Quality improvement assessment of inpatient medical stabilization for restrictive eating disorders among adolescents during COVID-19

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Abstract

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The objective of this study was to assess the impact of the CSW Eating Disorder - Refeeding Pathway modifications during the COVID-19 pandemic on patient hospital length of stay at Seattle Children's Hospital (SCH) from October 2017 through March 2022. This was performed through retrospective chart review of patients 8 to 17 years of age who required medical stabilization for severe malnourishment due to eating disorders. Analysis included calculated mean (SD), median, and comparisons of mean between race and ethnicity, language, age, and insurance type on length of stay (LOS) using Two-Sample t-Test or One-Way ANOVA. Additionally, a run chart was used to examine average LOS per month, upper-and-lower control limit, and overall mean. Findings indicated no significant change to LOS due to pathway modifications and a significant association was observed between race (P=.02), language (P=.04), age (P=.05) and LOS. Future research should separate patients who started at a higher calorie level from the lower calorie level and LOS because this was first encouraged and left to the discretion of the treating physician. Additionally, association between patient diagnosis, body mass index z-score, heart rate in the first 48 hours, and gender identity with LOS would provide valuable insight.

Introduction

Problem description

Eating disorder diagnoses have escalated nationally and internationally during the pandemic (Mathews et al., 2021). Some institutions experienced admission (up to 3.54 times higher) following the COVID-19 lockdown (Abigail et al., 2021). The Royal Children's Hospital Eating Disorder Service in Melbourne, Australia reported an increased mean of annual presentations from 98.7 (2017-2019) to 161 in 2020 alone, which is a 63 percent increase (Springall et al., 2022). Several factors could be associated with the increased need for treatment, such as social isolation, disruption of daily activities, and increased media exposure (Rodgers et al., 2020; Otto et al., 2021; Benowitz et al., 2012). Eales et al. (2021) used quantitative and qualitative data analysis and identified screen media use increased among adolescents from an average of 149 minutes per day to 199 minutes per day. This increased media use during COVID-19 isolation can have a serious impact on mental health and body image; greater exposure to media messages regarding appearance can result in internalization of social expectations (Benowitz et al., 2021). Due to more frequent emergency services use during the pandemic and lockdown guidelines, hospitals had to cut standard services for those in treatment for eating disorders to prioritize COVID-19. One survey of 150 patients ≥13 years of age, discharged from inpatient treatment, reported decreased access to in-person mental health therapy by 37 percent and only 26 percent participated in videoconference therapy (Schlegl et al., 2020). This resulted in 20.1 percent of patients reporting worsening eating disorder symptomology and quality of life. In addition to an overall increase of total admissions during the pandemic, hospital length of stay (LOS) increased for patients who required medical stabilization. Shum et al. (2022) compared average LOS before and during the pandemic and reported that average LOS increased from 12.6 days to 18.0 days during the pandemic.

All levels of care for eating disorders have been insufficient to meet the demand resulting in delayed initiations of treatment and increased severity of presenting symptoms, often requiring hospitalization for medical stabilization (Fernandez-Aranda et al., 2020). As healthcare resources have been stretched during the pandemic, the delivery of efficient care and decreased length of hospitalization is paramount to lessening the burden on the healthcare system. All medical services including emergency general surgery have been impacted, McGuinness et al. (2020) reported a 43.6 percent reduction in emergency surgeries in one month due to COVID-19 lockdown. Due to the broad impact COVID-19 has had on all health care services, an efficient approach to treatment that prioritizes patient safety while achieving medical stabilization is paramount.

There are risks to refeeding starving patients and refeeding syndrome is a potentially fatal complication when the body is renourished at a higher rate than it can tolerate. The hallmark of the syndrome is a dropping phosphorus level which if not corrected may lead to diaphragmatic paralysis, cardiac arrhythmia, and death (Friedli et al., 2020). To prevent refeeding syndrome patients are started at lower than goal calories and refeeding is increased by daily increments as tolerated. During medical stabilization and the refeeding process, patients are monitored closely for changes in vital signs, physical exam, and electrolyte levels. Currently, there is no internationally accepted definition of refeeding syndrome and treatment guidelines are determined by the institution and available research (Gallagher et al., 2021).

