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Hospital Care for Mental Health and Substance Abuse in Children with Epilepsy

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Abstract

Background—Reducing the burden of pediatric mental illness requires greater knowledge of Mental Health and Substance Abuse (MHSA) outcomes in children who are at an increased risk of primary psychiatric illness. National data on hospital care for psychiatric illness in children with epilepsy are limited.

Methods—We used the Kids' Inpatient Database (KID), Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality, from 2003-2009 to examine MHSA

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hospitalization patterns in children with comorbid epilepsy. Non-parametric and regression analyses determined the association of comorbid epilepsy with specific MHSA diagnoses and examined the impact of epilepsy on length of stay (LOS) for such MHSA diagnoses while controlling for demographic, payer and hospital characteristics.

Results—We observed 353,319 weighted MHSA hospitalizations of children ages 6 - 20; 3,280 of these involved a child with epilepsy. Depression was the most common MHSA diagnosis in the general population (39.5%) whereas bipolar disorder was the most common MHSA diagnosis among children with epilepsy (36.2%). Multivariate logistic regression models revealed that children with comorbid epilepsy had greater adjusted odds of bipolar disorder (AOR 1.17, 1.04-1.30), psychosis (AOR 1.78, 1.51-2.09), sleep disorder (AOR 5.90, 1.90-18.34), and suicide attempt/ ideation (AOR 3.20, 1.46-6.99) compared to the general MHSA inpatient population. Epilepsy was associated with a greater LOS and a higher adjusted incidence rate ratio (IRR) for prolonged LOS (IRR 1.12, 1.09-1.17), particularly for suicide attempt/ideation (IRR 3.74, 1.68-8.34).

Conclusions—Children with epilepsy have distinct patterns of hospital care for mental illness and substance abuse, and experience prolonged hospitalization for MHSA conditions. Strategies to reduce psychiatric hospitalizations in this population may require disease specific approaches and should measure disease relevant outcomes. Hospitals caring for large numbers of children with neurological disease (such as academic centers) may have inaccurate measurements of mental health care quality unless the impact of key comorbid conditions such as epilepsy is considered.

Keywords

Pediatric Health Services Research; Psychiatry; Epidemiology; Epilepsy; Suicide; Addiction; Length of Stay

Introduction

Mental illness is common in children in the United States, affecting up to 1 in 5 children aged 3 to 17 years.¹ Inpatient mental health care accounts for 10% of pediatric hospitalizations and has recently become a priority topic for national quality measurement and improvement.² The prevalence of neurological disorders in the pediatric population cared for at children's hospitals has grown substantially due to increased survivorship of children with prematurity, perinatal illness, or other diagnoses that are commonly associated with co-morbid neurodevelopmental disorders.³ Epilepsy is a common pediatric neurological condition, and it is associated with increased risk of psychiatric illness.^{4;5} Psychiatric comorbidities in children with epilepsy (CWE) are strongly associated with long-term quality of life, even if seizures are controlled or remit.⁶ Further, the medications used to manage epilepsy may produce psychiatric adverse effects. In 2008, the United States Food and Drug Administration required that warnings be placed on all antiepileptic medications indicating that use of these drugs may result in increased risk of suicidal tendencies in children and adolescents.⁷ However, there are limited data on hospital care for psychiatric illness in children with epilepsy. Notably Hesdorffer and Kanner expressed three potential problems with the FDA alert. First, adverse event data were used rather than systematically collected data. Second, the eleven drugs that were examined were grouped

together as a single class; however many of them have different mechanisms of action and varying relative risks. Finally, the risk of adverse health and disability from uncontrolled seizures outweighs the small risk of suicidality. The authors recommend that all patients with epilepsy be routinely evaluated for depression, anxiety, and suicidality.⁸

Enhancing the quality of pediatric care requires research that examines how health care experiences differ between two groups in order to identify clinically relevant differences in outcomes and disparities in care that may be responsive to policy changes. In this context, we examined national patterns of hospital care for Mental Health and Substance Abuse (MHSA) conditions in children with epilepsy using the Kids' Inpatient Database (KID), Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality.

Materials and Methods

This study was approved by the Institutional Review Board at the Perelman School of Medicine at the University of Pennsylvania.

