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Variables associated with emergency department and/or unplanned hospital utilization for children with epilepsy

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ABSTRACT

In the United States, approximately one million people are evaluated annually in an emergency department (ED) for the diagnosis of a seizure or epilepsy. The highest percentages of these patients are less than five years of age. No studies have been performed on assessing potential variables associated with recurrent ED visits and/or unplanned hospitalizations for children with epilepsy. Institutional review board approval from Nationwide Children's Hospital was obtained prior to study initiation. An accountable care organization (ACO), Partner for Kids (PFK), database was searched for patients with the highest and the lowest number of ED visits and/or unplanned hospitalizations from 2007 through 2011 using ICD-9 codes of 345.xx and 780.39. The patients were stratified into a high and a low utilizer group. The total number of visits and their associated health care costs were noted for each patient. In total, 120 patients were included for review. Information on the total number of no-shows to outpatient neurology clinic visits and telephone calls to neurology triage nursing was noted. A chart review was performed by a pediatric epileptologist to determine if each individual patient was an appropriate candidate for an emergency seizure treatment. The dose of emergency seizure medication was cross-checked to the patient's actual dose during the time of ED or hospital presentation to determine if the dose given was high, low, or accurate based on dosing recommendations. Multivariable logistic regression was used to test the effects of factors. When controlling for other factors, patients who were given an incorrect or no emergency seizure dosing had a high probability of having multiple ED visits/unplanned hospitalizations compared with patients who were given correct dosing (odds ratio = 11.28, 95% CI of odds ratio = (2.42, 52.63), p value < 0.01 (p = 0.0021)). Using a similar model, patients who experienced a higher number of no-shows to clinic visits had a higher probability of having multiple ED visits/unplanned hospitalizations (odds ratio = 5.73 per 1 more number of no-show, 95% CI of odds ratio = (1.78, 18.44), p value < 0.01 (p = 0.0034)). Future studies are planned to target these risk factors with the goal of decreased ED and/or hospital utilization for children with epilepsy.

1. Introduction

In the United States, approximately one million people are evaluated annually in an emergency department (ED) for the diagnosis of a seizure or epilepsy. The highest percentages of these patients are less than five years of age [1]. Emergency department visits are associated with a higher percentage of patients with uncontrolled epilepsy [1–6]. A study in adult patients with epilepsy determined that higher seizure frequency and lower quality of life were associated with higher number of ED visits [7]. Overall, epilepsy can be very costly in terms of health care dollars utilized. In addition, hospitalizations and ED visits account for a majority of the annual costs associated with epilepsy [8]. A study in 2009 determined that the average excessive health care expenditure per child due to epilepsy was approximately $4523 per patient [9]. Therefore, identifying variables for patients that are associated with utilization of the ED or hospital for epilepsy care can be useful in potential visit reduction, thus, improving the quality of epilepsy care provided and decreasing the associated costs. We are not aware of any studies that have been performed on assessing potential risk factors for recurrent ED visits and/or unplanned hospitalizations for children with epilepsy.

Therefore, the present study evaluated if potential variables predict recurrent ED visits and/or unplanned hospitalizations for children with epilepsy. Variables selected were the number of no-shows to clinic visits and triage nursing calls by a care provider. Further, we evaluated if the patient received an emergency seizure treatment when appropriate and if the medication was dosed correctly according to published dosing guidelines. We compared a group of high utilizing children with a group

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of similar children with low ED or hospital utilization. Our null hypothesis was there would be no difference in the selected variables when compared between the two groups.

2. Methods

Institutional review board approval from Nationwide Children's Hospital was obtained prior to study initiation. A retrospective case–control design was employed for this study. An accountable care organization, Partner for Kids (PFK), database was searched for patients with the highest and the lowest number of ED visits and/or unplanned hospitalizations from 2007 through 2011 using the epilepsy and seizure ICD-9 codes of 345.xx and 780.39. Utilizing this database allowed for data on such visits to be obtained regardless of location. The patients were stratified into a high and a low utilizer group by selecting the twelve patients with the highest and the lowest number of ED visits and/or hospitalizations per year from 2007 through 2011. In total, 120 patients were included for review. The number of patients selected was to ensure appropriate numbers for statistical analysis and also represented the top 1% of ED and/or hospital utilization. 60 patients with the lowest utilization were selected to ensure equal numbers in each group. The total number of visits and their associated health care costs were noted for each patient based on information collected from the PFK database. Information on the total number of no-shows to outpatient neurology clinic visits and telephone calls to neurology triage nursing within the 12 months of presentation to the ED was noted. A chart review was performed by a pediatric epileptologist to determine if each individual patient was an appropriate candidate for an emergency seizure treatment. If the patients had documented seizure duration greater than 5 min or three seizures in 24 h without complete return to baseline, they were determined to be an appropriate candidate for emergency seizure treatment. Then, the appropriate dose of an emergency seizure medication dose based on age and weight at year of presentation was determined [10]. This dose was cross-checked to the patient's actual dose during the time of ED and/or hospital presentation to determine if the dose prescribed was high, low, or accurate based on dosing recommendations. The information was noted among the high and the low utilizer group and compared. The socioeconomic status and insurance provider of each patient group were the same as all patients were participants in the accountable care organization, Partner for Kids (PFK). Therefore, all subjects belonged to a low socioeconomic status.

