RESEARCH ARTICLE

Characteristics of Children Hospitalized for Psychogenic Nonepileptic Seizures Due to Conversion Disorder Versus Epilepsy

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ABSTRACT

OBJECTIVES: Psychogenic nonepileptic seizures (PNES) are a manifestation of conversion disorder among children but can be difficult to distinguish from epilepsy. We sought to identify characteristics that differentiate children with PNES from those with epilepsy.

METHODS: We conducted a retrospective cohort study of children admitted with epilepsy or PNES to 45 children's hospitals from 2004 to 2014. Children with PNES (n = 399) versus those with epilepsy (n = 13 241) were compared on demographic and clinical characteristics, testing, treatment, and health care use. Hierarchical multivariable logistic regression was used to identify characteristics associated with PNES diagnosis.

RESULTS: Children with PNES were more likely to be female (adjusted odds ratio [aOR] 2.3; 95% confidence interval [CI] 1.8–3.0), older (aOR 3.8; 95% CI 2.7–5.3 for 14–16 years old), African American (aOR 2.0; 95% CI 1.5–2.7), and have diagnosis codes for psychiatric disorders (aOR 7.1; 95% CI 5.6–9.1) and pain (aOR 2.6; 95% CI 1.9–3.4). They were also more likely to be admitted in the fall (aOR 2.0; 95% CI 1.4–2.8) or spring (aOR 1.9; 95% CI 1.4–2.6) versus summer. Total adjusted hospitalization costs were greater for children with epilepsy ($4724, 95% CI $4413–$5057 vs $5326, 95% CI $5259–$5393; P = .001); length of stay was similar.

CONCLUSIONS: Demographic and clinical characteristics differed among children with PNES versus those with epilepsy, including significantly increased odds of psychiatric and pain diagnoses among children with PNES. To better inform treatment and prognostication for children with PNES, research is needed to understand reasons for these differences, seasonal admission patterns, and the relationship between PNES and other psychiatric disorders.

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Nonepileptic seizures are episodes of altered movement, sensation, or behavior that are not caused by abnormal cortical discharges but resemble epileptic seizures. These episodes may have physiologic or psychogenic origins, with the latter being a manifestation of conversion disorder (CD) among children.[1–3] The estimated prevalence of psychogenic nonepileptic seizures (PNES) is 2 to 33 per 100 000 among the general population,[4] although there are no specific estimates regarding PNES among children.

PNES are poorly understood by providers and may be difficult to distinguish from epilepsy.[5–7] Video EEG used to capture an episode is the gold standard for diagnosing PNES[8]; however, EEG may require inpatient admission, is used inconsistently, and clinicians report variable confidence in its diagnostic reliability.[9–11] Diagnosis may therefore be delayed by years while patients are treated for presumed epilepsy.[11–15] Individuals with undiagnosed PNES incur costs similar to those with epilepsy[13] (up to $20 000 annually[16]) and are often prescribed antiepileptic drugs (AEDs) with potentially toxic side effects.[17,18] Moreover, patients experience emotional distress, impaired quality of life, and poorer prognosis because of diagnostic latency.[11,19] Children with PNES also frequently have psychiatric disorders or experience abuse,[17,18,20–22] and failure to recognize PNES as a manifestation of these issues may result in further harm.

Much of what is known about PNES is based on studies of adults who have different clinical characteristics and worse outcomes compared with children.[17,23] In addition, many studies of children with PNES were conducted outside of North America, involved single institutions, or had small sample sizes. Therefore, the literature reveals a wide range of patient characteristics and management practices.[17,18,20,23–25] Determining factors that distinguish children with PNES from children with epilepsy may improve clinicians' abilities to evaluate, treat, and educate children with PNES and their parents. Therefore, we sought to define characteristics and inpatient resource use patterns that differentiate children with PNES secondary to CD versus children with epilepsy, without other complex chronic or critical medical conditions, using a large, multicenter North American cohort.

METHODS

Study Design

We performed a multicenter, retrospective cohort study using the Pediatric Health Information System (PHIS), an administrative database of 49 North American children's hospitals affiliated with the Children's Hospital Association (Overland Park, KS). In the PHIS, patients are assigned unique identifiers that permit longitudinal analysis across encounters within hospitals. Demographic data, *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) diagnosis and procedure codes and clinical transaction classification (CTC) codes for billed services (eg, laboratory studies, imaging, and pharmacotherapy) are included for each encounter. PHIS-member hospitals, the Children's Hospital Association, and Truven Health Analytics (Ann Arbor, MI) monitor data reliability and validity. The Colorado Multiple Institutional Review Board approved this study with a waiver of informed consent.