There is no national standard protocol for refeeding patients and subsequently, there is variation in protocols for managing safe refeeding. In 2017, Seattle Children’s Hospital initiated a clinical standard work pathway, which was created after extensive literature review and expert consensus, for refeeding patients with eating disorders requiring inpatient medical stabilization. Recognizing that hospitals were over capacity due to COVID pandemic, the refeeding pathway

was modified in efforts to decrease the number of emergency department visits, hospital admissions and length of hospital stay for patients with eating disorders.

Available knowledge

Research has shown that lower calorie (1200-1600 kcal) refeeding in patients with mild to moderate malnourishment is too conservative (Cuntz et al., 2022). Evidence suggests refeeding patients at a higher starting calorie level (1800-2000 kcal) achieves quicker weight restoration with low risk of refeeding syndrome symptoms (O'Connor et al., 2016; Madden et al., 2015). A retrospective chart review study at Rady Children's Hospital in San Diego, CA examined 87 patients with restrictive eating disorders and the majority (75.8%) received a higher calorie diet (1900-2200 kcal) on admission. Hypophosphatemia, hypomagnesemia, and hypokalemia were not associated with higher starting calorie groups within the first 72 hours (Maginot et al., 2017). Some studies have shown success treating patients at a higher starting calorie level but did note an increase in mild hypophosphatemia (Whitelaw et al., 2010; Garber et al., 2013).

In a multicenter-randomized clinical trial, patients who required medical stabilization for restrictive eating disorders were treated with a higher calorie refeeding (2000 kcal) or a lower calorie refeeding (1400 kcal) to compare short-term efficacy, safety, and cost (Garber et al., 2021). Results demonstrated higher calorie refeeding achieved medical stabilization earlier with a decrease in LOS by approximately 4 days, and decreased hospital charges by $19,056 per patient (Garber et al., 2021).

Previous studies analyzing outcomes of a higher starting calorie level vs. a lower starting calorie level are limited and additional research would contribute to the limited research available.

Additionally, research focused on outcomes associated with a higher starting calorie level during the COVID-19 pandemic and the impact on patient care would benefit from further study. The limited studies focused on these outcomes have shown a positive association between higher calorie diets and earlier medical stability. Improvement of patient care and earlier weight restoration can prevent further impairment of growth, menses, and bone health (Parker et al., 2016).

Rationale

Modifications were made to the refeeding protocol at the start of the pandemic to decrease patient burden for the Emergency Department and to avoid exposing severely malnourished and subsequently immunosuppressed patients to the hospital in the setting of the COVID pandemic (Figure.1). The first change was the admission heart rate (HR) criteria by decreasing HR from < 50 bpm to < 45 bpm in March 2020. In addition to decreased HR for admission to inpatient treatment, the encouraged starting calorie level was 1800 kcal to 2000 kcal and the daily calorie intake increased by an additional 400 kcal/d instead of 200 kcal/d (*CSW Eating Disorder - Refeeding Pathway*, 2017). In July 2021, the starting calorie level changed to 1800 kcal for ≤12 years and 2000 kcal for adolescents >12 years and HR criteria increased to <50 bpm. Finally in October 2021, HR admission criteria was again reduced to <45 bpm. Shortly after the pandemic began, inpatient admissions for restrictive eating disorders began to rise and has maintained this increase. This CSW Eating Disorder - Refeeding Pathway was developed to standardize care for patients with eating disorders who required medical stabilization. The intention of this pathway was to accelerate care delivery safely and decrease hospital length of stay. This standard of care includes specific admission and discharge criteria, medical monitoring, behavioral support, and safe nutritional advancement. The modifications applied

during the COVID-19 pandemic (March 2020-October 2021) and the impact on hospital LOS had not been previously reviewed. This study provided an opportunity to assess if any changes occurred to hospital length of stay.

Specific Aims

This study examined the impact the changes in admission criteria and the refeeding pathway had on patient length of stay. Additionally, associations of LOS and age, race, ethnicity, priority language, and insurance type were analyzed.

Methods

Context

Seattle Children's Hospital (SCH) is a large hospital established in 1907 and treats approximately 373,939 patients annually in the main hospital and a variety of outpatient regional locations. In 2021, 144,367 patients received treatment on the main campus alone. Currently, SCH has 407 total licensed beds and 41 beds in the Psychiatry and Behavioral Medicine Unit (PBMU) with only 6 out of the 41 beds for ED patients to receive treatment and medical stabilization for severe malnourishment (Seattle Children's Hospital, 2022). During COVID-19, patients received treatment in General Medicine instead of the PBMU. The limit of available beds requires streamlined and optimal care to ensure patients reach medical stability safely and efficiently. Reduced length of stay will decrease hospital costs, patient costs, and open available beds to other patients when medical stabilization is required.

