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The Importance of Specialized Inpatient Medical Stabilization for Weight Restoration of Individuals with Extreme Eating Disorders

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Abstract

Inpatient care is a significant contributor to the health-care costs associated with the treatment of individuals with eating disorders (EDs). This study seeks to better understand the treatment outcomes of individuals with extreme EDs requiring inpatient medical stabilization at specialized medical versus nonspecialized medical units. Patients transferred via air ambulance to ACUTE Center for Eating Disorders and Severe Malnutrition (specialized care) from an outside hospital (nonspecialized care) between January 2022 and March 2024 were included in this retrospective, non-randomized cross-over trial. Weekly weight trends, length of stay, unit on which patients received medical care, and development of medical complications after admission were compared between the nonspecialized the specialized inpatient medical stabilization units. Final analysis included 92 patients. Those with restricting EDs experienced an average of -0.9 kg/week of weight gain while receiving nonspecialized medical care, compared to 1.6 kg/week of weight gained at the specialized medical

stabilization unit. Individuals with purging EDs experienced an average of -0.2 kg/week weight change at the nonspecialized medical units compared to 1.7 kg/week gained at the specialized unit, after excluding patients who developed complications related to improper fluid management. Patients were also more likely to be treated in an intensive care unit and develop increased iatrogenic complications while receiving nonspecialized medical treatment compared to those patients treated on a specialized ED unit. Specialized, inpatient medical care for those with extreme EDs is associated with positive weight trends and reduced rates of iatrogenic complications, compared to nonspecialized inpatient medical care.

Keywords
Anorexia nervosa; hospital; malnutrition; weight gain; nutrition; medical complications

1. Introduction

Treatment outcomes for anorexia nervosa (AN) have not improved since the mid-20th century [1, 2], contributing to the ongoing high mortality rate associated with this illness [3]. Moreover, AN is associated with substantial direct and indirect health-care costs, the majority of which is attributable to the expense of hospitalization [4, 5]. Lower body mass index (BMI), need for enteral feeds, older age, multiple prior admissions, and increased comorbidities are also significant contributors to this cost [6-10].

Treatment recommendations for the different levels of eating disorder (ED) care differ amongst the treatment guidelines published by the National Institute for Health and Care Excellence (NICE) [11], Royal Australian and New Zealand College of Psychiatrists (RANZCP) [12], and the American Psychiatric Association (APA) [13]. However, inpatient medical stabilization is generally recommended for: significant bradycardia, hypotension/orthostasis, hypoglycemia, electrolyte disturbances, organ compromise, and/or a significantly low BMI (generally <15 kg/m^2). Options for inpatient care can include hospitalization at: (1) specialized medical/pediatric ED units, (2) nonspecialized general medical/pediatric units, (3) specialized ED psychiatric units, and (4) nonspecialized general psychiatric units [13]. Medical/pediatric programs generally offer greater medical oversight as well as more numerous treatment interventions, such as the ability to provide intravenous fluids (IVF) and enteral nutrition, as compared to inpatient psychiatric programs [13].

Safe weight restoration is above all the primary goal for individuals when at such extremely low body weights. Cessation of purging behaviors and attention to the medical complaints inherent to this patient population are also critical to achieve medical stabilization of these patients with extreme forms of EDs [14], as well as psychotherapy to address the underlying cognitions of the ED. Indeed, high kilocalorie (kcal) refeeding (i.e., 3500-4500 kcal/day) is considered a cost-effective, evidence-based intervention for AN and is associated with increased rates of weight restoration with reduced medical complications [15-18]. Clinical consensus recommends a weight gain of 0.9-1.8 kg/week for individuals in inpatient or residential programs, 0.45-1.36 kg/week in partial hospital programs, and 0.45-0.9 kg/week in outpatient programs [13].

However, safe weight restoration of individuals with EDs can be arduous. First, most clinicians receive little to no medical training regarding the treatment or medical complications of EDs during

their residencies, leading to a lack of general knowledge in this field [19]. Second, there are inherent biases in treating those with EDs, even amongst healthcare professionals, which can further impact the barrier to treatment [20, 21]. In addition, AN is an egosyntonic illness [22], meaning patients often do not desire weight gain or additional treatment for their illness and will frequently engage in various surreptitious behaviors to prevent weight restoration, which will often go undetected by those unfamiliar with these illnesses.

No studies have examined weight restoration outcomes for patients with EDs admitted to nonspecialized inpatient medical/pediatric units and their associated medical complications, versus those admitted to a specialized inpatient ED medical stabilization unit. The purpose of this study is to better understand treatment outcomes of patients presenting to nonspecialized inpatient units, specifically regarding rates of weight restoration and development of medical complications during hospitalization. It also seeks to understand how these outcomes compare to those at an inpatient ED unit which specializes in the medical stabilization of individuals with extreme EDs.