Population

Inclusion Criteria

Children who were 8 to 20 years old and discharged between January 1, 2004, and December 31, 2014, were eligible for inclusion (Fig 1). We chose the lower age limit of 8 years because PNES due to CD are rarely diagnosed earlier.[1,2,15,25] The upper age limit of 20 years is within the age limits of pediatrics.[26] Eligible subjects had principal diagnosis codes for epilepsy or PNES. All epilepsy codes 345.00 through 345.91 were included. We studied children with PNES due to CD because CD is the most common underlying psychiatric disorder among children with PNES.[2,20] There is no unique ICD-9-CM code for PNES secondary to CD, so we defined PNES by using CD (300.11) and "other convulsions" (780.39). The latter is the equivalent diagnosis to "unspecified convulsions" (R56.9), one of the most frequently used diagnosis codes to classify PNES under the *International Classification of Diseases, 10th Revision*.[10] To be included in the PNES cohort, the record needed to contain diagnosis codes for CD and "other convulsions" with one of those being the principal diagnosis.

Exclusion Criteria

To prevent potential confounding, we excluded records with diagnoses codes for conditions that may predispose patients to epilepsy, cerebrovascular accidents and/or increased resource use, including complex chronic conditions,[27] history of malignancy, congenital anatomic malformations, cardiovascular disease, hematologic disorders, cerebral palsy, severe intellectual disability, vasculitides, infection, trauma (except for falls), fractures, encephalopathy, suicide attempts and/or toxic ingestions, and pregnancy (Fig 1). Similarly, we excluded encounters for surgical and/or invasive procedures, severe illnesses that required intubation for >96 hours, central or arterial line placement, or intracranial pressure monitoring. We excluded records without charge data and records of patients who were transferred from other institutions. Data regarding tests performed at transferring institutions are not available in the PHIS; thus, these records may have contained incomplete information. Records with a psychiatrist as the admitting provider were also excluded because these may reflect psychiatric admissions.

If patients were admitted more than once for PNES or epilepsy, the first encounter was analyzed. Encounters with diagnosis codes for epilepsy and PNES were excluded, as were children with PNES who were previously hospitalized for epilepsy. Children may have PNES and epilepsy;[12,14,17,18,24] however, the known presence of 1 condition may impact treatment of the other (eg, children with epilepsy may be more likely to undergo EEG) and receiving treatment of both may increase resource use, thus biasing our findings. Similarly, hospitalizations with secondary psychiatric diagnoses that may confound epilepsy treatment were excluded, including somatization and/or somatoform disorders (ICD-9-CM codes 300.81, 300.82, and 300.89) and CD, because we could not determine if children had nonepileptic seizures or other complaints that prompted further investigation.

