested for this study.

Statistical Analyses

The demographic, anthropometric, and clinical characteristics of the patient population were described using frequency statistics. Normality statistics were conducted on continuous variables (age, weight, height, BMI *z* score, LOS) to determine the appropriate descriptive measure of central tendency. A Mann Whitney U test was used to examine differences in LOS by dichotomous categorical variables (gender, age categorized as <13 vs. ≥13 years, type of insurance, in-state vs. out-of-state, mode of nutrition therapy). The Kruskal-Wallis test was used to examine differences in LOS by race and BMI *z* score category for the total population and after subdivision by state status. LOS was also categorized as expected (≤9 days) vs. extended (>9 days). A Student's t-test was used to examine differences in BMI z score by LOS category. The Chi-square statistic was used to determine differences in LOS category by gender, type of insurance, in-state vs. out-of-state, and mode of nutrition therapy. Fisher's Exact Test was used when the expected count was less than 5 in any cell. All statistical analyses were performed using SPSS (version 20.0, SPSS, Inc., Chicago, IL).

CHAPTER IV

RESULTS

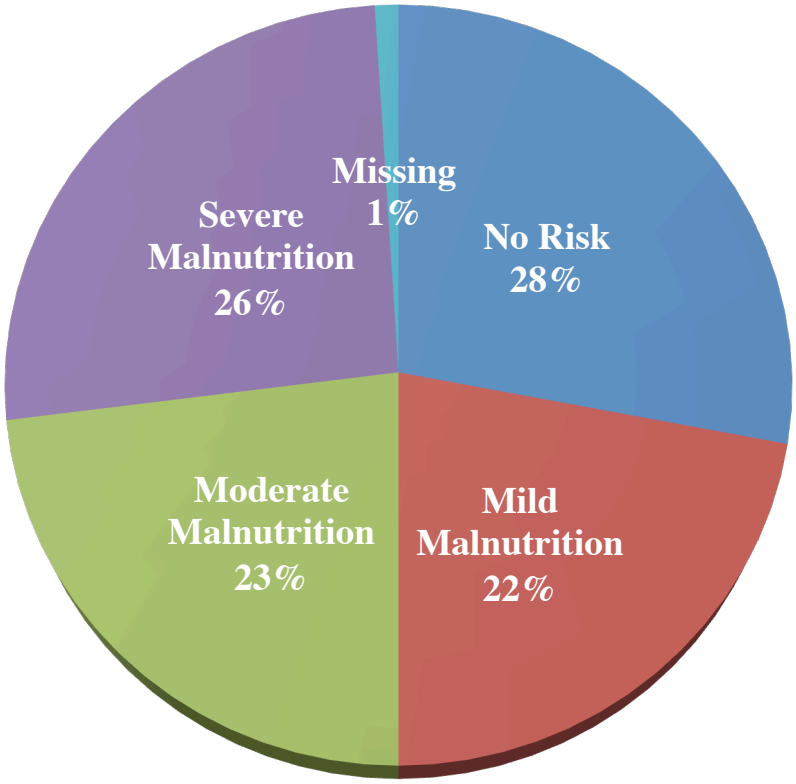
The demographic and clinical characteristics for the sample population (n=65) are shown in Table 1. The mean age of the sample was 14.6 ± 2.4 years (range, 9-20 years) with the majority of the patients being female (94%), Caucasian (89%), 13 years or older (80%), and privately insured (89%). There were no patients admitted with BN during the study period. The vast majority of the children and adolescents in the population were diagnosed with AN restrictive type (85%). All continuous variables were normally distributed except for LOS. The mean admission BMI z-score was -2.16 ± 1.64 which corresponds to the 0.2-2.3 growth percentiles. Malnutrition status based on the BMI category was divided evenly amongst patients (Figure 1).

Table 1: Demographic, Anthropometric and Clinical Characteristics of the Total Population

Characteristic	Total Population (N=65)
Age[a] (years)	14.6 ± 2.4
Age Category [n (%)]	
<13 years	13 (20)
≥13 years	52 (80)
Gender [n (%)]	
Male	4 (6)
Female	61 (94)
Race [n (%)]	
Asian	2 (3)
African American	1 (2)
Caucasian	58 (89)
Unknown	4 (6)
Type of Insurance [n (%)]	
Private	58 (89)
Medicaid	7 (11)
ED Diagnosis [n (%)]	
AN Restrictive	55 (85)
AN Bingeing/Purging	9 (14)
AN Purging Only	1 (1)
LOS[b] (days)	9 (6, 13)
Height[a] (cm)	159.4 ± 9.6
Weight[a] (kg)	41.3 ± 9.2
Admission BMI[a] (kg/m^2)	16.0 ± 2.4
Admission BMI Z-score[a,c]	-2.16 ± 1.64
Mode of Nutrition Therapy [n (%)]	
No NG tube	34 (52)
NG tube	31 (48)