2. Materials and Methods

2.1 Population

ACUTE Center for Eating Disorders and Severe Malnutrition (ACUTE) is an inpatient hospital unit, designated as a center of excellence in 2018 by Anthem Health, that specializes in the medical stabilization of adolescents and adults (ages 15+ years) with the most critically low BMIs and/or medical complications related to extreme forms of EDs or malnutrition from other causes. Criteria for admission to ACUTE generally includes one or more of the following: weight less than 70% of the patient's ideal body weight (IBW) or a BMI < 14.5 kg/m^2, serious medical complications resulting from their starvation and/or psychiatric comorbidities, a history of significant refeeding syndrome, severe purging behaviors resulting in electrolyte aberrations, and patients who continue to lose weight or experience increased medical complications at lower levels of ED care. Once patients are deemed medically stable, they transition to a lower level of care for continued behavioral health treatment for their ED.

In this retrospective non-randomized cross-over study, all patients who admitted to ACUTE between January 2022 and March 2024 were eligible for enrollment if they directly transferred to ACUTE from the nonspecialized general medical or pediatric units via air ambulance, thereby preventing the patient from engaging in any behaviors that would have resulted in weight manipulation, such as purging or excess fluid consumption.

2.2 Unit Protocols

Multidisciplinary staff, including internists, psychiatrists, registered dieticians, clinical psychologists, physical therapists, occupational therapists, social workers, nurses, and certified nursing assistants provide individualized care in the medical complications and refeeding of people with extreme malnutrition at ACUTE. Vital signs and point of care fingerstick glucose levels are obtained in supine position every four hours on admission, with a reduction in frequency pending increased medical stability. Serum chemistries and hematology measures are obtained regularly during the first week of admission, with titration of frequency based on medical stability. Prophylactic supplementation of electrolytes are not prescribed.

Meal plans are prescribed by a registered dietician. All patients on admission are prescribed similar kcal (1400 kcal/daily for females, 1800 kcal/daily for males) spread throughout the day amongst three meals and three snacks, with 400 kcal increases every 2-3 days until weight trends of 1.36-1.8 kg/week are achieved. Nasogastric feeds are used in place of or to supplement oral nutrition, depending on the needs of the patient and/or the need for medical stabilization. Parenteral nutrition is utilized only when patients have a gastrointestinal condition warranting its use, require nothing by mouth status for an extended amount of time, or, rarely, when patients are engaging in excessive purging behaviors that are unable to be controlled with enteral nutrition. Certified nursing assistants, specially trained in the care of individuals with EDs, monitor patients during all meals/snacks to ensure completion of the prescribed kcal, and they monitor patients for any surreptitious behaviors during all bathroom visits.

The primary therapeutic intervention utilized by the psychologists at ACUTE consists of specialist supportive clinical management (SSCM), although all other therapeutic modalities are utilized, dependent on the patients' BMIs and mental health needs [23]. Patients can also receive court-mandated treatment for their EDs when meeting certain criteria that deem them to be at risk for imminent danger to themselves, especially without continued nutritional rehabilitation and/or continued generalized treatment for their ED. Patients who were placed under short term certification (court-mandated care) at any point during their hospitalization were recorded as such.

Body weight measurements at ACUTE are obtained at the same time daily in a blinded manner while the patient wears only a gown. Weekly weight gain at ACUTE and the nonspecialized medical units was calculated by dividing the absolute weight gain (discharge weight minus admission weight) by the length of stay in weeks.

2.3 Measures

Outside records received from the nonspecialized hospital units were reviewed for measured body weight within 24 hours of hospital admission, measured body weight on the day of hospital discharge, length of stay, the unit on which the patient received most of their hospital care, and medical complications resulting directly from their malnutrition that developed during hospitalization. Since most patients did not have repeat body weights included in the medical records sent from the transferring facility, total weight gain at the nonspecialized inpatient unit was calculated by subtracting the initial body weight recorded within 24 hours of arrival to the outside hospital from the initial body weight measured upon admission to ACUTE; however, total weekly weight gain at the nonspecialized units was calculated using the measured body weight on the day of transfer when this was documented in the records. Self-reported weights, when documented as such, were excluded from the analysis.

Complications resulting from the medical care were obtained by chart review for each patient but only those complications that were experienced by more than one individual in this cohort were included in the final analysis. Medical complications that were present on admission were excluded from this analysis, since these complications were not a manifestation of the hospital care provided. Medical complications included the following critical electrolyte values: hypophosphatemia ≤1.1 mg/dL, hypoglycemia ≤30 mg/dL, hyponatremia ≤120 mmol/L, and hypernatremia ≥155 mmol/L. Patients were considered to have underwent extensive workup for liver disease if they completed a multitude of testing including: infectious workup, autoimmune workup, testing for genetic

diseases such as Wilson's disease, or liver biopsy. Patients who received any amount of care in the intensive care unit (ICU) were recorded as such, regardless of the amount of time spent there.