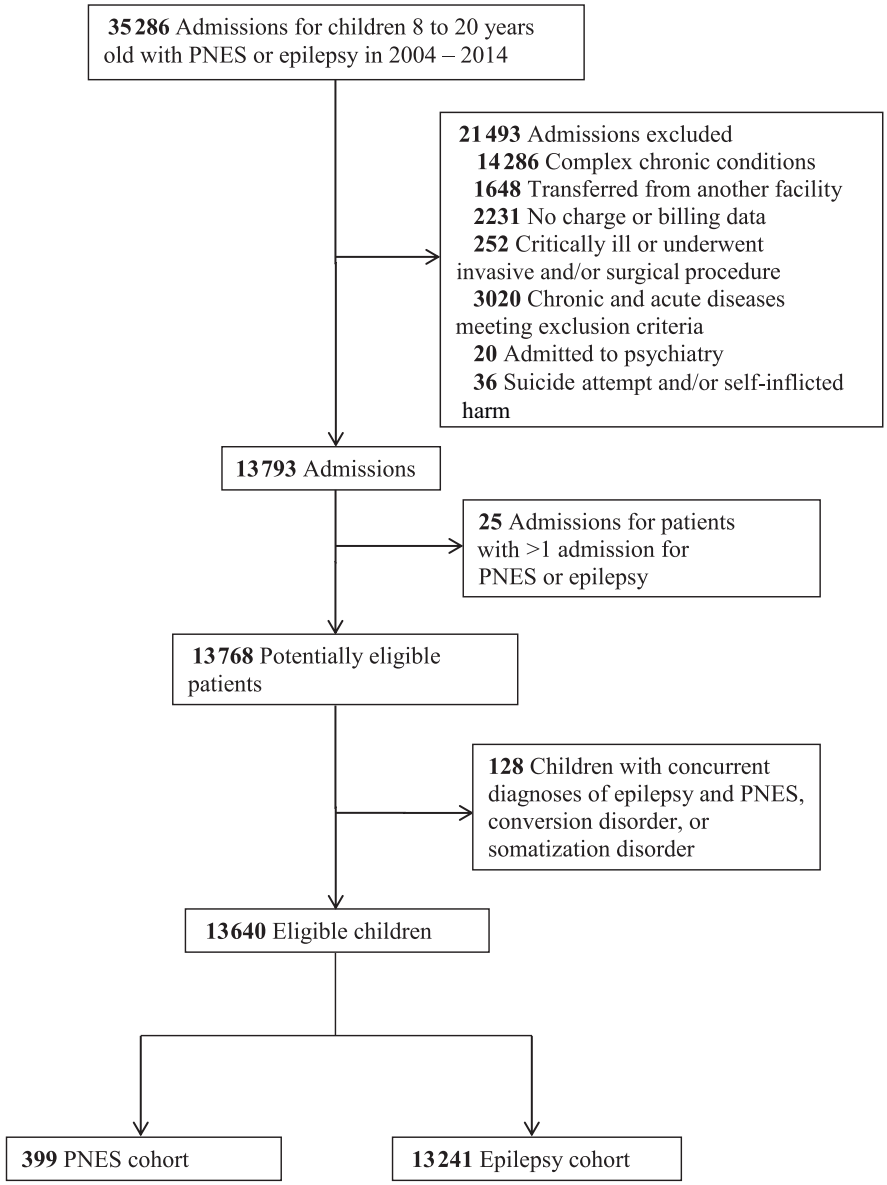

FIGURE 1 Admissions of children with PNES and epilepsy from 2004 to 2014 at 45 US children's hospitals.

Patient Characteristics

Demographic characteristics of children with PNES versus those with epilepsy were assessed, including age, sex, race, primary payer, and region. To analyze comorbid mental health disorders, we extracted ICD-9-CM codes and manually grouped them according to the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* classification criteria for depressive, anxiety, bipolar, and trauma and stressor-related disorders.[3] Patients with PNES may have a higher prevalence of headaches and pain;[28] thus, we examined records for the presence of headaches and/or migraines; limb and/or joint, back, chest and abdominal pain; and pain without a specified site (see Supplemental Table 4 for ICD-9-CM coding classifications). To assess seasonal and temporal trends, we classified admissions by month and year.

Outcome Measures

Outcome measures included length of stay and total adjusted hospitalization costs. We calculated total adjusted hospitalization costs by multiplying the charge, adjusted for hospital location, by the relevant cost-to-charge ratio and inflating costs to 2016 US dollars using the Consumer Price Index. Other outcomes were diagnostic testing and therapeutic interventions. EEG was identified by using ICD-9-CM (89.14 and 89.19) and CTC (515001) codes. We also included diagnostic studies and/or interventions that may be administered to patients with presumed epileptic seizures (lumbar puncture, brain imaging, and laboratory tests, including chemistry and hematologic testing, microbiology studies, therapeutic drug monitoring, and toxicology screening). Patients with epilepsy or PNES may present with falls,[29] and patients with PNES may have higher autonomic arousal affecting heart rate and variability[30]; therefore, we also identified spinal imaging, chest radiography, electrocardiogram, and echocardiogram. To characterize therapeutic interventions, we examined attending physician subspecialties and medications, including AEDs, psychotherapeutics, antimicrobial agents, benzodiazepines, and opioid and nonopioid analgesics. The PHIS does not contain information regarding psychology, psychiatry, or social work consultations; however, we identified psychological or psychiatric testing, services, or therapies using CTC codes (551000, 551010, 551050, 551051, 551055, 551059, and 551099).

