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Predictors of Length of Stay on the Pediatric Psychiatric Floors in the US Hospitals: A
Nationwide Study Using NIS Database

By

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Degree to be awarded: MPH

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Predictors of Length of Stay on the Pediatric Psychiatric Floors in the US Hospitals: A Nationwide Study Using NIS Database

By

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An abstract of
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Abstract

Predictors of Length of Stay on the Pediatric Psychiatric Floors in the US Hospitals: A Nationwide Study Using NIS Database

By: Pankaj Manocha

Objective: To determine the effect of clinical and demographical factors on the length of stay (LOS) in patients admitted to pediatric psychiatric floors across hospitals in the United States.

Design: Analysis of Nationwide Inpatient Sample (NIS) dataset, which is a systematic sample of the Healthcare Cost and Utilization Project (HCUP) hospital care data.

Methods: We analyzed the 2014 NIS dataset with records of all the children and adolescents age six to eighteen years who were admitted to community hospitals. Candidate variables included in the model were age, gender, race, median household income, urbanicity of patient residence, geographic region, insurance provider information, admission type, primary psychiatric diagnosis, and hospital characteristics (HC) such as ownership, bed size, location, teaching status. Analyses were conducted using SPSS version 26.0 (IBM Corp, Armonk, NY). Means (SD) were calculated for continuous variables and bivariate analyses were conducted with ANOVA. Frequencies (%) were calculated for categorical variables and bivariate analyses were conducted with Pearson's chi-square test. Linear regression with an outcome of log-transformed length of stay (LOS) was used to identify statistically significant predictors of prolonged LOS. A backward elimination method was used for multivariate regression. P values ≤ 0.05 were considered statistically significant.

Results: A total of 184,340 patients age 6-18 years old were included. Of these, 24,840 were children (age 6-11 years) and 159,500 were adolescents (age 12-18 years). The median LOS was 5.6 days. There were significant demographic differences between the children and adolescent populations. The stepwise backward elimination method determined that median household income, sex, and urbanicity were not significant predictors of LOS. Compared to mood disorder, the LOS was as follows: schizophrenia and other psychotic disorders (41% longer), developmental disorder (18% longer), impulse-control disorder (16% longer), attention deficit hyperactivity disorder (15% longer), anxiety disorder (14% longer), suicide and intentional self-injury (6% longer), alcohol related disorder (14% shorter) and substance related disorder (3% shorter). Patients admitted voluntarily had 20% longer LOS. Compared to hospitals in the Northeastern (NE) region, all the other regions had shorter LOS. Compared to public hospitals, private hospitals have longer LOS. Patients in teaching hospitals stay 8% longer. Compared to public insurance, LOS was shortened in private insurance group (6%) and self-pay (7%).

Conclusion. Substantial regional differences were observed with LOS longer in hospitals in the NE. Additionally, HC, including owner (public vs private) and teaching status also affect LOS. This suggests potential disparities in care for patients based on where they access care.

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which made this process a unique learning experience.

Chapter 1: Introduction

Prevalence of Mental Disorders in Children and Adolescent

According to the United States Census Bureau, as of 2016 there were 74 million children and adolescents under the age of 18 in the United States, accounting for 23% of the population (1). According to the National Comorbidity Survey Adolescent Supplement (NCS-A), which is a face-to-face interview of ten thousand adolescents aged 13 to 18 years, 22% percent of the adolescent population are estimated to have a severe impairment or distress due to mental disorder (2). In this survey, anxiety disorder (32%) was the most common condition followed by behavior disorders (19%), mood disorders (14%), and substance use disorders (14%) (2). The study also noted that the median age of onset of anxiety disorders is at 6 years, followed by behavior disorders at 11 years, mood disorder at 13 years and substance use disorders at age 15 years (2). Similarly, in another nationally representative survey of more than fifty thousand surveys across the United States, the 2016 National Survey of Children's Health, showed a national prevalence of 17% of at least one diagnosable mental disorder among children and adolescents (4). This survey was filled by parents on behalf of children younger than 18 years. It also showed that fifty percent of children and adolescents in need of mental health treatment or counseling do not get any treatment or counseling from mental health professionals (4).

Impact of Untreated Mental Disorder in Children and Adolescent

The development of a psychiatric disorder in early childhood or adolescence has a huge impact on growth and development. It has also been estimated that close to fifty percent of all lifetime mental health disorders have their first onset under the age of 18 (2,3,4, and 5). This not only affects educational achievement but also the ability to cope

and self-protect later in life. Untreated psychiatric disorders have a high association with family dysfunction, school expulsion, poor school performance and drop-outs, juvenile incarceration, substance use disorder, and unemployment (6). It is estimated that fifty to seventy-five percent of children and adolescents placed in foster care have a diagnosable mental health disorder (7). These children and adolescents become vulnerable populations as they enter adulthood with several economic and social disadvantages (6,7). With the increased prevalence of mental disorders occurring early in life, child and adolescent psychiatry has grown as a field; however, it is still not being funded enough in the proportion of the contribution of the burden of the disease.