Given the physiologic changes associated with purging behaviors which ultimately impact weight trends, patients were classified into purging and restricting cohorts [24]. Any patient who engaged in compensatory purging behaviors to prevent weight gain, such as vomiting or laxative and diuretic abuse, or patients who were experiencing excessive non-volitional loose stools or emesis were classified into the purging cohort. All other patients were classified into the restricting cohort.

2.4 Statistical Analysis

Baseline demographic data are presented in tabular form. Univariate statistics, including frequencies, percentages, ranges, means and standard deviations were used to describe the sample. Demographic and clinical variables were summarized descriptively, with count and percentage for categorical variables, and mean, standard deviation (SD), median, and range for continuous variables. Bivariate analysis comparing groups of interest was done using chi-squared tests, two-sample t-tests, or Mann-Whitney U test, as appropriate. P-values < 0.05 were considered significant.

2.5 Ethics Statement

The study was evaluated by the Colorado Multiple Institutional Review Board and was determined to be exempt from institutional review board approval due to the retrospective nature of this study and use of only secondary data (COMIRB #24-0763; April 24, 2024).

3. Results

A total of 99 patients directly transferred from a nonspecialized inpatient unit to ACUTE via air ambulance between January 2022 and March 2024 (15% of all the admissions to ACUTE during this time period). Four patients were excluded due to missing records, two patients were excluded due to early discharge from ACUTE, and one patient was excluded due to receiving most of her care on an inpatient behavioral health unit prior to receiving care at ACUTE, resulting in 92 patients included in the final analysis. Twenty-three patients (25%) did not have a measured body weight within 24 hours of admit to the nonspecialized medical or pediatric units, and only nine (10%) patients' records included a measured weight on the day of discharge. A majority of the patients were female (92%), average age was 29.7 years, and they had been suffering from their ED for an average of 11.6 years. Average BMI on admission to ACUTE was 12.1 kg/m^2. Fifteen percent of patients required treatment in an ICU while receiving care at the nonspecialized inpatient units, compared to 3% requiring ICU transfer while receiving care at ACUTE ($p = 0.0109$). Parenteral nutrition (PN) was also utilized in 11 patients (12%) at the nonspecialized inpatient units compared to 5 patients (5%) receiving care at ACUTE ($p = 0.1908$), whom received PN for the following reasons: prolonged transition off PN that was being administered on admission (two individuals), ileus, intractable nausea and vomiting, and extreme purging behaviors that could not first be controlled with jejunal feeds. Table 1 depicts the demographics of the participants from this study, separated into restricting and purging cohorts.

Table 1 Demographic and Clinical Characteristics of restricting and purging cohorts upon admission to ACUTE. Variables are presented as mean (SD) or count (%), unless otherwise noted.

	Purging Cohort (n = 26)	Restricting Cohort (n = 66)
Age, Mean (SD), [Range]	27.2 (10.9), [16–56]	30.7 (13.5), [16–62]
Female Sex	24 (92%)	57 (86%)
Duration of ED, Mean (SD), [Range]	9.2 (7.5), [1–28]	12.4 (12.9), [0.5–50]
ED Diagnosis		
AN-BP	25 (96%)	0 (0%)
AN-R	0 (0%)	55 (83%)
ARFID	0 (0%)	5 (8%)
OSFED	1 (4%)	6 (9%)
Admit kg	35.3 (6.6)	33.3 (10.2)
Discharge kg	44.7 (7.1)	42.8 (8.4)
Total gained weight (kg)	9.4 (5.1)	9.5 (5.0)
Height (inches)	65.8 (3.0)	65.5 (3.4)
Admit % IBW	60.8 (8.1)	57.3 (10.0)
Discharge % IBW	77.1 (7.7)	74.4 (6.4)
Admit BMI (kg/m^2)	12.6 (1.8)	11.9 (2.6)
Discharge BMI (kg/m^2)	16.0 (2.0)	15.4 (1.8)
Area of hospitalization prior to transfer		
General Medicine	14 (54%)	47 (71%)
Intensive Care Unit	6 (23%)	8 (12%)
Eating Disorder Unit	1(4%)	1 (2%)
General Pediatrics	1 (4%)	2 (3%)
Adolescent Medical Unit	0 (0%)	2 (3%)
Unclear from records	4 (15%)	6 (9%)

Abbreviations: AN-BP: anorexia nervosa binge/purge subtype; AN-R: anorexia nervosa restricting subtype; ARFID: avoidant restrictive food intake disease; BMI: Body mass index; ED: eating disorder; IBW: ideal body weight; kg: kilogram; m: meter; OSFED: other specified feeding and eating disorder; SD: standard deviation.