Data Source

This study utilizes the Kids' Inpatient Database (KID) which is one of the databases developed for the Healthcare Cost and Utilization Project sponsored by the Agency for Healthcare Research and Quality.⁹ The KID is an all-payer database that contains patient, clinical, geographic, socioeconomic, payor and cost data from approximately 3 million pediatric hospitalizations each year. Participating states in the Healthcare Cost and Utilization Project provide hospital characteristic and patient discharge data from all community (defined as nonfederal) hospitals in that state. Data are collected every three years, and may be weighted to generate national estimates for the entire United States population. KID coverage of pediatric discharges in the United States discharges is extensive. For example, the 36 states included in the 2003 KID dataset represent ~80 percent of United States community hospitals, almost 65 percent of children's specialty hospitals, and approximately 87 percent of the 2003 U.S. population. KID coverage increased with the 2006 and 2009 datasets. The KID has previously been used to describe mental health care in the general United States pediatric population, as well in several specific subgroups (e.g. children with sickle cell anemia).^{10;11} We performed a serial cross-sectional analysis of KID hospitalizations in 2003, 2006, and 2009.

Study Population

Hospitalizations of all young children (aged 6-11), adolescents (aged 12-17) and young adults (aged 18-20) with an MHSA condition as the primary discharge diagnosis were extracted. Specific MHSA diagnoses were identified by applying the ICD-9 based Clinical Classifications Software (CCS) designed by Agency for Healthcare Research and Quality for use with Healthcare Cost and Utilization Project data. Co-morbid epilepsy (i.e., epilepsy listed as a secondary discharge diagnosis) was identified in the hospital setting using the following ICD-9 code: "345.x". We constructed a control cohort consisting of all KID hospitalizations with a principle MHSA diagnosis but no secondary diagnosis of epilepsy.

Additionally we also excluded other neurological conditions (e.g., traumatic brain injury, meningitis/encephalitis, stroke, multiple sclerosis, cerebral palsy) for both children with epilepsy and controls. A complete list of excluded neurological diseases is available as a supplement (table e1).

Outcomes and Covariates

The primary outcomes were psychiatric diagnosis and length of stay (LOS) for psychiatric admission as well as LOS for each specific psychiatric diagnosis. We used the Healthcare Cost and Utilization Project's Mental Health Substance Abuse Clinical Classification (CCS-MHSA) software to identify and assign the principal reason for psychiatric hospitalization as being due to alcohol abuse, anxiety, bipolar disorder, depression, eating disorder, psychosis, psychogenic disorder, substance abuse, or attempted suicide/ideation. LOS (in days), was extracted for each MHSA hospitalization.

We extracted patient, hospital and geographical data associated with each admission. Patient characteristics included race, age, gender, total number of diagnoses, ZIP income quartile, and primary payer (private insurance, Medicare, Medicaid, uninsured, and Health Maintenance Organization). We chose to use ZIP income quartile (based on the median house hold income from an individual's neighborhood) and primary payer type as variables for socioeconomic status. In order to qualify for Medicaid an individual must a household income that is below a specific percent of the Federal Poverty level. Thus, payer type is an indirect indicator of socioeconomic status. Hospital characteristics included admission type (emergent, urgent, elective, other, missing, newborn), teaching status (teaching, non-teaching), number of beds, location (urban, rural), and geographic region (North, South, Midwest, West, missing census region).

Statistical Analyses

We applied sampling weights to account for the design of the KID and produce national estimates of the hospitalizations for each principle MHSA diagnosis in the United States from 2003-2009. Descriptive analyses compared the weighted proportions of each MHSA diagnosis, patient and hospital characteristics, LOS between the children with co-morbid epilepsy and controls. We used chi-square and Student's t-tests to assess the statistical significance of categorical and normally distributed continuous variables. LOS was not normally distributed in this dataset so the Wilcoxon-Mann-Whitney (WMW) was used to assess whether LOS differed significantly between the study groups.

We built logistic regression models to determine the relative odds of each MHSA condition in the epilepsy population compared to controls while adjusting for variables that differed significantly between the study groups in descriptive analyses: age, sex, race, primary insurance payer, ZIP income quartile, and hospital teaching status (teaching, non-teaching). Through model fitting, we determined that the best count model to use for the analysis of LOS was a negative binomial count regression, based on descriptive analyses, which found over-dispersion (non-normal distribution) of the dependent variable LOS across the predictor variable. The negative binomial count regression model was run on the unweighted dataset using neurological disease category (epilepsy and control population) as the predictor

variable, and the same covariates described above. We used this model to generate adjusted incidence rate ratios (IRR) which is the ratio of the predicted average LOS, adjusting for confounders, for children with comorbid epilepsy compared to controls. Thus, an IRR greater than 1 implies that patients with epilepsy had longer LOS than those without epilepsy when admitted for a specific MHSA condition. All analyses were performed using SAS v9.4 (SAS Institute Inc., Cary, NC, USA).