[a]Mean ± SD, [b]Median (Interquartile range; 25%, 75%), [c]1 subject had missing value
ED – eating disorder, AN – Anorexia Nervosa, LOS – length of stay, cm – centimeter, kg – kilogram, m – meter, BMI – body mass index, NG – nasogastric

Figure 1: Body Mass Index Category/Malnutrition Status in the Total Population



The median LOS was 9 days and did not differ by any demographic characteristics (Table 2). Thirty-one patients (48%) had a NG tube placed during admission while others received an oral diet only. Children and adolescents were primarily discharged to treatment programs that were in state (65%). The remaining patients were discharged to residential treatment centers, which are only available out of state (Figure 2). Length of stay differed by mode of nutrition therapy ($p<0.002$) and discharge treatment program location ($p<0.001$; Table 3). A significant negative correlation was found between LOS and BMI z-score ($p=0.027$; Figure 3). However, the strength of this relationship was only fair ($r = 0.276$). After subdivision by treatment

program location (in state vs. out of state), a significant difference in LOS by BMI category/malnutrition status was observed for those referred to in state treatment programs (p=0.021; Table 4). This difference was predominantly between those with no risk vs. moderate malnutrition (median LOS = 5 days vs. 11 days; respectively).

Table 2: Demographic Characteristics of the Population by Length of Stay

Characteristic	n	LOS*	Significance
Age Category			
<13 years	13	10 (8, 18.5)	p=0.135
≥13 years	52	8 (6, 12)	
Gender			
Male	4	6.5 (6, 28)	p=0.722
Female	61	9 (6, 13)	
Race			
Asian	2	13.5 (10, -)	p=0.435
African American	1	14 (14, 14)	
Caucasian	58	8.5 (6, 13)	
Unknown	4	8.5 (5.8, 9)	
Type of Insurance			
Private	58	9 (6, 13)	p=0.687
Medicaid	7	9 (5, 10)	
ED Diagnosis			
AN Restrictive	55	9 (6, 13)	p=0.794
AN Bingeing/Purging	9	8 (4.5, 22.5)	
AN Purging Only	1	7 (7, 7)	

*Median (Interquartile range; 25%, 75%)
SD – standard Deviation, LOS – length of stay, ED – eating disorder, AN – Anorexia Nervosa