The restricting cohort averaged -0.9 kg of weight gain/week (median -0.7 kg/week) at the nonspecialized inpatient units before transfer to ACUTE, where they averaged 1.6 kg/week of weight gain (median 1.7 kg/week) ($p < 0.001$). The purging cohort experienced a mean weekly weight gain of 2.1 kg (median of 0.3 kg/week) at the nonspecialized inpatient units but this reduced to a mean weekly weight change of -0.2 kg/week (median weekly weight gain of 0.2 kg/week) after excluding patients who were provided aggressive IVF upon hospitalization, an intervention that contributes to a complication known as pseudoBartter syndrome (described below); the purging cohort at ACUTE averaged a weekly weight gain of 1.7 kg (median 1.8 kg/week) ($p < 0.001$). These six individuals, who were prescribed aggressive IVF at the nonspecialized inpatient units, recorded a mean weekly weight gain of 6.95 kg, with one patient gaining 8.5 kg during three days of hospitalization.

The average length of stay (LOS) for individuals with a purging history was 23.1 days at the nonspecialized inpatient units, compared to 36.4 days at ACUTE (p = 0.017). The average LOS for individuals with a restricting history was 17.5 days at the nonspecialized inpatient units, compared to 37.8 days at ACUTE (p < 0.001). Table 2 compares the LOS and weekly weight changes between ACUTE and the nonspecialized inpatient units. LOS and weekly weight gain were significantly different between the specialized and the nonspecialized inpatient medical stabilization units, with greater rates of weight gain and longer LOS at ACUTE. Twenty-eight percent of this cohort also received court-mandated treatment while hospitalized at ACUTE but this did not have any impact on LOS (p = 0.1279) or weekly weight gain (p = 0.6562) (Table 3).

Table 2 Comparison of length of stay and weight trends between nonspecialized hospital units and ACUTE (specialized). The table below reports. P-values are based on a paired t-test. Values listed below the specialized and nonspecialized columns are reported as Mean (SD), Median [Range].

Outcome	Cohort	Specialized Unit	Nonspecialized Unit	P-value
Length of stay (weeks)	Purging	5.2 (2.5), 4.4 [1.7, 13.6]	3.3 (4.4), 2.0 [0.1, 21.4]	0.017
	Restricting	5.4 (2.4), 5.3 [0.9, 16.9]	2.5 (2.1), 1.7 [0.1, 8.4]	<0.001
Weekly weight change (kg)	Purging	1.9 (1.0), 1.9, [-0.6, 5.0]	2.1 (5.5), 0.3, [-2.7, 19.8]	0.040
	Purging (removal of patients with PB syndrome; n = 6)	1.7 (0.5), 1.8, [0.6, 2.6]	-0.2 (1.1), 0.2 [-2.7, 1.3]	<0.001
	Restricting	1.6 (0.7), 1.7 [-2.1, 2.8]	-0.9 (2.1), -0.7 [-5.8, 3.1]	<0.001

Abbreviations: kg: kilograms; OSH: outside hospital; PB: pseudo Bartter.

Table 3 Comparison of outcomes between patients receiving court-mandated treatment versus voluntary treatment. Values are reported as Mean (SD), unless otherwise noted. P-values are based on paired t-test or Mann-Whitney U test.

	Voluntary (n = 66)	Mandated (n = 26)	P-value
Length of stay (weeks), Median [Range]	5.0 [0.9–9.6]	5.5 [2.6–16.9]	0.1279
Weekly weight change (kg)	1.7 (1.0)	1.8 (0.4)	0.6562
Total weight gained (kg)	8.8 (4.7)	11.1 (5.4)	0.0668
Admit % IBW	59.8 (9.9)	54.7 (7.7)	0.0109
Discharge % IBW	75.5 (6.8)	74.4 (7.1)	0.5173
Admit BMI (kg/m^2)	12.4 (2.5)	11.2 (1.8)	0.0124
Discharge BMI (kg/m^2)	15.6 (1.7)	15.3 (2.1)	0.4636

Abbreviations: BMI: body mass index; IBW: ideal body weight; kg: kilograms; m: meter.

Patients also developed increased complications at the nonspecialized medical units. Thirteen individuals underwent extensive testing for their elevated liver function tests at the nonspecialized

inpatient units prior to transfer to ACUTE, where only three patients underwent testing (p = 0.0185). Eleven patients at the nonspecialized inpatient units developed critical electrolytes during hospitalization compared to only one of the individuals receiving care at ACUTE (p = 0.0072). Four patients developed pressure wounds while hospitalized at the nonspecialized units, with zero individuals developing pressure wound while receiving care at ACUTE (p = 0.1294). Table 4 describes these complications during hospitalization at the nonspecialized units versus ACUTE.

Table 4 Number of individuals developing complications during hospitalization.