Results

Patient Demographics

We identified a weighted total of 353,319 hospitalizations of children ages 6-20 with a principal MHSA diagnosis. Of these hospitalizations, 0.9% (n=3,280) were also diagnosed with epilepsy. As shown in Table 1, the demographic characteristics of children with epilepsy differed from the general inpatient MHSA population. Psychiatric hospitalizations of children with epilepsy had a slightly higher proportion of males (53.0% in CWE compared to 47.3% in controls, rate ratio 1.12 95%CI: 1.08-1.16) and blacks (18.2% in CWE compared to 15.6% in controls; rate ratio 1.16 95%CI: 1.08-1.25) than those in the control population. There was no statistically significant difference in the mean age of 15.9 years (SEM 0.14) among children with epilepsy compared to 15.8 years (SEM 0.08) in the control population. Inpatient pediatric psychiatric care appeared to cluster at academic medical centers, with teaching hospitals discharging the majority of patients with an MHSA diagnosis in both children with epilepsy (57.7%) and the general population (56.3%). A greater proportion of CWE discharges were living in a low income neighborhood, based on the median household income (32.0% in CWE compared to 26.9% in controls, rate ratio 1.19 95%CI: 1.13-1.25). As further evidence of low socioeconomic status associated with an epilepsy diagnosis, we found Medicaid insurance was the most common payer for children with epilepsy (53.7%), whereas the general population most often had private insurance (46.3%), rate ratio 1.34, 95%CI: 1.30-1.38. We also found evidence of the known disability associated with epilepsy and the neurodevelopmental factors that predispose to epilepsy (such as cortical migration disorders, cerebral palsy). Medicare insurance is provided to children with mental and physical disabilities, and was utilized 3 times more often in the CWE group (rate ratio 3.00, 95%CI: 2.17-4.16).

Psychiatric Conditions

As shown in Table 2, the most common MHSA diagnoses in both the epilepsy and general populations were depression and bipolar disorder. However, depression was more common in the general population (incidence 39.5%, 95%CI: 38.0-41.0) and bipolar disorder was more common among children with epilepsy (incidence 36.2% 95%CI: 33.3-39.0). Differences in the incidence of other conditions were also evident. Psychosis was almost twice as common in children with epilepsy, accounting for 13.2% (95%CI: 11.3-15.1) of hospital encounters for these children. The crude incidences of suicide attempt/ideation, and sleep disorders, although uncommon, were slightly more common among children with epilepsy.

Backward elimination stepwise logistic regression models compared the odds of each diagnosis between the epilepsy and control groups, adjusting for potential confounders. MHSA hospitalized children with epilepsy not only had greater adjusted odds of bipolar disorder (AOR 1.17, 95% CI: 1.04-1.30), but were 78% more likely than controls to be admitted for psychosis (AOR 1.78, 95% CI: 1.51-2.09), over three times as likely to have suicide attempt/ideation (AOR 3.20 95% CI: 1.46-6.99) as the reason for admission, and almost six times more likely to have a sleep disorder diagnosis (AOR 5.90, 95% CI: 1.90-18.34), whereas alcohol abuse, depression, eating disorders, and substance abuse were each approximately 50% less likely in children with epilepsy (AOR 0.52, 95% CI: 0.35-0.78; AOR 0.44, 95% CI: 0.39-0.49; AOR 0.46, 95% CI: 0.26-0.81; and AOR 0.53, 95% CI: 0.40-0.70, respectively). Notably, the odds of a diagnosis of anxiety and psychogenic disorder did not differ significantly between discharges of children with epilepsy versus controls.