Statistical Analysis

Categorical variables were described by using frequencies and proportions. Patient characteristics, diagnostic, treatment, and health care use data were stratified according to diagnosis (PNES versus epilepsy) and compared by using χ^2 or Fisher's exact tests for categorical variables. Because of non-normal data distributions, geometric means and 95% confidence intervals (CIs) of the mean were calculated for continuous variables and compared with *t* tests. Simple logistic regression with site as a random effect was used to obtain a site-adjusted *P* value for each of the demographic and clinical bivariable comparisons. To determine demographic and clinical factors associated

with diagnosis, we incorporated variables associated with PNES versus those associated with epilepsy with $P < .10$ in bivariable analyses into a hierarchical multivariable logistic regression model with hospital as a random effect using backward elimination method. The hospital-level variable of region and statistical interactions of age and sex and primary payer and race were considered in the model, as were variables indicating season and the presence of pain or mental health diagnoses. Unadjusted odds ratios and adjusted odds ratios (aORs) and 95% CIs for variables associated with PNES are reported. A 2-sided P value of $< .05$ and a 95% CI exclusive of 1.0 were considered statistically significant. All analyses were performed by using SAS version 9.4 (SAS Institute, Inc, Cary, NC).

RESULTS

Study Cohort

A total of 13 640 children from 45 institutions were included; 399 (2.9%) had PNES and 13 241 (97.1%) had epilepsy (Fig 1). Only 20 admissions by a psychiatrist and 36 admissions for suicide attempts and/or self-inflicted harm were excluded. Patient characteristics are summarized in Table 1.

Patient Characteristics

Compared with children with epilepsy, those with PNES were more likely to be female ($P < .001$), older ($P < .001$), Black ($P < .001$), and have public insurance ($P = .009$; Table 1). Although there was no statistically significant difference in admission year, children with PNES were less likely to be admitted in the summer (June, July, or August) than children with epilepsy (Fig 2; $P < .001$). Children with PNES were more likely to have diagnosis codes for mental health disorders, including anxiety (26.6% vs 4.1%), bipolar (10.3% vs 2.4%), trauma and stressor-related (7.8% vs 0.8%), and depressive disorders (7.8% vs 0.5%, $P < .001$ for all). Those with PNES were also more likely to have diagnosis codes for pain (21.8% vs 7.1%; $P < .001$), particularly for headaches and/or migraines (16.5% vs 6.4%; $P < .001$).

TABLE 1 Demographic and Clinical Characteristics of Children Hospitalized for Epilepsy or PNES at 45 US Children's Hospitals From 2004 to 2014

Characteristic	Overall Cohort ($N = 13\,640$)		PNES ($n = 399$)		Epilepsy ($n = 13\,241$)		Adjusted P
	n	%	*n*	%	*n*	%	
Female	6820	50.0	289	72.4	6531	49.3	<.001
Age, y							<.001
8–10	4635	34.0	49	12.3	4586	34.6	
11–13	3834	28.1	97	24.3	3737	28.2	
14–16	3729	27.3	187	46.9	3542	26.8	
17–20	1442	10.6	66	16.5	1376	10.4	
Race							<.001
White	9246	70.1	261	67.1	8985	70.2	
Black	2209	16.7	104	26.7	2105	16.4	
Other[a]	1742	13.2	24	6.2	1718	13.4	
Primary payer							.009
Commercial	6370	47.2	168	42.5	6202	47.4	
Public	5909	43.8	192	48.6	5717	43.7	
Other	1001	7.4	23	5.8	978	7.5	
Self-pay	204	1.5	12	3.0	192	1.5	
Region							.39
South	5586	41.0	190	47.6	5396	40.8	
Midwest	3371	24.7	103	25.8	3268	24.7	
West	2676	19.6	63	15.8	2613	19.7	
Northeast	2007	14.7	43	10.8	1964	14.8	
Mental health disorder							
Anxiety disorders	649	4.8	106	26.6	543	4.1	<.001
Bipolar disorders	359	2.6	41	10.3	318	2.4	<.001
Trauma and stressor-related disorders	131	1.0	31	7.8	100	0.8	<.001
Depressive disorders	95	0.7	31	7.8	64	0.5	<.001
Any of the above mental health disorders	1117	8.2	164	41.1	953	7.2	<.001
Pain							
Headache and/or migraine	908	6.7	66	16.5	842	6.4	<.001
Abdominal	56	0.4	9	2.3	47	0.4	<.001
Limb and/or joint	50	0.4	6	1.5	44	0.3	.002
Back	26	0.2	5	1.3	21	0.2	<.001
Chest	24	0.2	7	1.8	17	0.1	<.001
Other or site unspecified	16	0.1	5	1.3	11	0.1	<.001
Any of the above pain diagnoses	1025	7.5	87	21.8	938	7.1	<.001
Year of admission							.48
2004	515	3.8	18	4.5	497	3.8	
2005	734	5.4	29	7.3	705	5.3	
2006	839	6.2	25	6.3	814	6.1	
2007	1210	8.9	38	9.5	1172	8.9	
2008	1253	9.2	37	9.3	1216	9.2	
2009	1306	9.6	32	8.0	1274	9.6	
2010	1361	10.0	44	11.0	1317	9.9	
2011	1449	10.6	37	9.3	1412	10.7	