Intervention

Patients receive treatment from a variety of providers with different specialties to achieve a successful recovery. Providers included in the patient's treatment plan are General Medicine, Adolescent Medicine, Psychiatry, Dietician(s), and nurses. An interdisciplinary team is essential to treatment for ED as it includes both medical and behavioral components, and the CSW Eating Disorder - Refeeding Pathway provides a standard of care for achieving streamlined effective services.

Study Population

A total of 381 patients met the eligibility criteria for study inclusion and 480 patient encounters were analyzed. Criteria included patients ages ≥5 to <18 years, who met HR admission criteria (<45 bpm to <50 bpm) and required medical stabilization from October 2017 to March 2022. This study sample resulted in an age range of 8 to 17 years of age.

Ethical considerations

Previous studies have shown that patients with restrictive eating disorders who were treated at a higher calorie level during medical stabilization were not at an increased risk of refeeding syndrome with close monitoring. Evidence suggests an association between higher calorie refeeding and efficient standardized care in clinical practice. Additionally, to protect patient privacy, all patients were assigned a unique study ID with patient identifiers removed and only accessible by SCH providers. This study was approved by the SCH Institutional Review Board prior to study initiation.

Collection of data on the intervention(s)

A retrospective chart review was used to analyze patient encounters from October 2017 to March 2022 to determine the impact of the pathway modifications. This QI assessment evaluated the impact of an encouraged starting calorie level of 1800-2000 kcal/d and a daily increase of 400 kcal/d for patients during medical stabilization. This starting calorie level was not implemented with every patient but was encouraged by the interdisciplinary team that established the pathway, but application was at the discretion of the hospital medical attending. In addition to the changes in starting and incremental calorie intake, changes in admission criteria reduced HR from <50 bpm to <45 bpm. Length of stay was examined to establish outcomes associated with the modifications. Additionally, a run chart was used to determine the overall mean for the duration of the study.

Measures

Decreased length of stay is associated with lower patient and hospital costs (Garber et al., 2021) and impacts the ability to treat other patients in need of medical stabilization. Higher weight gain can assist with recovery and prevent the need of future emergency services (Swenne & Ros, 2017). Additionally, examining the relationship between LOS and total readmissions could help identify if increased weight restoration could help prevent future emergency department use. Average LOS was calculated for each month in addition to the overall average LOS for the entire duration of the study.

Analysis

Patient demographics were summarized using descriptive statistics, QI Macros SPC Software in Excel version 16.0 was used to create a run chart that would show the average LOS per month

and overall mean LOS during the study period. Upper-and-lower control limit were added to this chart using the mean ± (3*SD).

Differences in LOS per ethnicity and race, age, language, and insurance type were compared by determining the differences in mean and median per group. Mean between groups was compared using Two-Sample t-Test or One-Way ANOVA. To determine total readmissions, patient encounters were divided into 1, 2, 3, 4, 5, and 6 encounter subgroups with the total and percentage.

Results

Patient demographics

A total of 381 patients met inclusion criteria from October 2017 to March 2022, and a total of 480 patient encounters were included. The majority of patients were >12 years (83%) and the overall median was 15 years (mean age: 14.32 ± 1.82). The majority were white, English speaking, and had commercial insurance (*Table 1).* Finally, 54 percent of patient encounters were with female patients and 46 percent of patient encounters were with male patients.

Clinical Features

Total readmissions were divided by total patient encounters, and the readmission was only counted if the patient was admitted to inpatient treatment. Visits to the emergency department that resulted in patients being discharged home instead of admitted to the hospital were not included in this analysis. Excluding other departments resulted in (n=313) 82% of patients only

having one encounter in the duration of the study. The overall mean (SD), median, and range are shown in *Table 2*.

LOS remained similar after introduction of the pathway modifications and did not exceed the upper-and-lower control limit (Figure 2). Following the intervention in July 2021, LOS remained above the overall mean indicating LOS was higher, but the mean was not consecutively increasing. This variation is not abnormal for the pathway. Therefore, the interventions did not significantly increase or decrease overall LOS.

No significant association was found between LOS and Hispanic vs. Non-Hispanic ethnicity (P =.14) or insurance type (P =.23). On the other hand, we found that longer LOS was associated with race (P =.02), language (P =.04), and age (P = .05) as shown in *Table 3*.