Figure 2: Treatment Program Placement after Discharge

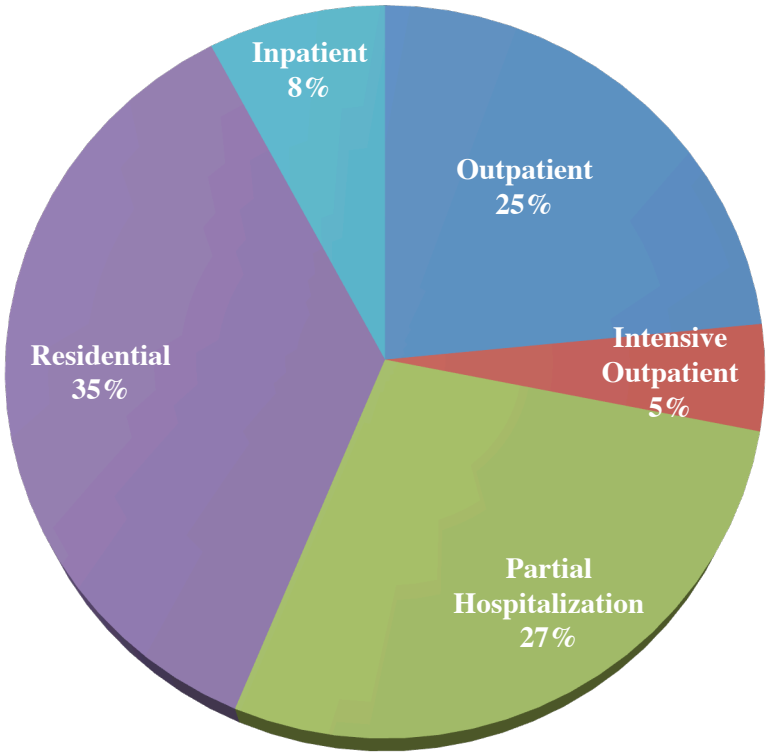
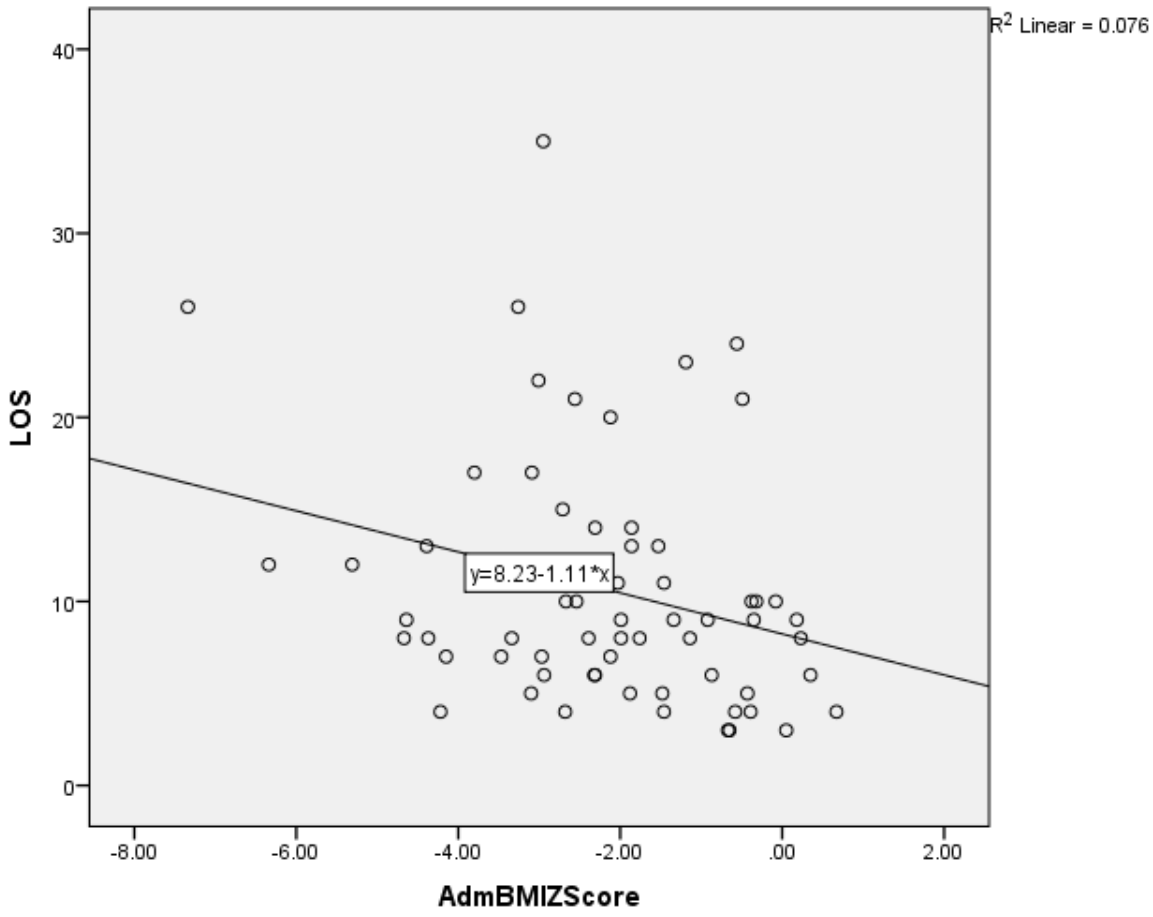


Table 3: Clinical Characteristics of the Population by Length of Stay

Characteristic	n	LOS*	Significance
Mode of Nutrition Therapy			
No NG Tube	34	8 (5, 9.3)	**p=0.002**
NG Tube	31	11 (7, 21)	
DISPO Treatment Program Location			
In State	42	8 (5, 11)	**p=0.006**
Out of State	23	10 (8, 21)	
Admission BMI Category/Malnutrition Status**			
No Risk	18	7 (4, 10)	p=0.099
Mild	14	8.5 (5.8, 13)	
Moderate	15	10 (7, 15)	
Severe	17	11 (7.5, 17)	

*Median (Interquartile range; 25%, 75%), **Subject had missing value
SD – standard deviation, NG – nasogastric, DISPO – disposition after discharge, BMI – body mass index

Figure 3: Pearson Correlation between Length of Stay and Admission Body Mass Index Z-score



LOS – length of stay, AdmBMIZScore – admission body mass index z-score

Table 4: Mean Length of Stay by Admission BMI Category/Malnutrition Status for those Discharged In State vs. Out of State*

	No Risk	Mild	Moderate	Severe	Significance
In State (n)	5 (3, 9) (11)	8 (5, 13) (11)	11 (7, 14.5) (9)	8.5 (7, 12.3) (10)	**p=0.021**
Out of State (n)	10 (8, 21) (7)	11 (9, -) (3)	8.5 (6.8, 20.3) (6)	17 (8, 26) (7)	p=0.531

*Median (Interquartile range; 25%, 75%)

When comparing LOS category (expected vs. extended stay) by the demographic and clinical characteristics of our population, we observed that a significantly greater number of patients were discharged as expected by the protocol if they did not have an NG tube (and if they were referred to an in state treatment program) (Table 5). Patients with an NG tube and referred to an out-of-state treatment program were more likely to experience an extended LOS. No significant difference in LOS category was found with other demographic and anthropometric variables.