The available resources are not organized and fragmented. Funding and grants differ from state to state, are short lived and not permanent, are usually pilot projects which are not sustainable by themselves, and are usually a blend of mental health, child welfare systems and juvenile justice systems. This poses a unique public health challenge for the entire field of child and adolescent psychiatry in meeting this growing demand. The American Academy of Child and Adolescent Psychiatry (AACAP), along with other organizations including the American Academy of Pediatrics (AAP), have listed five mental health principles to provide actionable opportunities that strengthen the health care workforce, insurance coverage and payment, integration of mental/behavioral health into pediatric primary care, early identification and intervention, and mental health parity (14). Five Mental Health Principles, Challenges, and Actionable Opportunities

1. Child and Adolescent Mental and Behavioral Health Workforce: The major challenge of the field is a severe shortage of health professionals specializing in mental and behavioral health for children and adolescents. It is estimated that we

need close to 30,000 child and adolescent psychiatrists across the nation, however, there are currently only 8,700(8). This deficit contributes to the fact that 50% of the children and adolescents in need of mental health services do not receive any treatment at all. The actionable opportunity here is to enhance the number of trainees by increasing accredited training programs. Expansion of student loan repayment assistance for trainees will also attract them to the filed. The inclusion of telehealth consultation for the children and adolescents in need of mental health services is also an actionable opportunity to increase access to psychiatric care.

2. Insurance Coverage and Payment: Although 45 million children are covered under Medicaid and Children's Health Insurance Program (CHIP), there is still a large percentage of uninsured children and adolescents. Medicaid, CHIP and private insurance expansions are major sources of providing health care services to children and adolescents. The actionable opportunity here will be to ensure that all public and private health care plans have comprehensive and affordable coverage for mental health disorders among children and adolescents. Another actionable opportunity will be to utilize mental health services in schools and other education agencies. This will allow educational institutes to mobilize Medicaid payments for mental health care of children and adolescents.

3. Integration of Mental and Behavioral Health into Pediatric Primary Care: Mental-health related stigma is a barrier to care. Pediatric primary care offices are the primary setting where parents and families access care for their children. Pilot programs that were funded through public and private grants have shown that the integration of mental and behavioral health into pediatric primary care increases

access to mental health care. The actionable opportunity here is to develop a sustainable funding opportunity for nationwide behavioral health integration into pediatric primary care.

4. Early Identification and Intervention: Although the onset of mental disorders occurs early in life, effective treatment is delayed until much later. Close to fifty percent of lifetime mental disorders begin in persons under the age of 18 (3, 4, 5). There is evidence that early identification and intervention can help to change mental health trajectories. Most children and adolescents do not get effective treatment early on. There can be several reasons for that including lack of knowledge among teachers, parents, childcare workers, and other health care professionals to identify the early signs of mental health problems as well as lack of knowledge towards the available services. The actionable opportunity here will be increasing the training to health care providers, childcare workers, teachers, and school behavioral health providers. This may improve developmentally appropriate screening and link them with developmentally appropriate services.

5. Mental Health Parity: The Paul Wellstone and Pete Domenici Mental Health Parity and Addiction Equity Act of 2008 (MHPAEA) is a federal law that mandates insurance issuers to have parity between mental health benefits and medical-surgical benefits. Although we have the mental health parity act and its subsequent expansions to Medicaid managed care, CHIP, and the insurance marketplaces, there are many opportunities to improve oversight and compliance. Even today, children and adolescents continue to have issues accessing mental health treatments due to insurance discrimination that singles out these services.

Expanding MHPAEA to children and adolescents enrolled in Medicaid fee-for-

service arrangements is one of the steps which will help us enforce parity.

Changes in the Practice of Mental health

When looking at the social structure in the United States, our families have

undergone constant changes in demographic structure, economic status and health care

coverage and these factors play a role in mental health care. The public mental health

system has also evolved from being a primarily state-financed system focused on providing

institutionalized services in state mental hospitals, to now being an increasingly federal-

funded system focused on providing services in the community, which is now becoming

the standard of care. As a result, Medicaid is now the largest payer of mental health services

for children, adolescent and adults. Despite this shift to community-based treatment, access

to community mental health care remains a major challenge. Many children in need of

mental health care often end up in the pediatric emergency department and often get

admitted to inpatient psychiatric units which are limited in number.

The annual report on healthcare for children and youth in the United States released

in 2015, estimated cost, utilization, and expenditures for children with mental health

conditions in the United States (13). The study is based on the Healthcare Cost and

Utilization Project (HCUP) Nationwide Inpatient Survey (NIS) databases from 2006 to

2011. As per the report, although overall all-cause children's hospitalizations did not

increase between 2006 and 2011, there was a nearly 50% increase in hospitalizations for

all listed mental health conditions among children aged 10 to 14 years. It showed that there

was an increase in inpatient visits for suicide, suicidal ideation, and self-injury by 104%

for children ages 1 to 17 years. It also shows that among children age 10-14 years this

increase was even steeper and was by 151% which may also explain the increase in inpatient visits overall. A total of $11.6 billion was spent on hospital visits for mental health during this period. Medicaid covered half of the inpatient visits and the length of stay for Medicaid covered patients was 50% and 30% longer in 2006 and 2011, respectively, compared to private payers (13). As mentioned above, due to the increased emphasis on outpatient and residential care, the capacity of state and county psychiatric hospitals has declined; however, the capacity at private psychiatric hospitals and psychiatric units of general hospitals has not kept up and remains almost the same. This lack of availability of child and adolescent inpatient psychiatric beds across private and public setting is a public health challenge that needs to be addressed.