Complication	Nonspecialized Unit	Specialized Unit (ACUTE)	P-value
Extensive evaluation for elevated liver function tests	13 (14%)	3 (3%)	0.0185
Critical Laboratory values ● Hypophosphatemia ● Hypoglycemia ● Abnormal sodium	11 (12%)* ● n = 3 ● n = 6 ● n = 3	1 (1%) ● n = 0 ● n = 0 ● n = 1	0.0072
Aggressive IVF in those with purging history	6 (23%)	0	0.0380
Hospital acquired pressure wound	4 (4%)	0	0.1294

Abbreviations: OSH: outside hospital; TPN: Total parenteral nutrition.

*1 patient developed both critical hypophosphatemia and hypoglycemia.

4. Discussion

The findings of this study support the importance of specialized inpatient medical care for individuals with extreme EDs requiring medical stabilization. Patients admitted to an inpatient medical stabilization ED unit (ACUTE) safely underwent faster rates of weight gain with development of fewer medical complications, while patients receiving nonspecialized inpatient medical care experienced negative weight trends with additional weight loss, experienced increased development of medical complications, and utilized higher frequency of care in the ICU, all contributing to the increased healthcare costs associated with this illness—all considered complications of underfeeding syndrome [25, 26]. There were no instances of refeeding syndrome at ACUTE, notwithstanding the faster weight gain.

Studies in AN show that higher BMI and faster rate of weight gain are associated with better short- and long-term outcomes [27-31]. Limited additional research is similarly suggestive that outpatient specialized services for adolescents with EDs are cost-effective and lead to improved outcomes [32-34]. These improved outcomes for specialized inpatient ED services are similar to the better outcomes for patients receiving care at specialized cancer treatment centers and highly-ranked cardiovascular treatment centers [35-37]. These findings all support the adage that volume does equal quality for complex medical-surgical conditions. Multidisciplinary teams with experience caring for the nuanced medical, psychological, and metabolic complications associated with extreme EDs are better able to anticipate potential complications and proactively intervene, as opposed to hospital providers whom only rarely encounter individuals with extreme EDs. The relative infrequency of patient encounters with extreme EDs combined with the egosyntonic nature of the illness and that ED patients often require increased time-intensive care, lend itself to poor

outcomes in nonspecialized hospital settings. Indeed, healthcare professionals inexperienced in treating individuals with EDs encounter many barriers contributing to the suboptimal care [38]. Court-mandated treatment is another intervention that can be utilized in certain situations when patients are increasingly resistant to medical and/or mental health care, but this was only utilized in a small minority of individuals in this study, and it did not have a significant impact on weekly weight gain while undergoing treatment at ACUTE.

Not only did patients experience the desired more aggressive weight trends at ACUTE but they also experienced a reduced frequency of complications related to their care. One of these complications that is relatively unknown to providers who infrequently treat individuals with EDs is known as pseudoBartter syndrome [39]. PseudoBartter syndrome is a complication that often develops in those with a significant purging history who receive aggressive fluid repletion for either electrolyte abnormalities and/or to normalize intravascular volume. Their baseline state of intravascular depletion causes chronically increased aldosterone levels to maintain their blood pressure and prevent syncope, and it contributes to the development of hypokalemia that is more commonly reported in those with a purging history as well as, frequently, a metabolic alkalosis. The elevated aldosterone also contributes to the sodium and water retention upon refeeding which can result in unsightly edema formation and overly aggressive weight gains. Indeed, 22% of those with a purging history, who were provided aggressive IVF during admission to the nonspecialized units, averaged 6.95 kg/week of weight gain. This is very distressing to a population of patients who are tormented badly by body image and body dysmorphia issues.

Starvation hepatitis is another complication encountered in about 50% of those with an extreme ED [40]. Starvation hepatitis causes increased AST and ALT due to autophagy of the liver, or programmed cell death, as a means to provide nutrients stored in the liver to the rest of the organs of the body. Weight restoration causes improvement in serum values but lack of knowledge of this diagnosis leads to over-utilization of diagnostic tests, including liver biopsy, to evaluate the increased serum values.

Critical electrolyte aberrations developed in 11 patients (12%) at the nonspecialized inpatient units as opposed to only 1 patient (1%) developing hyponatremia while admitted at ACUTE. Individuals with EDs are at risk for hypoglycemia due to depleted glycogen stores and disrupted hepatic gluconeogenesis, which contributes to the increased mortality in this population [41]. Aggressive weight restoration ultimately normalizes the glycogen stores and restores metabolic pathways that allow for gluconeogenesis. Hypophosphatemia is also a common iatrogenic cause of increased morbidity and mortality during inpatient medical stabilization. As nutrition is introduced, and the body switches from a catabolic to an anabolic state, the insulin release due to increased glucose intake causes movement of phosphorous intracellularly, further depleting serum phosphorous that is needed by metabolically active organs to generate adenosine triphosphate (ATP). If this refeeding hypophosphatemia is not aggressively corrected, patients are at increased risk for development of the dangerous refeeding syndrome, characterized by the pentad of hemolysis, rhabdomyolysis, heart failure, seizures, and respiratory insufficiency. Low BMI is indeed the greatest predictor for development of refeeding hypophosphatemia [42]. Excessive water loading, especially in the setting of impaired renal water diuresis due to low solute intake, substantially increases the risk to develop hyponatremia, especially when patients are not directly monitored for this potential complication [43]. However, some individuals with EDs will also volitionally restrict fluids, thereby increasing the risk to develop hypernatremia [44]. The protocols

at ACUTE proactively address these electrolyte concerns, thereby minimizing the risk of development.