Length of Stay

The results of the WMW test for all MHSA hospitalizations examining LOS by epilepsy comorbid disease status were statistically significant with a p-value <0.001, indicating there was a difference in LOS between the groups. We then tested discrete MHSA diagnoses to determine any differences in LOS between the control and epilepsy groups using a count regression model that also accounted for patient, hospital, and insurance characteristics. Children with comorbid epilepsy had greater incidence of longer LOS compared to the control population (IRR 1.12, 95% CI 1.09-1.17), that is, children with epilepsy had a mean adjusted LOS that was 1.12 times greater than the general population for any MHSA diagnosis. As shown in table 3, there were also diagnosis specific variances in the adjusted IRR for LOS for children with epilepsy compared to the control group. Children with epilepsy had more than three times the incidence of longer LOS for suicide attempt/ideation (IRR 3.74, 95% CI 1.68-8.34). Substance abuse was not more commonly diagnosed among hospitalized children with epilepsy, also along with alcohol abuse, was associated with decreased need for prolonged hospital care (IRR for prolonged LOS: substance abuse: 0.77 (0.60-0.98); alcohol abuse: 0.55 (0.33-0.92).

Discussion

According to the American Academy of Pediatrics, pediatric mental health emergencies are increasing in frequency in part due to a fragmented psychiatric care infrastructure with critical information shortages at all levels.¹² Children with neurological conditions constitute the largest identifiable segment of the pediatric inpatient population,^{13;14} and outpatient studies have shown that children with epilepsy have an increased incidence of psychiatric symptoms or diagnoses.^{3;15-20} For example, a recent case-control study of inpatient, outpatient claims data from a single U.S. state reported the odds of a mental health diagnosis was 2.20 (95% CI: 2.02-2.39) for children and adolescents with epilepsy compared to controls. In this study, we provide benchmark data on the patterns of hospitalization for mental health and substance abuse among children with epilepsy. Our data suggest that inpatient psychiatric care needs for epilepsy populations differ substantially from the general pediatric population. We found that hospitalizations of children with epilepsy were more

likely to be for bipolar, sleep, psychotic and suicide related disorders and less likely to be diagnosed with depression. One immediate potential effect of our data is to inform ongoing development of pediatric inpatient quality measures. A previous study of acute care for mental illness identified depression and bipolar disorder as the most frequent inpatient MHSA diagnoses in the KID,¹⁰ and suggested that these diagnoses should be used as priority conditions for inpatient quality measurements, a component of reimbursement determination. Our data suggest that hospitals caring for large numbers of children with epilepsy (such as specialty or academic centers) may receive inaccurate quality assessments. Since the majority of MHSA discharges occur from teaching hospitals, this inaccuracy may be particularly relevant for teaching hospitals. A patient-centered interpretation of our findings is that our data suggest CWE may need improvements in coordinated care that address both psychiatric and neurological elements of epilepsy. This view is supported by a recent study which found that comorbid psychiatric illness in CWE strongly predicted QOL, even when seizures were controlled.²¹

Several studies have demonstrated that suicidal ideation is highly prevalent among adults with epilepsy, even in the untreated state.²²⁻²⁵ We found much higher odds of hospitalization for suicide attempt/ideation, and prolonged LOS for suicide related admissions in CWE. Previous studies have attributed an increased risk in suicidality in person with epilepsy to multiple psychiatric conditions, including depression, psychosis and mania.²⁶⁻³³

Depression is the leading cause of suicidality in the general population, but was less common in this study of hospitalizations of CWE. One possible explanation is that children with epilepsy have sufficient access to specialists and monitoring that effective depression treatment occurs more often in the outpatient setting, avoiding hospitalization unless symptoms are very severe. Alternatively, symptoms of depression and anxiety may be under-recognized by parents of CWE until suicidality is expressed.

Psychosis is an independent risk factor for suicide and is more prevalent among adults with epilepsy.^{34;35} Our data demonstrate a greater burden of inpatient care for psychosis in CWE. Antiepileptic drugs have been associated with suicide related behavior³⁶⁻³⁹ and many of these drugs have a black box warning for suicidality. However, there is uncertainty over whether the observed relationship between antiepileptic drugs exposure and suicidality is causal.⁴⁰⁻⁴² Finally, our finding of greater hospital care for suicidality in children with epilepsy may reflect adherence to quality guidelines for epilepsy care. Frequent outpatient screening for suicidal ideation and lower clinical threshold for admission for presumed or possible suicidality may result in more admissions for suicide related illness and fewer successful suicides (which would not be contained in our dataset) in the CWE group. Future studies that are able to examine screening, familial context, and drug exposures may place our findings of increased suicidality in a framework that can further guide clinical guidelines.