Inpatient Hospitalization and Length of Stay (LOS)

Inpatient psychiatric hospitalization remains an important component of psychiatric care for patients who are undergoing a mental health crisis. There remains a knowledge gap in identifying the predictors of the LOS among children and adolescents. Aside from social determinants, several other factors influence hospital LOS in these patients, including patient demographic characteristics such as age, gender, race, household income; clinical characteristics such as type and severity of mental health disorders and other factors such as hospital characteristics, insurance coverage, and geographical locations (15). The objective of this study is to understand the effect of demographic and clinical factors in predicting the LOS. Understanding factors that are associated with an extended length of stay in hospitals remains an important question to better understand psychiatric service use. The use of a large sample size will ensure enough statistical power to identify demographic and clinical characteristics that predict LOS, which may have been previously

overlooked in smaller studies. Identifying these predictors of LOS during admission will also help us better plan the disposition of these patients. In addition, yearly, billions of dollars are being spent on inpatient hospital visits for mental health. This is not only a huge economic burden on Medicaid but also on private insurances (13). Identifying predictors of extended stay will further enhance our understanding of the economic burden that these factors may have on child and adolescent psychiatry as a field.

Chapter 2: Manuscript

Introduction

Inpatient psychiatric hospitalization remains an important component of psychiatric care for patients who are undergoing a mental health crisis. There remains a knowledge gap in identifying the predictors of the length of stay (LOS) among children and adolescents. Aside from social determinants, several other factors influence hospital LOS in these patients, including patient demographic characteristics such as age, gender, race, household income; clinical characteristics such as type and severity of mental health disorders and other factors such as hospital characteristics, insurance coverage, and geographical locations. Understanding factors that are associated with an extended length of stay in hospitals remains an important question to better understand psychiatric service use. The objective of this study is to understand the effect of demographic and clinical factors as well as hospital characteristics in predicting the LOS in patients admitted to pediatric psychiatric floors across hospitals in the United States.

Methods

Data Source

The Healthcare Cost and Utilization Project (HCUP, pronounced "H-Cup") is the nation's most comprehensive source of hospital care data. HCUP has several healthcare databases that are developed through a Federal-State-Industry partnership and sponsored by the Agency for Healthcare Research and Quality (AHRQ). The Nationwide Inpatient Sample (NIS) is one of these HCUP databases which includes all inpatient discharge records from community-based and non-federal hospitals in that United States. There were forty-five states (all except Alabama, Alaska, Delaware, Mississippi, and Nebraska) across

the United States that were part of the NIS in 2014. So, the NIS contains a systematic sample of admissions and discharges from all hospitals and includes all inpatient data that are currently contributed to the HCUP. It approximates a 20-percent stratified sample of all discharges from U.S. hospitals, excluding rehabilitation and long-term and acute care hospitals. The NIS database, compiled annually since 1988, constitutes information on all hospital stays, regardless of the expected payer, with each observation representing a unique hospitalization from the U.S. hospitals. The NIS database includes information on patient demographics, administrative codes for primary diagnosis and secondary diagnoses, medical procedures, survival to discharge, disposition, hospital charges, and length of stay (LOS). The NIS can be used to examine the utilization of hospital health services, practice variation, cost, and the impact of health policy interventions in the inpatient setting [16]. For this study, we analyzed the 2014 NIS dataset with approximately seven million discharge records from a sample of 4,400 community, non-federal hospitals across 45 states [16].

We examined the records of children and adolescents age six to eighteen years who were admitted to community hospitals [17] in the NIS where all mental health/substance abuse discharges are defined using the Clinical Classification Software (CCS) categories for principal International Classification of Disease (ICD)-9-CM diagnosis which are listed in Table 1. Mental Health Substance Abuse Clinical Classification Software (CCS-MHSA) assigns variables that identify mental health and substance abuse-related diagnoses in hospital discharge records using the ICD-9-CM diagnosis codes. There are 14 three-digit general CCS-MHSA categories included in CCS for Mental Health and Substance Abuse – General (CCSMGNn), such as adjustment disorders (value 650), anxiety disorders (value

651), and developmental disorders (value 654). The four-digit CCS-MHSA categories included in Clinical Classification Software (CCS) for Mental Health and Substance Abuse – Detail (CCSMSPn) include additional detail. For example, the 3-digit category 654 for Developmental Disorders, is further divided into the following categories: Communication Disorders (value 6541), Developmental Disabilities (value 6542), Intellectual Disabilities (value 6543), Learning Disorders (value 6544) and Motor Skill Disorders (value 6545).

Description of Variables

Patient variables included in the model are age, gender, race, median household income, patient location, and insurance provider information. Age was categorized into two different age groups: 6-11 years which were defined as children and 12-18 years which were considered adolescents for this study purposes. Race is categorized as Caucasian, Black, Hispanic and other. The median household income in the NIS dataset was calculated in US dollars based on the patient's zip code and ranged from less than or equal to $39,000 in the lowest quartile to more than $66,000 in the top quartile as shown in Table 3. The hospital setting based on the ownership and funding was differentiated between public hospitals and a private hospital. Other hospital characteristics include bed size which is also based on the hospital location (see Table 2), region (Northeast, Midwest, Southern, and Western) as well as teaching status of the hospital and are explained in the table below. For example, small urban non-teaching hospital in Northeastern region can have up to 124 beds compared to Southern (99 beds), Western (99 beds) and Midwestern region (74 beds). The discharge diagnoses which were considered were the following: attention deficit hyperkinetic disorder (ADHD), conduct & disruptive behavior disorder, anxiety disorder, developmental disorder, impulse-control disorder, mood disorder, schizophrenia & other

psychotic disorder, suicide ideation during current hospitalization, alcohol use disorder, and substance use disorder. LOS in the hospital was defined as the number of days between admission and discharge dates for each admission experienced during the study period.