Malnourished individuals are at risk for pressure wounds due to the reduced subcutaneous tissue resulting from their starvation; in addition, many individuals with extreme EDs are put on bedrest when admitted to nonspecialized inpatient units due to their sarcopenia. Although only a small percentage of individuals developed this complication at nonspecialized units, this further adds to healthcare costs, and the Center for Medicare and Medicaid (CMS) no longer provides reimbursement for pressure ulcers that develop as a complication of hospital admission.

Another important finding from this study was the lack of accurate body weights obtained at outside hospitals. Not only is an accurate weight on hospital admission considered a best practice by different institutions, especially in this malnourished population, given the importance of body weight for medication dosing, refeeding protocols, and other diagnostic purposes [45]. Twenty five percent of patients did not undergo weight measurement within 24 hours of admission, and many patients did not have any additional documented body weights during their admission to the nonspecialized units, despite their severe protein calorie malnutrition.

One limitation of this study is that many of the reviewed medical records were incomplete, often with many consecutive days of hospitalization records missing, which resulted in some missing data from the nonspecialized medical stabilization units. However, this likely lent itself to under-estimation of the number of complications while at the nonspecialized medical units. It is possible that measured body weights were indeed checked more frequently than discussed above. It is also unclear if these nonspecialized inpatient units weighed patients in a manner similar to the protocol at ACUTE, which could contribute to inaccuracies in the calculated weight changes while at the nonspecialized units. However, the mean difference in the ACUTE admission weight versus the discharge weight from the nonspecialized units, for the nine patients with a documented discharge weight at the nonspecialized units, was 0.09 kg (SD = 0.8), suggesting accuracy of the weights between the two facilities. Furthermore, given the average LOS of 3.3 and 2.5 weeks for the two cohorts at the nonspecialized units, any meaningful weight gain at the nonspecialized units would have resulted in positive weight trends as opposed to the negative weight trends that were calculated in this study. Likewise, weighing patients in a blinded manner, per protocol at ACUTE, may have positively impacted the weekly weight trends, although this is psychologically disadvantageous in that it encourages avoidance behavior as the patients are not confronted with body weight information that is a critical part of treatment. Similarly, bioimpedance testing was not utilized, and, therefore, true weight gain versus fluid retention during early refeeding could not be analyzed. An additional limitation includes the inherent issues associated with a retrospective study. Furthermore, the sample size of this study was relatively small, limiting the statistical analysis. Finally, the generalizability of this study is limited to those individuals with extreme EDs.

5. Conclusions

The findings of this study support the need for increased utilization of a specialized medical stabilization unit for ED patients requiring hospitalization. This is based in much greater rates of desired weight gain and less complications as a result of refeeding and hospitalization itself compared to care provided by nonspecialized inpatient medical stabilization units. Hospital providers infrequently encounter individuals with extreme EDs, thereby limiting development of

clinical protocols and education of staff on this condition, which contribute to the reduced quality of care that these patients experience in nonspecialized inpatient units. The findings of this study add to the limited but burgeoning research showcasing better outcomes and cost-effectiveness of specialized care for those suffering from EDs.

Author Contributions

Dennis Gibson: Conceptualization; Methodology; Data curation; Writing – original draft, review, and editing; Supervision. Amy Stein: Formal analysis; Writing – original draft, review, and editing. Marina Foster: Project administration. Philip S Mehler: Writing – original draft, review, and editing; Supervision.

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Competing Interests

The authors have declared that no competing interests exist.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to the privacy or ethical restrictions.