Discussion

Summary

The impact of the interventions did not increase or decrease overall LOS significantly in the duration of the study. We found a significant association between LOS and age, race, and language. Longer LOS was associated with younger patients as displayed in *Figure 3.*

Outliers were included in the data presented in the study and patients in the ≤12 age group had a median LOS of 10.64 with one patient in the hospital for 54 days. This LOS higher than all the other patients but was included because of the association per age group.

Longer LOS was also associated with patients who were White or Caucasian and whose priority language was English. In part, this can be attributed to the majority of the patient population studied being white and English speaking. The sample size of patients who did not fit into those categories was much smaller and resulted in an uneven distribution to compare between groups.

Interpretation

A longer, though not statistically significant, LOS may in part be explained by the first and last modification to the pathway, which reduced admission criteria for HR from <50 bpm to <45 bpm. Patients admitted with a lower heart rate will take longer to reach the HR criteria for medical stability and discharge. This modification may explain the spikes in the run chart following the first intervention specifically in the September 2020 increased LOS and in October 2021 HR was again reduced to <45 bpm for admission and an increase in LOS is shown November 2021 thru March 2022. Also, the starting calorie level increase to 1800-2000 kcal was encouraged but not done consistently with every patient admitted following this pathway modification. Therefore, the study population included some patients who started at a lower calorie level.

This study was able to confirm LOS was not significantly increased due to the changes in HR criteria, starting calorie level, and daily incremental calorie increase. This study also demonstrated that the pathway remained controlled with no evident disruptions to patient care as demonstrated in the control chart due to all data points remaining within the control limits (mean ± (3*SD). Points that go beyond the UCL and LCL indicate a disruption to the pathway, and this was not demonstrated in the data set showing that no significant disruptions to the pathway occurred.

Previous studies did show a significant association between LOS and starting calorie level, but these studies compared a higher calorie refeeding group and lower calorie refeeding group (Garber et al., 2021). This study used QI assessment versus the cohort study approach done previously. The goal of this study was to evaluate overall program performance following the pathway modifications during the pandemic. This study did align with the association between age and LOS demonstrated in previous studies, there was an association between patients in the younger age group and longer hospital LOS (Shum et al., 2022). Other studies also reported a similar mean in LOS for patients requiring medical stabilization, Peebles et al. (2017) reported a mean of 11 days which matches the overall mean in our run chart. Previous studies have not noted a significant association between LOS and race or language (Shum et al., 2022).

Limitations

This study did not separate patients who started at the encouraged starting calorie level from those that started at the lower calorie level. Looking at overall LOS was a technique for QI assessment but evaluating the difference in LOS between these groups would provide more insight about the impact on LOS. Additionally, body mass index z-score would have provided insight about the degree of patients ‘malnutrition at admission. Understanding the percentage of patients with advanced malnutrition would assist with understanding the patient population better and analyzing LOS within that group. Because HR criteria was modified to control patient admissions during the pandemic, resting HR within the first 48 hours would provide valuable insight about LOS in patients with lower resting HR as there is an association observed in clinical practice.

SCH did not start recording patient gender identity until recently and this resulted in only examining patients sex assigned at birth. Including gender identity would provide valuable insight due to the increased prevalence of eating disorders among the transgender community (Simone et al., 2022).

Conclusions

The COVID-19 pandemic influenced pathway modifications for the safety of the patients who require medical stabilization. This pathway has provided a resource for all providers within the care team to streamline the treatment process and work cross functionally. These modifications were implemented to support the healthcare team with guidelines during unprecedented times and prioritize efficient patient care. These pathway modifications did not increase or decrease patient LOS. Lowering LOS would decrease patient and hospital costs in addition to efficient patient treatment and SCH can use QI Assessments to analyze these costs. Future research opportunities include separation of patients following the first intervention in March 2020 into the higher and lower starting calorie level refeeding groups for LOS stay and total readmissions comparisons. Additionally, association between patient diagnosis, body mass index z-score, HR in the first 48 hours, and gender identity with LOS would provide valuable insight.