Analysis

The goal of the study is to determine the factors which predict the length of stay among children (6-11 years) and adolescent (12-18 years). Descriptive statistics and cross-tabulations will be used to describe the study population by demographic, hospital characteristics and psychiatric diagnoses. Possible predictors of LOS were identified by reviewing previous studies on this subject. The predictors available in the data set which were included to create the model were gender, race, median household income, patient location, primary insurance or payer (public, private, or self-pay/uninsured), hospital characteristics (ownership, bed-size, region, and teaching status), admission type and discharge psychiatric diagnosis. The reference categories used were as follows: male (gender); White (ethnicity); 0-25 percentile median household income (income), "Central" counties of metro areas of >=1 million population (patient location), small (bed size of the hospital), northeast (region of the hospital), public insurance (primary payer), non-teaching(teaching status of the Hospital) and elective (voluntary) admission.

Analyses were conducted using SPSS version 26.0 (IBM Corp, Armonk, NY). Means (SD) were calculated for continuous variables and bivariate analyses were conducted with ANOVA. Frequencies (%) were calculated for categorical variables and bivariate analyses were conducted with Pearson's chi-square test. Dummy variables were created for variables with more than 2 levels. Linear regression analysis was conducted using all the variables to identify predictors of increasing LOS among our patient

population. Multicollinearity was checked and was confirmed by the variance inflation factor and tolerance factor. The length of stay (LOS) variable was checked for skewness. LOS was positively skewed and was log transformed to improve the normality of the distribution. The backward elimination method was used where all the independent variables were entered in the model and the least-significant non-significant variable was removed until all remaining predictors were statistically significant. P values ≤ 0.05 were considered statistically significant. The unstandardized coefficients in the regression model were exponentiated to convert back to calendar days from the log-transformed model coefficients.

Results

Sample Characteristics

A total of 184,340 patients age 6-18 years old in the 2014 NIS dataset were discharged with at least one psychiatric diagnosis. Of these, 24,840 were children (age 6-11 years) and 159,500 were adolescents (age 12-18 years). The median length of stay (LOS) was 5.6 days. Demographic and diagnostic information for the study sample is provided in Table 3. 42.4% of the sample was male. 61.4% were Caucasians, 17.4% were Black, 13.8% were Hispanic and the remaining 7.4% were other races. The median household income was calculated based on patient's zip code and the ranged from less than or equal to $39,999 in the lowest quartile to more than $66,000 in the top quartile. More than fifty percent of patients were living in central or fringe counties of metro areas of population more than or equal to one million. Most patients (93%) were insured and were distributed among public (49%) and private sector (44%) insurers. A majority of the patients were discharged from private hospitals (88%). More then fifty percent of patients

were discharged from large hospitals. The South (38%) accounted for the largest proportion of inpatient admissions, followed by the Midwest (32%), Northeast (19%) and West (11%). Most of the patients in our data were discharged from teaching hospitals (74%). The most prevalent diagnoses at discharge were mood disorder (34%) followed by suicidal ideation during current hospitalization (34%) and substance use disorder (20%).

There were significant demographic differences between the children and adolescent populations. Overall, there were significant differences in discharge diagnosis ($\chi2 = 12814.7$, $p \leq 0.001$) and primary payer ($\chi2 = 2128.3$, $p \leq 0.001$) between children and adolescents. They were significantly more male children admissions when compared to adolescents (68% vs. 39%, $\chi2 = 7394.1$, $p \leq 0.001$). Children were more likely to be Black (23%) when compared to adolescents (17%, $\chi2 = 866.6$, $p \leq 0.001$). Similarly, there were a greater number of White (63%) adolescents when compared to children (54%). More children were under public insurance when compared to adolescents (62% vs 47%, $\chi2 = 2128.3$, $p \leq 0.001$). The notable difference among children and adolescents discharge diagnoses were as follows: there were more children with mood disorder (41% vs 33%, $\chi2 = 2851.3$, $p \leq 0.001$); ADHD, conduct, & disruptive behavior disorder (10.5% vs 1.5%, $\chi2 = 12145.7$, $p \leq 0.001$); developmental disorder (2.6% vs 0.5%, $\chi2 = 1110.5$, $p \leq 0.001$); and impulse control disorder (4.9% vs 1.2%, $\chi2 = 1299.7$, $p \leq 0.001$) compared to adolescents. Adolescent admissions had higher prevalence of suicidal ideation during the current hospitalization (35% vs 26%, $\chi2 = 2046.9$, $p \leq 0.001$) and substance use disorders (22% vs 8%, $\chi2 = 816.9$, $p \leq 0.001$).

Multiple Linear Regression Results

Table 4 displays the results of the multiple linear regression model which was created to predict the LOS based on age, sex, race, median household income, patient location based on "Urbanicity", insurance provider, type of admission, hospital characteristics such as ownership, bed size, region and teaching status, and the diagnosis at discharge. The LOS variable was checked for skewness and was noted to significantly positively skewed with standard residuals ranging from -1.2 to 29.5 and the skewness factor being 13.84. Therefore, LOS was log-transformed for analyses. Since LOS had values which were zero, 0.5 was added before it was log transformed. Log transforming LOS brought down the skewness sufficiently with skewness factor = 0.36, std error= 0.006 and the histogram appeared to be normally distributed. A significant regression equation was found [F (22, 183486) = 899.9 Mean Square Error = 80.2, p <0.001), with an R2 of 0.097 (i.e. 9.7% of dependent variance of the dependent variable is explained by the independent variables).