TABLE 1 Continued

Characteristic	Overall Cohort (N = 13 640)		PNES (n = 399)		Epilepsy (n = 13 241)		Adjusted P
	n	%	n	%	n	%	
2012	1561	11.4	41	10.3	1520	11.5	
2013	1724	12.6	34	8.5	1690	12.8	
2014	1688	12.4	64	16.0	1642	12.3	

[a] Asian, American Indian, Alaskan native, Native Hawaiian, Pacific Islander, and other.

On multivariable logistic regression analysis, female sex (aOR 2.3; 95% CI 1.8–3.0), older age (aOR 2.3, 95% CI 1.6–3.4 for 11–13 years old; aOR 3.8, 95% CI 2.7–5.3 for 14–16 years old; and aOR 3.4, 95% CI 2.2–5.0 for 17–20 years old), Black race (aOR 2.0; 95% CI 1.5–2.7), and self-pay status (aOR 2.9; 95% CI 1.5–5.7) were associated with increased likelihood of PNES diagnosis versus epilepsy diagnosis within a given hospital (Table 2). Children with PNES were more likely to be admitted in the fall (aOR 2.0, 95% CI 1.4–2.8) or spring (aOR 1.9; 95% CI 1.4–2.6) versus summer. PNES diagnosis was also associated with pain (aOR 2.6; 95% CI 1.9–3.4) or mental health (aOR 7.1; 95% 5.6–9.1) diagnosis codes.