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Figure1. Changes to the CSW Eating Disorder-Refeeding Pathway

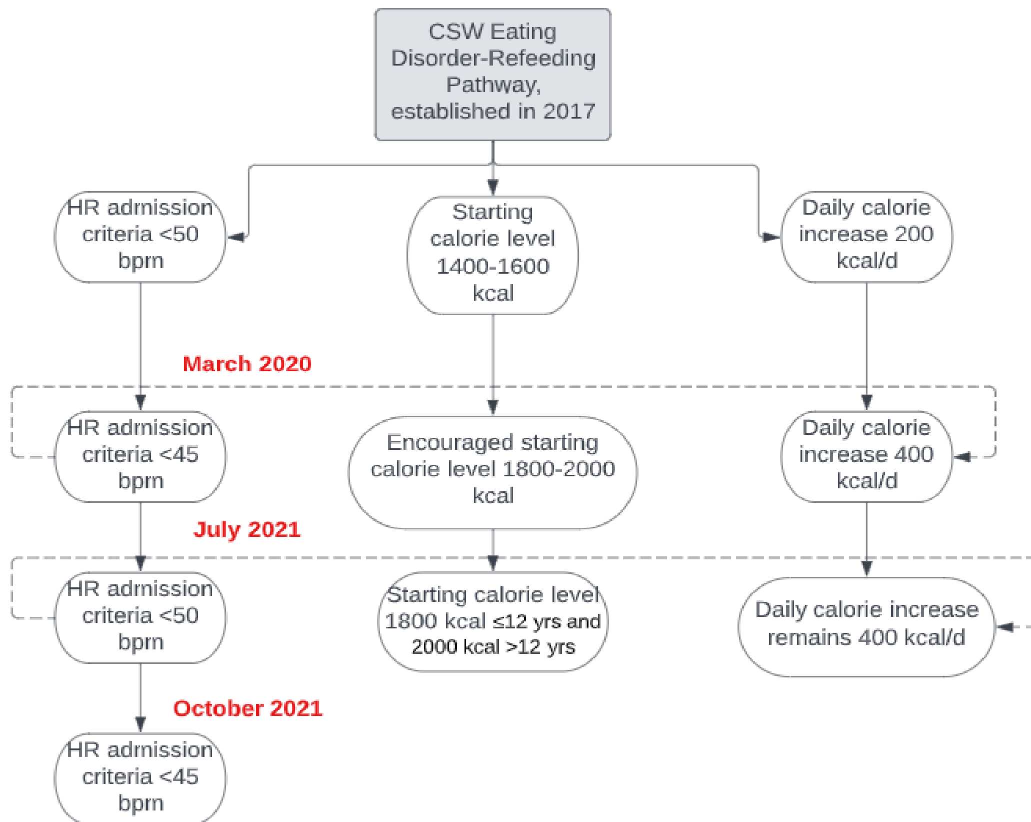


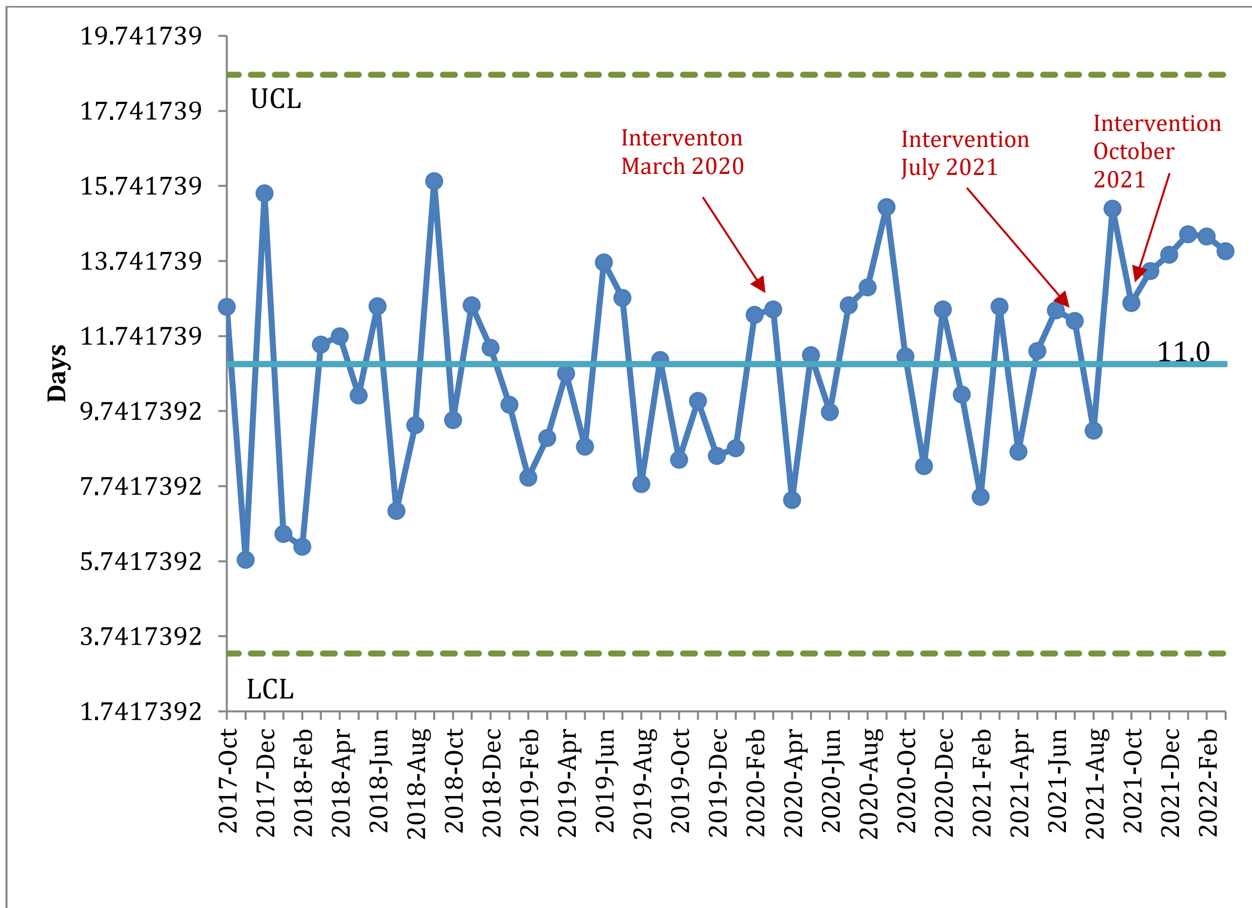
Table 1. Patient Demographics

Variable	n	Level	Overall
Age	480	mean (SD) median [min, max]	14.32 (1.82) 15.00 [8,17]
Sex assigned at birth	480	Female Male	260 (54%) 220 (46%)
Race	448	White or Caucasian Other	321 (72%) 127 (28%)
Ethnicity	450	Non-Hispanic Hispanic	386 (86%) 64 (14%)
Language	480	English Spanish Other	442 (92%) 31 (6%) 7 (1%)
Insurance	478	Commercial Healthy Options Champus Medicaid Washington	343 (71%) 108 (23%) 22 (5%) 5 (1%)

Table 2. Clinical Features

Variable	n	Level	Overall
Number of patient encounters	381	1 2 3 4 5 6	313 (82%) 50 (13%) 10 (3%) 4 (1%) 3 (1%) 1 (<1%)
Length of Stay	480	mean (SD) median [min, max]	11.21 (6.68) 9.77 [0.46, 54.25]

Figure 2. Run Chart: Mean Hospital Length of Stay



Intervention March 2020- HR admission criteria <45 bpm, encouraged starting calorie level 1800-2000, and daily calorie increase to 400 kcal/d.