Median household income, sex, and the patient location based on "Urbanicity" were not significant predictors of LOS with p value> 0.05 and were removed in stepwise backward elimination method. All the other factors remained significant predictors of LOS with p value ≤ 0.05. Controlling for all the other remaining factors in table 3, compared to mood disorder, the diagnoses which prolonged the LOS with varying degree were schizophrenia and other psychotic disorders (41% longer), developmental disorder by (18% longer), impulse-control disorder (16% longer), ADHD, conduct, and disruptive behavior disorders (15% longer), anxiety disorder (14% longer) and suicide and intentional self-injury (6% longer). Compared to mood disorder, the diagnosis which had shorter LOS

were alcohol related disorder (14% shorter) and substance related disorder (3% shorter). When compared to children, adolescents have shorter LOS by 7%. Patients admitted voluntarily with parent consent had 20% longer LOS compared to those admitted involuntarily. Compared to white patients, black (1.5% longer) and other race (3.5% longer) patients had longer LOS while Hispanic patients had shorter LOS (10% shorter). Compared to public insurance, LOS was shortened in private insurance group (6%) and self-pay (7%). Compared to hospitals in the Northeastern region, all the other regions had shorter LOS by varying degree as noted: Midwestern (24%), Southern (26%) and Western (23%). When compared to public hospitals, private hospitals with and without profit have longer LOS by 3% and 5%, respectively. Patients in teaching hospitals stay 8% longer than those in non-teaching hospitals, holding all the other variables constant. Medium size and large size hospitals had shorter LOS by 4% and 1% respectively compared to small size hospitals.

Discussion

The median LOS is approximately five and a half days. Schizophrenia and other psychotic disorders increase the LOS more than other disorders. Hospital characteristics such as ownership, region, bed size and teaching status of the hospitals demonstrate a significant effect on LOS with hospitals in the Northeastern region have the longest LOS compared to other regions. Adolescents have a significantly shorter LOS when compared to children. Voluntary admissions have longer LOS when compared to involuntary admissions. Median household income, sex, and urbanicity (county of patient location) were not significant predictors of LOS.

AHRQ: Agency for Healthcare Research and Quality; NIS: Nationwide Inpatient Sample; ICD: International Classification of Disease; CCS-MHSA: Mental Health Substance Abuse Clinical Classification Software (CCS-MHSA); CCSMGNn: Clinical Classification Software (CCS) for Mental Health and Substance Abuse – General; CCSMSPn: Clinical Classification Software (CCS) for Mental Health and Substance Abuse – Detail; LOS: length of stay

Chapter 3: Discussion

Major Finding of the Study

The median LOS is approximately five and a half days. This finding resembles the national trend where LOS has been decreasing drastically in the 1990s from 12.2 days to 4.5 days in the early 2000s (22). Several factors may explain this shift as encouraged by our mental health policy. As explained earlier, although the supply of pediatric psychiatric beds in the community has not kept up with the increase in mental health need. However, community hospitals evaluate, treat and discharge children and adolescents far more expeditiously than in the past. Since the Affordable Care Act was signed into law in 2010, there has been an enhancement in the enrollment of children and adolescents to managed Medicaid. This has allowed these patients to have greater access to less restrictive means of treatment in the community such as partial hospitalizations programs, intensive outpatient treatments and intensive in-home therapy, which likely contributes to the shorter LOS (21,22). Other major findings of our study demonstrate that hospital characteristics are significant predictors of LOS. The significant hospital characteristics that affect the LOS are ownership, bed size, region, and teaching status of the hospitals. This finding is important as this study is a large representation of the national database of patients admitted to the public and private hospitals. This finding aligns with the literature published that also shows that hospital characteristics play an important role in the LOS in children, adolescents, and adults (33, 34, 36). Our study showed that patients admitted voluntarily with parental consent had longer LOS compared to those admitted involuntarily. This finding parallel's previous finding published in the literature comparing voluntary and involuntary child and adolescent inpatient psychiatry admissions (38).

Another important finding is that gender, median household income for the county of the residence and location of the patients based on urbanicity were not significant predictors of LOS. This finding is consistent with the literature which studied the trends in the inpatient treatment of children and adolescents in US community hospitals between 1990 and 2000 (22). Another important finding from our study shows that more children in the US who are admitted for inpatient stays with psychiatric diagnoses are under public health insurance when compared to adolescents. This is an important finding as there has been substantial literature on disparities in children getting mental health services in the US (21). This can be explained by the implementation of the Affordable Care Act (ACA). This health care reform increased enrollment in managed Medicaid and the private sector. This increase in enrollment appears to be reasonable for mental health services as well. Our study showed having a psychiatric diagnosis of schizophrenia and other psychotic disorder increases the LOS the most. This finding is consistent with the literature (18, 33) and can be explained as we know psychotic symptoms are associated with poor functioning of activities of daily living (ADL), poor judgment and insight requiring a longer LOS for stabilization. Similarly, our study also showed that having a diagnosis of developmental disorder also increases the LOS. This finding is consistent with literature as having such a diagnosis involves prolonged care and treatment (36). Our study also shows that patients with an anxiety disorder and ADHD, conduct, and disruptive behavior disorders stay longer than patients with a mood disorder and is in line with the study published which showed similar results for anxiety disorder (22) and ADHD, conduct, and disruptive behavior disorders (37). Our study shows that compared to mood disorder, the diagnosis of the alcohol-related disorder and substance-related disorder results in shorter LOS. These

findings are parallel to results in HCUP's statistical brief which studied hospitalizations involving mental and substance use disorders among adults (39)