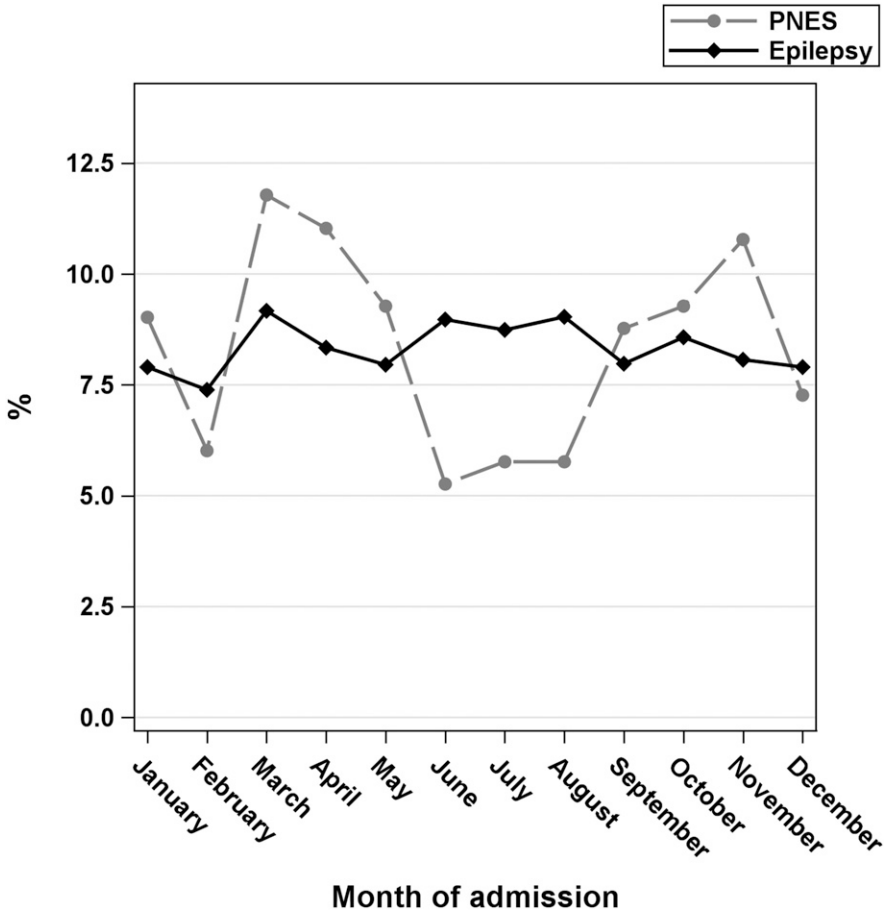

FIGURE 2 Month of admission for children hospitalized with PNES or epilepsy from 2004 to 2014 at 45 US children's hospitals.

Inpatient Resource Use

Length of stay was similar between groups (Table 3). Total adjusted hospitalization costs were greater for children with epilepsy versus PNES (geometric mean $4724, 95% CI $4413–$5057 vs $5326, 95% CI $5259–$5395; P = .001).

Diagnostic Testing

A greater proportion of children with epilepsy underwent EEG (72.4% vs 77.6%; P = .02); however, rates of brain imaging were similar (Table 3). Compared with children with epilepsy, those with PNES were more likely to receive other tests, including electrocardiogram (23.6% vs 8.8%; P < .001), chest radiograph (7.0% vs 3.8%; P = .001), lumbar puncture (4.0% vs 2.3%; P = .03), echocardiogram (3.3% vs 0.8%; P < .001), and spinal imaging (3.5% vs 0.6%; P < .001). Children with PNES were also more likely to undergo laboratory testing except therapeutic drug monitoring (P < .001 for all).

Treatment

Although most were admitted to neurologists, children with PNES were more likely to be admitted to a general medicine or other subspecialty physician (P < .001; Table 3). Children with epilepsy were more likely to receive AEDs (81.4% vs 41.6%; P < .001); however, those with PNES were more likely to receive psychotherapeutic medications (31.1% vs 12.2%), opioid (6.3% vs 3.2%), and nonopioid analgesics (53.6% vs 29.5%; P < .001 for all). Children with PNES were more likely to receive psychological and/or psychiatric testing, therapy, or services versus children with epilepsy (7.3% vs 2.3%; P < .001).

DISCUSSION

We found significant differences in seasonal admission patterns and patient characteristics among children with PNES versus those with epilepsy. These findings suggest a relationship between school stressors and the onset or exacerbation of mental health disorders, raise the possibility of potential differential access to outpatient subspecialty and mental health care, and highlight the importance of longitudinal mental health care among children with PNES.

TABLE 2 Hierarchical Multivariable Logistic Regression Analysis of Demographic and Clinical Characteristics Associated With Diagnosis of PNES Versus Epilepsy Among Children Admitted to 45 US Children's Hospitals From 2004 to 2014

Characteristic	Odds Ratio (95% CI)	aOR (95% CI)
Sex		
Male	1 [Reference]	1 [Reference]
Female	2.8 (2.2–3.5)	2.3 (1.8–3.0)
Age, y		
8–10	1 [Reference]	1 [Reference]
11–13	2.4 (1.7–3.5)	2.3 (1.6–3.4)
14–16	5.0 (3.6–6.8)	3.8 (2.7–5.3)
17–20	4.8 (3.3–7.0)	3.4 (2.2–5.0)
Race		
White	1 [Reference]	1 [Reference]
Black	1.6 (1.3–2.1)	2.0 (1.5–2.7)
Other[a]	0.6 (0.4–0.9)	0.7 (0.4–1.1)
Primary payer		
Private	1 [Reference]	1 [Reference]
Public	1.3 (1.0–1.6)	1.2 (0.9–1.5)
Self-pay	2.5 (1.3–4.7)	2.9 (1.5–5.7)
Other	0.9 (0.6–1.4)	1.0 (0.6–1.6)
Season of admission		
Summer (June–August)	1 [Reference]	1 [Reference]
Fall (September–November)	1.9 (1.4–2.5)	2.0 (1.4–2.8)
Winter (December–February)	1.5 (1.1–2.1)	1.5 (1.0–2.1)
Spring (March–May)	2.0 (1.5–2.7)	1.9 (1.4–2.6)
Pain (any diagnosis)	3.8 (2.9–4.9)	2.6 (1.9–3.4)
Mental health disorder[b]	8.6 (6.9–10.7)	7.1 (5.6–9.1)

[a] Asian, American Indian, Alaskan native, Native Hawaiian, Pacific Islander, and other.
[b] Anxiety, bipolar, depressive, and trauma and/or stressor-related disorders.