References

1. Murray SB. Updates in the treatment of eating disorders in 2019: A year in review in eating disorders: The Journal of Treatment & Prevention. Eat Disord. 2020; 28: 21-31.
2. Steinhausen HC. The outcome of anorexia nervosa in the 20th century. Am J Psychiatry. 2002; 159: 1284-1293.
3. Arcelus J, Mitchell AJ, Wales J, Nielsen S. Mortality rates in patients with anorexia nervosa and other eating disorders: A meta-analysis of 36 studies. Arch Gen Psychiatry. 2011; 68: 724-731.
4. Deloitte Access Economics. The social and economic cost of eating disorders in the United States of America: A report for the strategic training initiative for the prevention of eating disorders and the academy for eating disorders [Internet]. Deloitte Access Economics; 2020. Available from: https://www.hsph.harvard.edu/striped/report-economic-costs-of-eating-disorders/.
5. Stuhldreher N, Wild B, König HH, Konnopka A, Zipfel S, Herzog W. Determinants of direct and indirect costs in anorexia nervosa. Int J Eat Disord. 2015; 48: 139-146.
6. Haas L, Stargardt T, Schreyoegg J, Schlösser R, Danzer G, Klapp BF. Inpatients costs and predictors of costs in the psychosomatic treatment of anorexia nervosa. Int J Eat Disord. 2012; 45: 214-221.
7. Marchili MR, Bozzola E, Guolo S, Marchesani S, Spina G, Mascolo C, et al. Pediatric acute hospitalization for anorexia nervosa: An economic evaluation. Ital J Pediatr. 2024; 50: 33.

8. Maguire S, Surgenor LJ, Abraham S, Beumont P. An international collaborative database: Its use in predicting length of stay for inpatient treatment of anorexia nervosa. Aust N Z J Psychiatry. 2003; 37: 741-747.
9. Makhzoumi SH, Coughlin JW, Schreyer CC, Redgrave GW, Pitts SC, Guarda AS. Weight gain trajectories in hospital-based treatment of anorexia nervosa. Int J Eat Disord. 2017; 50: 266-274.
10. Nozoe SI, Soejima Y, Yoshioka M, Naruo T, Masuda A, Nagai N, et al. Clinical features of patients with anorexia nervosa: Assessment of factors influencing the duration of in-patient treatment. J Psychosom Res. 1995; 39: 271-281.
11. National Institute for Health and Care Excellence. Eating disorders: Recognition and treatment [Internet]. London, UK: National Institute for Health and Care Excellence; 2020. Available from: https://www.nice.org.uk/guidance/ng69.
12. Hay P, Chinn D, Forbes D, Madden S, Newton R, Sugenor L, et al. Royal Australian and New Zealand College of Psychiatrists clinical practice guidelines for the treatment of eating disorders. Aust N Z J Psychiatry. 2014; 48: 977-1008.
13. American Psychiatric Association. Practice guideline for the treatment of patients with eating disorders. 4th ed. Washington, D.C.: American Psychiatric Association; 2023.
14. Leach K, Bauschka M, Watters A, Mehler PS. Medical and psychiatric features of patients hospitalized for severe restrictive eating disorders: Analysis of 545 consecutive patients with severe anorexia nervosa or avoidant/restrictive food intake disorder. J Acad Consult Liaison Psychiatry. 2024; 65: 347-356.
15. Faller J, Perez JK, Mihalopoulos C, Chatterton ML, Engel L, Lee YY, et al. Economic evidence for prevention and treatment of eating disorders: An updated systematic review. Int J Eat Disord. 2024; 57: 265-285.
16. Maginot TR, Kumar MM, Shiels J, Kaye W, Rhee KE. Outcomes of an inpatient refeeding protocol in youth with anorexia nervosa: Rady Children's Hospital San Diego/University of California, San Diego. J Eat Disord. 2017; 5: 1.
17. O'Connor G, Nicholls D, Hudson L, Singhal A. Refeeding low weight hospitalized adolescents with anorexia nervosa: A multicenter randomized controlled trial. Nutr Clin Pract. 2016; 31: 681-689.
18. Guarda AS, Cooper M, Pletch A, Laddaran L, Redgrave GW, Schreyer CC. Acceptability and tolerability of a meal-based, rapid refeeding, behavioral weight restoration protocol for anorexia nervosa. Int J Eat Disord. 2020; 53: 2032-2037.
19. Mahr F, Farahmand P, Bixler EO, Domen RE, Moser EM, Nadeem T, et al. A national survey of eating disorder training. Int J Eat Disord. 2015; 48: 443-445.
20. Evans EJ, Hay PJ, Mond J, Paxton SJ, Quirk F, Rodgers B, et al. Barriers to help-seeking in young women with eating disorders: A qualitative exploration in a longitudinal community survey. Eat Disord. 2011; 19: 270-285.
21. Ali K, Farrer L, Fassnacht DB, Gulliver A, Bauer S, Griffiths KM. Perceived barriers and facilitators towards help-seeking for eating disorders: A systematic review. Int J Eat Disord. 2017; 50: 9-21.
22. Gregertsen EC, Mandy W, Serpell L. The egosyntonic nature of anorexia: An impediment to recovery in anorexia nervosa treatment. Front Psychol. 2017; 8: 2273-2273.
23. Kiely L, Touyz S, Conti J, Hay P. Conceptualising specialist supportive clinical management (SSCM): Current evidence and future directions. J Eat Disord. 2022; 10: 32.