One of the striking features of the hospital characteristics on LOS showed in our study is that hospitals in the Northeastern region have substantially longer LOS when compared to all the regions of the United States. This finding is similarly noticed in the literature published for our adult population showing similarly longer LOS in the Northeastern region compared to Midwestern, Southern and Western regions (33). Similar to the published literature, our study shows that LOS is shorter among patients having private insurance or self-insured when compared to patients with public insurance such as Medicaid or Medicare (33). However, our finding of longer LOS in private hospitals when compared to public hospitals is different from the previously published adult literature (33) which shows longer LOS in public hospitals. There is no literature in the writer's understanding comparing LOS in children and adolescents in private and public hospitals. This may be explained in a way here as there are far fewer children and adolescent beds in public hospitals when compared to adult beds evident from our patient population where 88% come from private hospitals. However, our study has shown a small but significantly shorter LOS in Medium size and large size hospitals compared to small size hospitals. This finding is in contrast to the published literature which has shown longer LOS in large hospitals (33) and can be explained by the nature of our data which had up to 70% admission from Midwestern and Southern regions.

Similarly, to the study published earlier on the effect of teaching status on LOS, our study also shows that patients in teaching hospitals stay longer than those in non-teaching hospitals (33). However, our study shows that LOS is shorter in adolescents when

compared to children. In the writer's understanding, there is limited literature that shows the LOS differences among children and adolescents. One of the old studies shows similar findings and shows children's inpatient stays were considerably longer than those of adolescents (37). Our study showed that black and other race patients have longer LOS than white population while Hispanics stay shorter than whites. The difference in the LOS was statistically significant however were small. This can be explained in a way that it is known that Hispanics as an ethnic minority group have been shown to underuse services because of access and because they do not experience the services as culturally competent and have been shown similarly in the literature (37). These differences have also been documented in adult literature and reflect the disparities in access to care and cultural practices.

Clinical and Demographic Factors among Children and Adolescents

Our demographics show that there was more male in the children group when compared to the adolescent group. This finding can be explained in two ways. First, fifty percent of our discharged patient population comprises of children with a mood disorder, ADHD, conduct, & disruptive behavior disorder. These disorders carry moderate to severe behavioral dysregulation which requires hospitalization and are more often seen in the males. Second, the adolescent group has a higher prevalence of patients with suicidal ideation that is a major contributor to adolescent category. Suicidal ideation is also more prevalent in adolescent females requiring inpatient hospitalization when compared to adolescent male counterparts (20). This finding is consistent with the literature which shows that there is a continuous increase in suicidal ideation among adolescents in the past decade, several times higher than in children (20). Our study shows that more than two-

thirds of the children and adolescents are admitted to private hospitals compared to public hospitals. This finding is consistent with literature as our present-day public mental health policy continues to promote deinstitutionalization, which has led to the decrease of public hospital beds during the last several decades (22). This was similarly noticed in the prior study of inpatient mental health treatment trends of children and adolescents in US community hospitals (22,37).

Our study demonstrates that children experience more ADHD, conduct and disruptive behavior disorders when compared to adolescents. This finding is supported in literature with the national numbers (23, 37). As per the National Institute of Mental Health (NIMH) health statistic report, the prevalence of children diagnosed with ADHD has increased by 42% between 2003 (7.8%) and 2011 (11.0%) when compared to adolescents where prevalence remains at consistent 8.7% (23). The reason for increasing prevalence may be explained by a better understanding of ADHD diagnosis and increased focus on the implementation of early interventions. Disruptive behavior disorders are a group of disorders that include oppositional defiant disorder, conduct disorder, intermittent explosive disorder, kleptomania, and pyromania. These disorders can cause people to behave angrily or aggressively toward other people or property. They may have difficulty controlling their emotions and behavior and may break rules or laws. An estimated 6% of children are affected by oppositional defiant disorders or conduct disorders (24, 25). When looking at the weighted average of the prevalence of intermittent explosive disorder (IED), it is estimated that it ranges between 2.7-3.9% of children and adults in the U.S. (24, 26). In our dataset, the prevalence of IED in children and adolescents is lower than the national average at 1.7%. This can be explained in three ways. First, IED is an episodic disorder

and only severe cases are admitted for an inpatient stay at the hospital. Second, our adolescent prevalence was lower (1.2%) compared to children (4.9%). Third, this difference in prevalence may be explained as children are more often diagnosed with IED compared to adolescents who are diagnosed with mood disorders. Our study also shows an increased diagnosis of mood disorder cases in children when compared to adolescents. This may be explained as follows: prevalence study showed that there was a 40-fold increase in the diagnosis of mood disorder in the 1990s and 2000s in children with behavioral dysregulation (27). This several-fold increase diagnoses may explain the increased prevalence of mood disorder in children compared to adolescents in our dataset. DSM-5 came out with a new diagnosis in 2013 named disruptive mood dysregulation disorder (DMDD) to counter this increased diagnostic prevalence of mood disorder. This diagnosis was created to differentiate children who experience explosive outbursts but have a different outcome then mood disorder. This new classification of DMDD included children aged 6-12 years (27).