Table 5: Demographic and Clinical Characteristics by Length of Stay Category

Characteristic	Expected LOS ≤9 days n (%)	Extended LOS >9 days n (%)	Significance
Gender			
Male	3 (4)	1 (2)	p=0.628
Female	34 (52)	27 (42)	
Type of Insurance			
Private	32 (49)	26 (40)	p=0.689
Medicaid	5 (8)	2 (3)	
Mode of Nutrition Therapy			
No NG Tube	26 (40)	8 (12)	**p=0.001**
NG Tube	11 (17)	20 (31)	
DISPO Treatment Program Location			
In State	29 (45)	13 (20)	**p=0.008**
Out of State	8 (12)	15 (23)	
BMI Z-score* (n)	-1.82 ± 1.51 (36)	-2.58 ± 1.74 (28)	p=0.078

*Mean ± SD
LOS – length of stay, DISPO – disposition after discharge; BMI – body mass index

CHAPTER V

DISCUSSION AND CONCLUSIONS

We examined demographic, anthropometric, and clinical characteristics of children and adolescents hospitalized with a diagnosis of AN or BN. The majority of patients admitted were Caucasian and female with a mean age of 14.6 years and a primary diagnosis of AN restrictive type. Most patients had private insurance. The median hospital stay was 9 days, which is what was expected but slightly longer than the 8.1-day national average for all age groups.[7] Of the factors that we examined that might affect LOS, statistical significance was found with mode of nutrition therapy and discharge treatment program location. For patients who were discharged to an in-state treatment program, there was a statistical significance between LOS and malnutrition status. Longer lengths of stay were determined to be significantly associated with having an NG tube and having been referred to an out-of-state treatment program. Therefore, we reject the null hypotheses that LOS would not differ by mode of nutrition therapy and discharge treatment program location.

Inpatient demographic characteristics in the present study were consistent with previous studies examining pediatric patients with EDs and LOS, which reported that the majority of patients were female, an average of 15-16 years of age, and primarily diagnosed with AN.[5,6,9,10,15] Studies that have examined children and adolescents only diagnosed with AN also report similar findings with regard to gender and the average age

(15-16 years).[11–13] Additionally, Fraga and colleges (2015) report a similar mean age (14.99 ± 1.55) and AN restrictive type to be a more prominent diagnosis than AN bingeing/purging type (n=65 vs. n=21, respectively).[14] Of the studies that reported race, most patients admitted were Caucasian; however, it is evident that EDs affect other racial groups as well.[6,10] Since race was a self-reported demographic factor in our study and subject to response bias, it is possible that the actual race counts and percentages are different. Zhao and Encinosa (2011) who examined national ED hospitalizations from 1999-2000 also found the majority of patients to be female.[7] The study; however, included subjects of all age groups, Medicare recipients, and other ED diagnoses. With respect to insurance, other studies found that most patients had private insurance while only a small percentage had Medicaid, which is consistent with the current study.[6,9,10]

The median LOS in our study (9 days) was congruent with many previous studies (8-18 days)[6,7,9,10,12,13] while others[5,11,14,15] reported a much longer mean or median LOS (35+ days). However, the spread around the mean (SD = 16.9 to 29.1 days) was much wider in some studies.[6,10] One of the predictors of LOS is having a diagnosis of AN vs. BN.[9] However, we were not able to determine this relationship since no patients in our study were diagnosed with BN. Instead, we examined the association between AN subtypes and LOS but found no significance. Calderon and colleagues (2007) found a longer LOS to be related to being admitted to a psychiatric unit vs. intensive care unit or medical intensive care unit.[6] We were not able to examine this variable because CHOA does not have a med-psych unit.