Children with PNES were less likely to be admitted in the summer versus children with epilepsy. This may be because they were not attending school, thus lessening anxiety related to peer group dysfunction or school performance, which contributes to PNES.[17,18] Our findings reveal that interventions focused on improving social functioning among children for whom school attendance is a PNES trigger may be an important area of future research.

School-based stressors may have a broader impact on pediatric health care use than our results reveal. PNES are only 1 somatic manifestation of a childhood mental health disorder and we only examined inpatient encounters. Schrijver et al[31] found that pediatric referrals for functional complaints (eg, chronic abdominal pain) nadired in the summer. Plemmons et al[32] observed fewer inpatient and emergency department encounters for pediatric suicidal ideations and/or attempts in the summer. Together, these findings reveal that hospitals may benefit from adjusting mental health provider staffing to account for seasonal variations as they do with other medical conditions (eg, bronchiolitis). Moreover, these results reveal the need for further research on the impact of school stressors on children's mental health and subsequent resource use and whether school-based interventions can mitigate these trends.

Children with PNES were more likely to be Black and self-paying compared with children with epilepsy, which, to our knowledge, has not previously been described in a large North American cohort. These differences may represent institutional referral biases. Our findings could also reflect differential access to outpatient subspecialty care. For example, in previous studies, Black and Hispanic children were less likely to receive mental health care compared with white children.[33,34] Appropriate mental health evaluations facilitate diagnosis and treatment and reduce health care use among children with PNES,[35] suggesting that access to these services may mitigate hospitalization. Additional investigations are needed to determine the reasons for these differences.

On multivariable analysis, having a mental health or pain diagnosis code was a significant factor differentiating children with PNES versus those with epilepsy. This may reflect a higher index of suspicion for these conditions among children with PNES or greater propensity for clinicians to document these diagnoses. Our results, however, are consistent with previous studies,[18,20,21,28,35,36] suggesting that PNES should be considered among the differential diagnoses for children with mental health or pain disorders who present with seizure-like symptoms.

Compared with other characteristics, having a mental health diagnosis code was associated with greater adjusted odds of PNES diagnosis. This underscores the need to screen children with PNES for psychiatric disorders. Rates of psychiatric diagnoses in both cohorts were lower than those in other studies.[18,20–22,37,38] This may reflect differences in methodology because previous studies included outpatient diagnoses, diagnosis rates after screening, or the prevalence of psychiatric disorders over time, whereas we examined data from a single admission. In addition, psychiatric diagnoses may have only been included if children were formally diagnosed or received treatment that impacted hospitalization charges. In addition, children in our study were relatively young. The prevalence of psychiatric disorders increases with age, and psychiatric disorders have a recurrent rather than chronic course among children,[39,40] suggesting that our results may underestimate the prevalence of psychiatric disorders and that prospective longitudinal studies are needed to determine the

TABLE 3 Diagnostic Testing, Treatment, and Inpatient Resource Use Among Patients Hospitalized for Epilepsy or PNES at 45 US Children's Hospitals From 2004 to 2014