24. Mehler PS, Walsh K. Electrolyte and acid-base abnormalities associated with purging behaviors. Int J Eat Disord. 2016; 49: 311-318.
25. Garber AK, Michihata N, Hetnal K, Shafer MA, Moscicki AB. A prospective examination of weight gain in hospitalized adolescents with anorexia nervosa on a recommended refeeding protocol. J Adolesc Health. 2011; 50: 24-29.
26. Robinson P, Rhys Jones W. MARSIPAN: Management of really sick patients with anorexia nervosa. BJPsych Adv. 2018; 24: 20-32.
27. Castro J, Gila A, Puig J, Rodriguez S, Toro J. Predictors of rehospitalization after total weight recovery in adolescents with anorexia nervosa. Int J Eat Disord. 2004; 36: 22-30.
28. Errichiello L, Iodice D, Bruzzese D, Gherghi M, Senatore I. Prognostic factors and outcome in anorexia nervosa: A follow-up study. Eat Weight Disord. 2016; 21: 73-82.
29. Glasofer DR, Muratore AF, Attia E, Wu P, Wang Y, Minkoff H, et al. Predictors of illness course and health maintenance following inpatient treatment among patients with anorexia nervosa. J Eat Disord. 2020; 8: 69.
30. Lund BC, Hernandez ER, Yates WR, Mitchell JR, McKee PA, Johnson CL. Rate of inpatient weight restoration predicts outcome in anorexia nervosa. Int J Eat Disord. 2009; 42: 301-305.
31. Wales J, Brewin N, Cashmore R, Haycraft E, Baggott J, Cooper A, et al. Predictors of positive treatment outcome in people with anorexia nervosa treated in a specialized inpatient unit: The role of early response to treatment. Eur Eat Disord Rev. 2016; 24: 417-424.
32. Byford S, Barrett B, Roberts C, Clark A, Edwards V, Smethurst N, et al. Economic evaluation of a randomised controlled trial for anorexia nervosa in adolescents. Br J Psychiatry. 2007; 191: 436-440.
33. Byford S, Petkova H, Barrett B, Ford T, Nicholls D, Simic M, et al. Cost-effectiveness of specialist eating disorders services for children and adolescents with anorexia nervosa: A national surveillance study. J Eat Disord. 2021; 9: 76.
34. House J, Schmidt U, Craig M, Sandau S, Simic M, Nicholls D, et al. Comparison of specialist and nonspecialist care pathways for adolescents with anorexia nervosa and related eating disorders. Int J Eat Disord. 2012; 45: 949-956.
35. Birkmeyer NJO, Goodney PP, Stukel TA, Hillner BE, Birkmeyer JD. Do cancer centers designated by the National Cancer Institute have better surgical outcomes? Cancer. 2005; 103: 435-441.
36. Wolfson JA, Sun C, Wyatt LP, Hurria A, Bhatia S. Impact of care at comprehensive cancer centers on outcome: Results from a population-based study. Cancer. 2015; 121: 3885-3893.
37. Wang DE, Wadhera RK, Bhatt DL. Association of rankings with cardiovascular outcomes at top-ranked hospitals vs nonranked hospitals in the United States. JAMA Cardiol. 2018; 3: 1222-1225.
38. Johns G, Taylor B, John A, Tan J. Current eating disorder healthcare services—The perspectives and experiences of individuals with eating disorders, their families and health professionals: Systematic review and thematic synthesis. BJPsych Open. 2019; 5: e59.
39. Bahia A, Mascolo M, Gaudiani JL, Mehler PS. Pseudobartter syndrome in eating disorders. Int J Eat Disord. 2012; 45: 150-153.
40. Gibson D, Watters A, Cost J, Mascolo M, Mehler PS. Extreme anorexia nervosa: Medical findings, outcomes, and inferences from a retrospective cohort. J Eat Disord. 2020; 8: 25.
41. Mehler PS, Watters A, Joiner T, Krantz MJ. What accounts for the high mortality of anorexia nervosa? Int J Eat Disord. 2022; 55: 633-636.

42. Brown CA, Sabel AL, Gaudiani JL, Mehler PS. Predictors of hypophosphatemia during refeeding of patients with severe anorexia nervosa. Int J Eat Disord. 2015; 48: 898-904.
43. Boyd ED, Durant NH. Recurrent hyponatremia in a young adult woman with anorexia nervosa and the effects of insufficient communication. Int J Eat Disord. 2018; 51: 1378-1381.
44. Aamodt K, Fitzgerald SL, Hanono A, Majzoub J, Millington K, Richmond TK, et al. Severe hypernatremia in an adolescent with anorexia nervosa. Clin Pediatr. 2021; 60: 586-590.
45. Bhalodia A, Hammam M, Paparella SF. Weight! Weight! … Don't Tell Me. J Emerg Nurs. 2019; 45: 572-575.