In our study, every patient had at least one ED visit; therefore, no data point existed with a 0 visit count. We wanted to compare children who utilized the ED for epilepsy care, so we dichotomized the outcome into >1 visits vs. =1 visit and felt that logistic regression was more appropriate.

3. Results

Multivariable logistic regression was used to test the effects of factors (including number of no-shows, number of phone calls, and incorrect or no emergency seizure medication dosing) on outcome: multiple ED visits/unplanned hospitalizations vs. only one ED visit. A p value < 0.05 was considered significant. We did not include the number of visits in the model since the outcome is defined by this variable (number of visits >1 vs. =1). In addition, categorical data were compared between the groups by using the likelihood ratio Chi-square test or Fisher's exact test when it was appropriate. Continuous data were compared by using nonparametric method Wilcoxon two-sample test. A p value < 0.05 was considered significant. All tests were conducted in SAS 9.3 (SAS Institute Inc., Cary, NC, USA).

When controlling for other factors, patients who were given an incorrect or no emergency seizure medication dose had a high probability of having multiple ED visits and/or unplanned hospitalizations compared with patients who were given correct dosing (odds ratio = 11.28, 95% CI of odds ratio = (2.42, 52.63), p value < 0.01 ($p = 0.0021$)). Similarly, patients who had a higher number of no-shows to clinic visits had a higher probability of having multiple ED visits/unplanned hospitalizations (odds ratio = 5.73 per 1 more number of no-show, 95% CI of odds ratio = (1.78, 18.44), p value < 0.01 ($p = 0.0034$)) (Table 1).

Table 1
Regression analysis.

Analysis of maximum likelihood estimates						
Parameter		DF	Estimate	Standard error	Wald Chi-square	Pr > ChiSq
Intercept		1	−2.3251	0.7695	9.1300	0.0025
App dose rec	No	1	2.4227	0.7860	9.5015	0.0021
No Show		1	1.7462	0.5961	8.5824	0.0034
phone calls		1	0.2656	0.1997	1.7684	0.1836

Odds ratio estimates				
Effect		Point estimate	95% Wald confidence limits	
App dose rec	No vs. Yes	11.277	2.416	52.627
No Show		5.733	1.782	18.440
phone calls		1.304	0.882	1.929

In children with multiple ED visits and/or hospitalizations, 80% were not given the correct dose of an emergency seizure medication, while for children in the low utilizer group, only 19% were not given the correct dose (Table 2). The difference was significant (p value < 0.0001). There was no significant difference in the distribution of a rescue medication between two groups ($p = 0.0952$) even though while all kids in the low utilizer group received it, only 83% of kids with multiple visits received a rescue medication. There is a significant difference in the number of no-shows and the number of phone calls between the two groups (Table 2). Children with multiple visits had a significantly higher number of no-shows to the outpatient neurology clinic (1.78 ± 1.39) compared with children in the low utilizer group (0.37 ± 0.61) ($p < 0.0001$), and children with multiple visits had a significantly higher number of telephone calls to the neurology triage nurses (2.70 ± 4.05) compared with children in the low utilizer group (0.42 ± 0.96) ($p < 0.0001$). (See Table 3.)

In total, the entire high utilizer group accounted for 237 visits and $2,014,281.00 in associated health care costs from these visits for the five years compared with 60 visits and $204,518.00 in the low utilizer group. The average associated health care costs for the ED visits and/or unplanned hospitalizations equaled $33,571.00 per patient in the high utilizer group and $3409.00 per patient in the low utilizer group.

4. Discussion

Variables that were associated with frequent utilization of the ED and/or hospital for children with epilepsy included frequent no-shows to clinic visits and increased number of telephone calls to triage nursing. Most importantly, a major risk factor based on these study results was an inappropriate or lack of an emergency seizure treatment when needed. As health care currently evolves, further interventions will be necessary to decrease health care utilization among patients when possible, especially high utilizing patients. In this study, the patients with high

Table 2
Rescue medication distribution.

Variable	1 visit group N (% by column)	Multiple visit group N (% by column)	p value
Rescue med			
Yes	21 (100%)	40 (83%)	0.0952
No	0 (0%)	8 (17%)	
Correct dose			
Yes	17 (81%)	10 (20%)	<**0.0001**
No	4 (19%)	38 (80%)	