Our finding that mania might be a more burdensome mental illness among children with epilepsy is a new finding within the epilepsy literature and it warrants further investigation. Mania can occur in individuals with temporal lobe epilepsy during the postictal state, or present as a complication of temporal lobectomy for medically intractable epilepsy.⁴³⁻⁴⁵

Further, some data suggest that individuals with epilepsy may have atypical depression symptoms, including pain, insomnia, fear, anxiety, and euphoric mood.⁴⁶ The atypical presentation of depression as euphoria could be interpreted as hypomania, and result in a diagnosis of bipolar disorder. Our data may also reflect a true increase in risk of mania and bipolar disorder diagnoses among CWE. Many AEDs are used off label as mood stabilizing agents, to prevent manic episodes.⁴⁷

If the mood stabilizing effects of AEDs decrease the need for hospitalization for mania and bipolar disorder among CWE, the actual burden of mania/ bipolar symptoms among CWE may be substantially greater than we observed with the KID.

Postictal psychosis is well described, and historically has been considered a complication of seizures.⁴⁸⁻⁵³ However, recent studies have suggested a mechanistic link between epilepsy and psychiatric syndromes. A matched longitudinal cohort study of 3,733 adults with epilepsy in the United Kingdom General Practice Research Database, broadly evaluated the association between psychiatric diagnoses and epilepsy. In this cohort, the incidence rate ratio (IRR) for psychosis was increased both before (IRR 1.5-15.7) and after (IRR 2.2-10.9) epilepsy was diagnosed, suggesting a bidirectional association between psychosis and adult onset epilepsy.¹⁸ The authors suggested that common underlying pathophysiological mechanisms might lower seizure threshold and increase the risk of psychiatric disorders. Our data are in alignment with this data in that we also find that psychosis is a common reason for psychiatric hospitalization among children with epilepsy, and further suggest that the relationship between epilepsy and psychosis may be present in younger epilepsy populations as well. Future studies are needed to better define the common mechanisms underlying susceptibility to seizures and psychiatric disorders at the earliest intervenable stage.

In this national study of hospital care for mental health and substance abuse, we demonstrate unique patterns of mental illness in children with comorbid epilepsy, and suggest initial targets for research aimed at understanding and reducing the burden of psychiatric illness in the pediatric epilepsy population. Our use of an administrative claims dataset offers large sample size and greater inclusivity than single center studies. However, this approach has methodological and data limitations. Importantly, the unit of analysis in the Healthcare Cost and Utilization Project data is a hospitalization, not the individual; it is possible that an individual patient contributes to more than one hospitalization to the database in any given year. For this reason, we did not attempt to produce estimates of the incidence of psychiatric illness in the epilepsy population. We cannot quantify readmission rates, whether they differed between study groups or impacted on our primary findings. Although measures to account for the complex sampling design were taken, there may be design related bias that is unknown or cannot be overcome in our study. We are restricted to the use of ICD-9 codes for diagnoses due to the de-identified nature of the KID. Coding bias or inaccuracy may be present on an individual or hospital level, and the extent to which coding bias or inaccuracy affects our primary findings is unknown. However, some studies have examined the accuracy of using the same ICD-9 code we used for epilepsy diagnosis in acute care setting discharge claims.^{54;55} One study reported a positive predictive value (PPV) of 100% (95% CI 93.5-100%) for ICD-9 epilepsy code '345.xx' in an inpatient dataset. Another claims based

study employed a computer algorithm to identify epilepsy cases using ICD-9-CM epilepsy codes and antiepileptic drugs as predictors. The best algorithm had a PPV of 84% (sensitivity 82%, specificity 94%), and correctly identified 90% of cases.⁵⁶ The KID also does not include pharmaceutical or laboratory records. Pharmaceutical data (assuming patient compliance) could allow one to identify AED use for improved diagnostic accuracy, identify secondary (drug or metabolic related) psychiatric illnesses. Individual level, longitudinal drug safety studies would be necessary to determine the extent to which psychiatric hospitalizations in CWE are preventable. We also cannot comment on the relative impacts of mental illness screening (which should be greater in CWE if clinical guidelines are followed), detection (CWE may have atypical MHSA presentations) and action (outpatient versus inpatient treatment) in CWE and the general population in our findings. The construction of our case-control design is based on the assumption that the pediatric individual previously had the diagnosis of epilepsy prior to being hospitalized for the MHSA condition. Children who have a psychiatric episode as the first manifestation of epilepsy may be more likely to have specific MHSA conditions, and the extent to which incident epilepsy presenting with psychiatric symptoms impacts our patterns is unknown. Despite these limitations, we present benchmark data on the patterns of psychiatric illness in hospitalized children with epilepsy. Our data provide initial targets for national efforts to reduce psychiatric hospitalizations in this population, and can also be used by clinicians to focus outpatient mental illness screening and treatment efforts.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Abbreviations