There were more adolescent discharges for suicidal ideation compared to children in our dataset. The literature illustrates that suicidal ideation and behavior typically increases after the age of 10 years and most sharply at age 13 to 14 years and continues to be on the rise (28). A study done in US young adults from 2009 to 2015 showed increase suicidal ideation from 6.1% to 8.3%, suicide plans from 2.0% to 2.7%, and prevalence of suicide attempts from 1.1% to 1.6% over 12-month prevalence period (28). Since inpatient units are the highest level of crisis stabilization, the prevalence of admission due to suicidal ideation is expected to be higher than the national prevalence. Similarly, there was a higher number of adolescent discharges when compared to children with alcohol use disorder and

substance use disorder as seen in earlier literature (37). Our understanding is similar that the critical risk period for the commencement of alcohol use is early (aged 12 to 14) to late (aged 15 to 17) adolescence (30). Several studies have shown associations between age at first alcohol use, the occurrence of alcohol abuse/dependence and other substance use disorders (30, 31). There is also evidence that suggests there is an increased risk of developing dependence among individuals who initiate use of these substances in adolescence or early adolescence than those who initiate use during adulthood (30,31, 32).

Conclusion

The median LOS is approximately five and a half days. Schizophrenia and other psychotic disorders increase the LOS more than other disorders. Hospital characteristics such as ownership, region, bed size and teaching status of the hospitals demonstrate a significant effect on LOS with hospitals in the Northeastern region have the longest LOS compared to other regions. Adolescents have a significantly shorter LOS when compared to children. Voluntary admissions have longer LOS when compared to involuntary admissions. Median household income, sex, and urbanicity (county of patient location) were not significant predictors of LOS.

Limitation of the study

Our final model has a low coefficient of determination (i.e., R-squared), indicating that there is a substantial amount of unexplained variance in LOS that remains. Incorporating additional predictors would help to improve the coefficient of determination. This study is designed from the NIS 2014 data set where we considered discharge diagnosis as a primary diagnosis with limited access to secondary diagnosis, primarily due to the missing secondary diagnostic data. This data set also lacks the social and family

determinants of mental health such as family structure, parent-child relationships, parenting style and the home environment that are important factors in depicting LOS in the present scenario. The dataset did not have information about other characteristics such as experiences of violence or aggression and legal history. The data also does not exclude patients who are admitted more than once in the same year to the same or different hospital in that area or region which limits our ability to control for clustering. Since the study is designed based on nationwide data, voluntary and involuntary admission criteria were based on parental consent and laws may differ from state to state.

 Implications

Our study shows that there are substantial regional differences among hospitals in LOS for inpatient pediatric psychiatry admissions. There is a need for additional work to understand why LOS is longer in hospitals in the NE. Additionally, hospital characteristics, including the owner (public vs private) and teaching status also affect LOS. This suggests potential disparities in care for patients based on where they access care. These results might help predict anticipated LOS for newly admitted patients and identifying possible drivers of disparities in psychiatric care nationally.

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Tables and Figures

Table 1. Principal ICD-9-CM diagnosis codes used.

651	Anxiety disorder
652	ADHD, conduct, & disruptive behavior disorder
654	Developmental disorder
656	Impulse control disorder
657	Mood disorder
659	Schizophrenia and other Psychotic Disorders
660	Alcohol use disorder
661	Substance Use Disorder
662	Suicide Ideation during current hospitalization

Table 2. Bed size status based on region, location and teaching status.

BEDSIZE CATEGORIES			
Location and Teaching Status	**Hospital Bed-size**		
	Small	Medium	Large
NORTHEAST REGION			
Rural	1-49	50-99	100+
Urban, nonteaching	1-124	125-199	200+
Urban, teaching	1-249	250-424	425+
MIDWEST REGION			
Rural	1-29	30-49	50+
Urban, nonteaching	1-74	75-174	175+
Urban, teaching	1-249	250-374	375+
SOUTHERN REGION			
Rural	1-39	40-74	75+
Urban, nonteaching	1-99	100-199	200+
Urban, teaching	1-249	250-449	450+
WESTERN REGION			
Rural	1-24	25-44	45+
Urban, nonteaching	1-99	100-174	175+
Urban, teaching	1-199	200-324	325+

Table 3 – Descriptive statistics of variables considered as possible predictors of length of stay in inpatient psychiatric admissions among children and adolescents in the United States (next page).