Another predictor of LOS is having a reduced BMI upon admission during the cold vs. warm semesters for adolescents with AN restrictive type.[14] In our study, we

looked at admission BMI z scores and their corresponding BMI category/malnutrition status, which are adapted from BMI. However, we did not include a variable to assess season of admission. We found that the BMI upon admission for our population to be consistent with previous studies (15.7-16.7 kgm^2).[11–15] After investigating the link between LOS and BMI z score, LOS was found to be negatively correlated with BMI z score. It could be interpreted that a lower growth percentile and a more severe malnutrition status may be related to a longer LOS, but not significantly. Also, patients discharged to in-state treatment programs had a significantly longer LOS, with the greatest difference observed between those who were moderately malnourished compared to those with no risk for malnutrition. We believe this relationship was discovered because malnutrition status may have an impact on medical stabilization and recovery time.

We found no significance between LOS and BMI category/malnutrition status with patients discharged to an out of state facility. Regardless of malnutrition status, patients generally experienced an increased number of days in the hospital, which may have been due to the logistics of sending children and adolescents out-of-state. We discovered that LOS was significantly longer in patients discharged to out-of-state vs. in-state treatment programs (10 vs. 8 days, respectively; $p<0.01$). In Georgia, there are no residential treatment programs and patients must be sent out-of-state. Therefore, it is important to be aware that this factor affects LOS in order to determine that more facilities are needed in the state of Georgia. Also, it is more difficult to find placement for patients under the age of 13 years because many specialized facilities are not licensed for

a child ED program. However, we found no statistical significance when comparing children <13 years old and LOS.

In a study with a similar design that examined children and adolescents with an ED from statewide New York hospitals, Robergeau and colleagues (2006) found patients with Medicaid to have a significantly longer LOS but found no significance with age, gender or race.[10] The authors stated that the reasons for a longer LOS could have been due to these patients having the most severe cases of EDs from delayed treatments. Contrary to this report, we found that a longer LOS was not significantly associated with insurance. However, we also observed no difference in LOS by age, gender or race. This difference may be due to our small sample size and the percentage of pediatric patients with Medicaid. Although it is more difficult to find specialized treatment centers that accept males in Georgia, we did not observe a significantly longer LOS with males. We cannot say if this is the case for hospitals nationwide or statewide since this study examined only one pediatric hospital in the state of Georgia. Therefore, future studies should include a larger population of males and examine gender differences compared to LOS in pediatric hospitals statewide and nationwide.

This study has several limitations. Our sample size was relatively small compared to previous studies and included few males or patients with Medicaid insurance (n=65). We considered only patients who were diagnosed with AN or BN since the CHOA ED protocol is only used with children who have these diagnoses. Additionally, we excluded patients under the age of 9 years since AN and BN is not predominant in this age group.[6,31] We also excluded patients who left before an assessment could be completed.

Another limitation was the lack of nutritional intake data, specifically calories. Previous studies examining hospital protocols and LOS reported a significantly shorter LOS with patients put on lower caloric prescriptions.[11–13] These protocols differed from the protocol at CHOA because they focused primarily on nutrition and specified only two discharge criteria (e.g., patients must be medically stable for 24 hours and have a mean BMI >75%).[5,11–13,15] The studies examining caloric prescriptions and LOS were able to examine high vs. low calorie groups since prescriptions were lower in previous years because of the concern for refeeding syndrome. Although refeeding syndrome continues to be a concern, it is now generally accepted that higher calories than what was initially suggested in 2008-2010 doesn't present any additional risk.[11–13] Due to the many components influencing caloric prescriptions, we decided not to examine this variable. Energy requirements are individualized based on a patient's age, weight, risk for refeeding, and caloric intake prior to admission. Since this information wasn't examined in our study, it is difficult to compare our results to Agostino and colleagues (2013), which found that being placed on an NG tube with higher caloric prescriptions vs. low calorie oral bolus feedings resulted in a shorter LOS.[11] In the present study, we found a longer LOS to be significantly associated with patients who had an NG tube placed vs. an oral diet only. Future studies should examine caloric prescriptions in order to determine if having an NG tube placed is associated with a longer LOS, independent of calorie intake.

Conclusion

The present study provides healthcare professionals with additional data regarding the demographic, anthropometric and clinical characteristics of pediatric patients who are

admitted to a pediatric hospital with an ED. It is important to continue to examine these characteristics as they relate to medical and nutritional outcomes so that inpatient and outpatient treatment protocols can be adjusted to meet the needs of the population. The longer lengths of stay that were observed in those who had an NG tube placed may have been due to patient lack of compliance with an oral regimen, failure to gain weight, and severity of malnutrition since more time is needed for medical recovery. The addition of treatment centers in the state of Georgia for children and adolescents with an ED may reduce hospital LOS. Future studies should include a larger population of children and adolescents that include a greater percentage of males.

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APPENDIX A

CHOA INPATIENT EATING DISORDER PROTOCOL