LOS	length of stay
MHSA	Mental Health and Substance Abuse

Highlights

- Children with epilepsy (CWE) have unique patterns of hospital care for mental illness.
- CWE had greater odds of bipolar disorder, psychosis, suicide attempt/ideation.
- Epilepsy was associated with a greater length of stay for mental illness.
- Our data provide targets for efforts to reduce psychiatric hospitalizations in CWE.

What's Known on This Subject

Mental illness is common, costly and in most cases preventable in the pediatric population. Children with neurological conditions constitute the largest identifiable segment of the pediatric inpatient population; however, there is no data on inpatient psychiatric care for this population.

What This Study Adds

Children with epilepsy have unique patterns of hospital care for mental illness. Our data provide initial targets for national efforts to reduce psychiatric hospitalizations, focus outpatient mental illness screening and treatment efforts in this population.

Table 1

Baseline Characteristics of Children Hospitalized for Mental Health or Substance Abuse in the Kids' Inpatient Database, 2003-2009 (weighted)

Characteristic	Control (n=350,039)	Epilepsy (n=3,280)	Rate ratio (epilepsy versus control 95%CI)
Sex			
Male	165,682 (47.3)	1,739 (53.0)	1.12 (1.08-1.16)
Female	184,358 (52.7)	1,541 (47.0)	0.89 (0.86-0.92)
Race			
White	233,032 (66.6)	2,076 (63.3)	0.93 (0.91-0.96)
Black	54,764 (15.6)	598 (18.2)	1.16 (1.08-1.25)
Hispanic	38,389 (11.0)	381 (11.6)	1.06 (0.96- 1.16)
Asian or Pacific Islander	3,899 (1.1)	41 (1.3)	1.12 (0.83-1.52)
Native American	2,786 (0.8)	26 (0.8)	0.99 (0.68-1.46)
Other	17,170 (4.9)	158 (4.8)	0.98 (0.84-1.14)
Age			
Mean (std. error)	15.8 (0.08)	15.9 (0.14)	t-test (p=0.06)
Primary Payer			
Medicare	1,313 (0.4)	37 (1.1)	3.00 (2.17-4.16)
Medicaid	140,011 (40.0)	1,761 (53.7)	1.34 (1.30-1.38)
Private insurance	162,156 (46.3)	1,180 (36.0)	0.76 (0.74-0.81)
Self-pay	23,443 (6.7)	139 (4.2)	0.63 (0.54-0.74)
No charge	2,277 (0.7)	19 (0.6)	0.89 (0.57-1.40)
Other	20,730 (5.9)	143 (4.4)	0.74 (0.63-0.86)
ZIP Income Quartile			
0-25 th Percentile	94,263 (26.9)	1,048 (32.0)	1.19 (1.13-1.25)
26 th -50 th Percentile	87,338 (25.0)	897 (27.3)	1.09 (1.03-1.16)
51 st -75 th Percentile	85,950 (24.5)	725 (22.1)	0.90 (0.84-0.96)
76 th -100 th Percentile	82,489 (23.6)	610 (18.6)	0.79 (0.73-0.85)
Hospital Teaching Status			
Teaching	196,975 (56.3)	1,894 (57.7)	1.03 (0.99-1.06)
Nonteaching	153,064 (43.7)	1,386 (42.3)	0.97 (0.93-1.00)

Odds of Specific MHSA Diagnoses among Hospitalized Children in the KID dataset 2003-2009