Variable	Age 6-11y (N= 24,840)	Age 12-18 y (N=159,500)	Total (184,340)	χ2 (p value)
Male (%) *	16775 (67.5)	61470 (38.5)	78245 (42.4)	7394.1(<0.001)
LOS (SD)	8.34 (14.1)	6.92 (11.4)	7.11(111.8)	2163.4(<0.001)
Elective Admission (%) *	4390 (17.8)	25270 (15.9)	29660 (16.1)	789.4(<0.001)
Race (%) White* Black Hispanics Other	12090(54.1) 5025(22.5) 3565(16) 1670(7.4)	87600(62.6) 23265(16.6) 18790(13.4) 10285(7.3)	99690(61.4) 28290(17.4) 22355(13.8) 11955(7.4)	866.6 (<0.001)
Median Household Income (%) 0-25th percentile (1-39,999 USD) * 26-50th percentile (40,000-50,999 USD) 51-75th percentile (51,000-65,999 USD) 76th-100th percentile (66,000+ USD)	8540(35.5) 6700(27.8) 5180(21.5) 3670(15.2)	42015(26.9) 41580(26.7) 37305(23.9) 35045(22.5)	50555(28.1) 48280(26.8) 42485(23.6) 38715(21.5)	1108.3(<0.001)
Urbanicity (%) "Central" counties of metros f >=1 mil population* "Fringe" counties of metro of >=1 mil population Counties in metro of 250K-999,999 population Counties in metro of 50,000-249,999 population Micropolitan Counties Not Metropolitan or micropolitan Counties	7060(28.5) 5610(22.6) 6485(26.1) 2440(9.8) 2055(8.3) 115(4.6)	41680(26.2) 42495(26.7) 37725(23.7) 15700(9.9) 13250(8.3) 8155(5.1)	48740(26.5) 48105(26.2) 44210(24.1) 18140(9.9) 15305(8.3) 9305(5.1)	241.9 (<0.001)
Insurance Provider/ Primary payer (%) Public Insurance (Medicaid and Medicare) * Private Insurance Self-pay/Uninsured/Other	15405(62.2) 7980(32.2) 1380(5.5)	74445(46.7) 73135(45.9) 11660(7.2)	89850(48.8) 81115(44.1) 13040(7.0)	2128.3(<0.001)
Ownership of the Hospital (%) Public Hospital* Private Not for Profit Hospital Private for-Profit Hospital	3440(13.8) 16880(68.0) 4520 (18.2)	19594(12.3) 116410(73.0)) 23495 (14.7)	23034(12.5) 133290(72.3) 28015(15.2)	287.2(<0.001)
Bed Size of Hospital (%) Small* Medium Large	5070(20.4) 6210(25.0) 13560(54.6)	31120(19.5) 40715(25.5) 87665(55.0)	36190(19.6) 46925(25.5) 101225(54.9)	11.7 (0.003)
Region of hospital (%) Northeast* Midwest South West	4725(19.0) 7020(28.3) 11090(44.6) 2005(8.1)	30410(19.1) 51735(32.4) 58710(36.8) 18644(11.7)	35135(19.1) 58755(31.9) 69800(37.9) 20649(11.2)	717.2(<0.001)
Teaching Status of Hospital (%) Non-Teaching* **Teaching**	4885(19.7) 19955(80.3)	43145(27.0) 116354(73.0)	48030(26.1) 136309(73.9)	653.9(<0.001)
Discharge Diagnosis (%) ADHD, conduct, & disruptive behavior disorder (%)	2615 (10.5)	2400 (1.5)	5015(2.7)	219.9 (<0.001)
Anxiety Disorder (%)	485(2)	2005 (1.3)	2490 (1.4)	12145.6(<0.001)

Developmental disorder (%)	645 (2.6)	805 (0.5)	1450(0.8)	1110.5 (<0.001))
Impulse control disorder (%)	1220 (4.9)	1835 (1.2)	3055 (1.7)	1299.7(<0.001))
Mood disorder (%)	10320(41.5)	52205(32.7)	62525(33.9)	2851.3(<0.001))
Schizophrenia & other psychotic disorder (%)	940 (3.8)	6315 (4.0)	7255(3.9)	169.1(<0.001)
Suicide Ideation during current hospitalization (%)	6405(25.8)	55540(34.8)	61945(33.6)	2046.9(<0.001)
Alcohol use disorder (%)	240 (1.0)	2955 (1.9)	3195(1.7)	816.9 (<0.001)
Substance use disorder (%)	1970 (7.9)	35440(22.2)	37410(20.3)	920.0(<0.001)

*Indicates the reference level.

Table 4- Final Model Linear Regression Model with dependent Variable is Log length of stay. Model Summary: R = 0.312; R Square = 0.097

Variables	Percent Change in Length of Stay	95.0% Confidence Interval for B		p-value
		Lower Bound	Upper Bound	
(Constant)		1.825	1.858	<0.001
Anxiety disorders	1.14	0.125	0.138	<0.001
ADHD, conduct, and disruptive behavior disorders	1.15	0.136	0.15	<0.001
Developmental disorders	1.18	0.155	0.181	<0.001
Impulse control disorders	1.16	0.136	0.16	<0.001
Schizophrenia and other psychotic disorders	1.41	0.332	0.356	<0.001
Suicide and intentional self-inflicted injury	1.06	0.049	0.062	<0.001
Alcohol-related disorders	0.85	-0.164	-0.137	<0.001
Substance-related disorders	0.97	-0.038	-0.021	<0.001
Age at admission	0.93	-0.074	-0.055	<0.001
Black	1.02	0.005	0.024	0.002
Hispanic	0.90	-0.113	-0.092	<0.001
Other Race	1.04	0.021	0.048	<0.001
Private Insurance	0.94	-0.068	-0.054	<0.001
Self Pay/Uninsured/Other	0.93	-0.081	-0.055	<0.001
Private not for profit	1.05	0.035	0.056	<0.001
Private for profit	1.08	0.062	0.088	<0.001
Hospitals in Midwest	0.76	-0.281	-0.262	<0.001
Hospitals in South	0.74	-0.307	-0.288	<0.001
Hospitals in West	0.77	-0.275	-0.25	<0.001
Admission	1.20	0.177	0.195	<0.001
Medium size hospital	0.96	-0.048	-0.029	<0.001
Large size hospital	0.98	-0.021	-0.004	0.004
Non-teaching Hospital	0.92	-0.091	-0.076	<0.001