Characteristic	Overall Cohort (N = 13 640)		PNES (n = 399)		Epilepsy (n = 13 241)		P
	n	%	n	%	n	%	
Diagnostic imaging and/or testing							
EEG	10 566	77.5	289	72.4	10 277	77.6	.02
Brain imaging	3949	29.0	100	25.1	3849	29.1	.08
Electrocardiogram	1262	9.3	94	23.6	1168	8.8	<.001
Chest radiograph	530	3.9	28	7.0	502	3.8	.001
Lumbar puncture	327	2.4	16	4.0	311	2.3	.03
Echocardiogram	120	0.9	13	3.3	107	0.8	<.001
Spinal imaging	87	0.6	14	3.5	73	0.6	<.001
Laboratory testing							
Hematology or chemistry	6748	49.5	252	63.2	6496	49.1	<.001
Therapeutic drug monitoring	4192	30.7	87	21.8	4105	31.0	<.001
Toxicology screening	1722	12.6	130	32.6	1592	12.0	<.001
Microbiology	1225	9.0	66	16.5	1159	8.8	<.001
Attending subspecialty							<.001
Neurology	10 116	74.2	229	57.4	9887	74.7	
General medical	1937	14.2	117	29.3	1820	13.7	
Unknown	1102	8.1	19	4.8	1083	8.2	
Other	485	3.6	34	8.5	451	3.4	
Medications							
AEDs	10 947	80.3	166	41.6	10 781	81.4	<.001
Nonopioid analgesics	4118	30.2	214	53.6	3904	29.5	<.001
Benzodiazepines	3683	27.0	120	30.1	3563	26.9	.16
Psychotherapeutics	1735	12.7	124	31.1	1611	12.2	<.001
Anti-infectives	725	5.3	20	5.0	705	5.3	.78
Opioid analgesics	453	3.3	25	6.3	428	3.2	<.001
Psychological or psychiatric assessment, therapy, or services	334	2.4	29	7.3	305	2.3	<.001
LOS, d[a]	1.9	1.9–1.9	1.9	1.8–2.0	1.9	1.9–1.9	.70
Total adjusted hospitalization costs, $[a]	5307	5242–5373	4724	4413–5057	5326	5259–5393	.001

LOS, length of stay.
[a] Values given as geometric mean, 95% CI

prevalence of comorbid psychiatric disorders among children with PNES.

As with previous studies,[36,41] children with PNES had high rates of AED administration. AEDs may be prescribed for other reasons other than epilepsy, such as mood stabilization and chronic pain. If children with PNES were prescribed AEDs empirically for seizures, however, our findings highlight the need for clear instructions for patients, families, and clinicians regarding how to discontinue AEDs after PNES diagnosis, particularly given that some AEDs have been associated with worsening behavior or mood.[42,43]

Our study has several significant limitations. Our sampling method introduces ascertainment and misclassification bias that may limit the generalizability of our findings and underestimate the prevalence of PNES. We focused on children with PNES due to CD and defined PNES using diagnosis codes for CD and "other convulsions"; however, not all patients with PNES have CD, and this definition was not validated. "Other convulsions" may have also been used for children with undifferentiated seizure disorders, thus misclassifying children with epilepsy. Using 2 diagnoses to define PNES may have enhanced the specificity our findings; however, many children with PNES were likely excluded. The *International Classification of Diseases, 10th Revision* includes a diagnosis code (F44.5) for "conversion disorder with seizures or convulsions" that may enhance investigators' abilities to identify patients in the future. This code, however, is used less frequently than "other convulsions," and practitioners use a wide variety of diagnosis codes for PNES.[10] These limitations

underscore the need for collaborative research supported by clinical data to better understand and treat children with PNES.

Our results may not be applicable to patients with other medical conditions. We excluded patients with epilepsy and other psychiatric disorders because we could not determine what treatment they received for each condition, although patients with PNES frequently have epilepsy.[12,14,17,18,24] To minimize bias, we also omitted patients with certain chronic and acute medical conditions, which may further limit the applicability of our findings. Our results are also based on inpatient data from free-standing, tertiary care children's hospitals, which may further limit the generalizability of our results.

Given our use of administrative data, we cannot determine the full scope of services received during admission, including consultations for psychiatry, psychology, or social work. Children may have undergone studies before admission that affected management but were not captured in our analysis. We also cannot determine clinical reasoning or evaluate for the presence of other symptoms that may have affected treatment that were not captured in ICD-9-CM or CTC codes. Finally, given the exploratory nature of this study, we did not adjust for multiple comparisons in our bivariable analyses, which may have increased our Type I error rate.

Despite these limitations, we observed several important differences in the demographic, clinical, and treatment characteristics of children with PNES compared with children with epilepsy that may help clinicians, patients, and families to better understand, diagnose, and treat PNES. Our findings reveal that patients with PNES may be at greater risk for certain psychiatric conditions and should increase awareness of the need to screen for these conditions and provide mental health referrals. Additional investigations are needed to understand the role of school-based stressors on pediatric mental health, the prevalence and effects of comorbid conditions, particularly pain and psychiatric disorders, among children with PNES and their clinical trajectories after hospitalization.

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