Table 2

MHSA Diagnosis	Control Group (N=355,514) No **/Total No. of MHSA Hospitalizations	Incidence (95%CI)	Epilepsy Group (N=10,463) No */Total No. of MHSA Hospitalizations	Incidence (95%CI)	Adjusted Odds Ratio *** CI	P-Value
<i>Alcohol abuse</i>	8,889 / 350,039	2.5 (2.2-2.8)	44 / 3,280	1.3 (0.8-1.9)	0.52 (0.35-0.78)	0.002
<i>Anxiety</i>	13,715 / 350,039	3.9 (3.5-4.3)	102 / 3,280	3.1 (2.4-3.9)	0.79 (0.61-1.01)	0.06
<i>Bipolar Disorder</i>	112,602 / 350,039	32.2 (30.6-33.8)	1,186 / 3,280	36.2 (33.3-39.0)	1.17 (1.04-1.30)	0.008
<i>Depression</i>	138,306 / 350,039	39.5 (38.0-41.0)	2,698 / 3,280	21.3 (19.1-23.5)	0.44 (0.39-0.49)	<0.001
<i>Eating disorder</i>	6,319 / 350,039	1.8 (1.3-2.3)	22 / 3,280	0.66 (0.26-1.06)	0.46 (0.26-0.81)	0.007
<i>Psychosis</i>	23,337 / 350,039	6.7 (6.3-7.1)	433 / 3,280	13.2 (11.3-15.1)	1.78 (1.51-2.09)	<0.001
<i>Psychogenic disorder</i>	455 / 350,039	0.13 (0.11-0.15)	* / 3,280	0.14 (0.00-0.29)	1.13 (0.36-3.56)	0.84
<i>Sleep disorder</i>	79 / 350,039	0.02 (0.01-0.03)	* / 3,280	0.15 (0.00-0.32)	5.90 (1.90-18.34)	0.002
<i>Substance abuse</i>	18,062 / 350,039	5.2 (4.5-5.8)	95 / 3,280	2.9 (2.1-3.7)	0.53 (0.40-0.70)	<0.001
<i>Suicide attempt/ideation</i>	241 / 350,039	0.07 (0.05-0.09)	* / 3,280	0.22 (0.03-0.40)	3.20 (1.46-6.99)	0.004

* HCUP DUA prohibits the reporting of 10 or fewer observations

** We do not display the data for the nonspecific diagnosis of 'mood disorder NOS' captured by the MHSA software, therefore, the total number of MHSA diagnoses listed does not equal the total number of encounters in either study population.

*** Adjusted for age, sex, race, insurance type (private, Medicaid, Medicare, self-pay), ZIP income quartile, and hospital teaching status

Table 3

Length of MHSA Hospitalization (per 365 days) in Children with Epilepsy and Controls, KID 2003-2009.

<i>MHSA Diagnosis</i>	<u>Length of Stay, Days Mean, (SD)</u>		Adjusted incidence rate ratio * 95%CI	P-Value
	Controls	Epilepsy		
<i>All MHSA diagnosis discharges</i>	7.27 (12.55)	8.39 (14.47)	1.12 (1.09-1.17)	<0.001
<i>Alcohol abuse</i>	3.57 (6.50)	2.04 (1.82)	0.55 (0.33-0.92)	0.02
<i>Anxiety</i>	8.35 (16.47)	8.12 (15.35)	1.04 (0.82-1.31)	0.74
<i>Bipolar Disorder</i>	7.94 (12.44)	9.35 (15.84)	1.16 (1.10-1.23)	<0.001
<i>Depression</i>	6.05 (9.53)	6.06 (5.51)	0.99 (0.92-1.06)	0.81
<i>Eating disorder</i>	13.45 (13.27)	9.93 (6.31)	0.82 (0.52-1.30)	0.40
<i>Psychosis</i>	10.83 (17.09)	10.18 (15.44)	0.99 (0.89-1.09)	0.80
<i>Psychogenic disorder</i>	2.78 (2.49)	2.00 (1.00)	0.65 (0.24-1.76)	0.40
<i>Sleep disorder</i>	1.96 (1.44)	1.00 (0.00)	0.78 (0.21-2.85)	0.71
<i>Substance abuse</i>	6.15 (10.62)	4.14 (4.19)	0.77 (0.60-0.98)	0.03
<i>Suicide attempt/ideation</i>	2.96 (3.61)	9.80 (10.43)	3.74 (1.68-8.34)	0.001

* Adjusted for age, sex, race, insurance type, ZIP income quartile, and hospital teaching status.