Intervention July 2021- HR admission criteria <50 bpm, starting calorie level 1800 kcal ≤12 years and 2000 >12 years, daily calorie increase remains 400 kcal/d.

October 2021- HR admission criteria reduced back to <45 bpm

UCL, LCL= mean ± (3*SD)

Table 3. Hospital Length of Stay

Variable	Mean (SD)	Median [min, max]	P
Age			
≤12	12.55 (8.15)	10.64 [1.51, 54.25]	.05
>12	10.95 (6.33)	9.70 [0.46, 43.73]	
Race			
White or Caucasian	11.50 (6.41)	10.49 [0.46, 43.68]	.02
Other	10.48 (6.89)	8.97 [0.84, 54.25]	
Ethnicity			
Non-Hispanic	11.45 (6.76)	9.83 [0.46,54.25]	.14
Hispanic	9.48 (4.79)	8.69 [2.93, 26.37]	
Language			
English	11.43 (6.80)	9.92 [0.46, 54,25]	.04
Spanish	9.02 (4.48)	8.69 [3.52, 23.69]	
Other	7.21 (3.94)	7.66 [2.54, 12.77]	
Insurance			
Commercial	11.54 (6.86)	9.81 [0.46, 54.25]	.23
Healthy Options	10.42 (6.38)	9.23 [0.84, 43.73]	
Champus	9.41 (5.01)	9.38 [2.82, 20.81]	
Medicaid Washington	11.73 (5.81)	11.87 [4.44, 20.08]	

Figure 3. Box Plot: Hospital Length of Stay per Age Group