

# Overall and Disease-Related Healthcare Utilization and Costs in Children with Stable and Uncontrolled Epilepsy

Cramer JA<sup>1</sup>, Wang Z<sup>2</sup>, Chang E<sup>3</sup>, Powers A<sup>2</sup>, Copher R<sup>2</sup>, Cherepanov D<sup>3</sup>, Broder M<sup>3</sup>

<sup>1</sup>Houston, TX; <sup>2</sup>Woodcliff Lake, NJ; <sup>3</sup>Beverly Hills, CA

## BACKGROUND

- Epilepsy, 3<sup>rd</sup> most common neurological disorder, accounts for \$9.6 billion/year in direct medical costs, and affects >300,000 children in the U.S.<sup>1,2</sup> About 85% of overall economic burden of epilepsy may be attributed to indirect costs.<sup>2</sup>
- More than 90,000 children have seizures that are not adequately controlled.<sup>1</sup>
- Studies indicated adults with uncontrolled epilepsy use more healthcare services and incur greater costs than adults with stable epilepsy,<sup>3,4</sup> however estimates of the economic burden of uncontrolled epilepsy in children is lacking.

## OBJECTIVE

To compare annual overall and epilepsy-related healthcare costs and utilization between children (age <12 years) with stable and uncontrolled epilepsy.

## METHODS

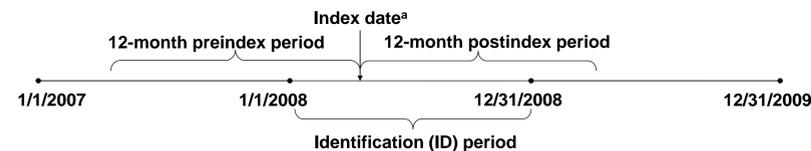
- Retrospective cohort study using data from Thomson Reuters MarketScan, a commercial HIPAA-compliant administrative claims database.
  - <12 years old, diagnosed with epilepsy, and treated with ≥1 antiepileptic drug (AED).<sup>a</sup>
- <sup>a</sup> Included carbamazepine, clonazepam, divalproex, valproate, ethosuximide, felbamate, gabapentin, lacosamide, lamotrigine, levetiracetam, oxcarbazepine, phenobarbital, phenytoin, pregabalin, primidone, tiagabine, topiramate, vigabatrin, and zonisamide.

### Inclusion Criteria:

- ≥2 medical claims in the ID period; and
- Cohorts were:
  - Stable** - on the same AED (monotherapy or combination) therapy for ≥12 mos.;
  - Uncontrolled** - added additional AED(s) in the ID period.

### Exclusion Criteria:

- Chronic pain, pregnancy, fibromyalgia, bipolar disorder, or migraines,<sup>5</sup>
- <24 mos. of continuous enrollment, or
- patients ≥12 years old.



<sup>a</sup> Index was date of additional AED start for uncontrolled patients and random date from AED fills for stable patients.

**Baseline measures:** demographics, usual care physician specialty (specialty seen at the most visits),<sup>6</sup> number of chronic conditions, Charlson comorbidity index (CCI),<sup>7</sup> and central nervous system (CNS) comorbidities.

### Outcome measures:

- Overall costs and utilization.
- Epilepsy-related costs (claims with 345.xx or 780.39 in any position or epilepsy-related tests) and utilization (AED fills and services with 345.xx or 780.39 in any position).

**Statistical analyses:** chi-square and t tests were used in univariate analyses and logistic regression and analysis of covariance were used to adjust for baseline differences.

## RESULTS

### Cohort Identification

- 2,170 AED-treated epilepsy patients age <12 years old who met selection criterion were identified.

### Demographic and Clinical Characteristics

- 80.6% (8,571) had stable epilepsy and 19.4% (1,536) had uncontrolled epilepsy.
- Mean age was 7.8 years for stable and 6.6 years for uncontrolled epilepsy patients.
- 45.2% of stable epilepsy patients and 46% of uncontrolled patients were female.

### Baseline Comorbidity Characteristics

- Uncontrolled epilepsy patients had a higher mean number of chronic conditions (2.7 vs. 2.1) and mean CCI (0.4 vs. 0.3) (P<.05).
- A higher proportion of uncontrolled patients had any CNS comorbidity (11.8% vs. 6.3%), brain tumor (2.6% vs. 0.9%), and cerebrovascular disease/stroke (5.0% vs. 2.2%) (P<.05).
- Usual care was most often received from primary care physicians (54.1%) than from neurologists (22%) or other specialists (23.9%).

### Postindex Annual Overall and Epilepsy-Related Healthcare Costs

	Stable n=1,748	Uncontrolled n=422	P Value
	Mean (SD) [Median]		
<b>Overall healthcare cost, \$</b>	18,206 (42,638)	30,343 (49,330)	<.001
Medical cost, \$	14,045 (39,471)	24,231 (47,375)	<.001
Inpatient hospitalization cost, \$	4,405 (25,141)	10,200 (35,073)	<.001
ED visits cost, \$	297 (782)	539 (1,112)	<.001
Outpatient (non-ED) service cost, \$	8,716 (23,233)	12,951 (25,491)	0.003
Pharmacy cost, \$	3,930 (6,234)	6,035 (6,271)	<.001
<b>Epilepsy-related<sup>a</sup> healthcare cost, \$</b>	7,979 (24,136)	16,894 (37,034)	<.001
Medical cost, \$	5,524 (23,514)	12,926 (36,615)	<.001
Inpatient hospitalization cost, \$	3,449 (22,190)	8,400 (33,483)	0.004
ED visits cost, \$	126 (486)	295 (820)	<.001
Outpatient (non-ED) service cost, \$	1,949 (4,999)	4,231 (11,606)	<.001
AED cost, \$	2,456 (3,183)	3,968 (3,494)	<.001

<sup>a</sup> Claims with a diagnosis of epilepsy in any position; standard deviation [SD]; emergency department [ED]; antiepileptic drug [AED].

### Postindex Annual Overall and Epilepsy-Related Healthcare Utilization

	Stable n=1,748	Uncontrolled n=422	P Value
<b>Annual Overall Healthcare Utilization</b>			
<b>No. of inpatient hospitalizations, n (%)</b>			<.001
0	1,538 (88.0)	295 (69.9)	
1	139 (8.0)	89 (21.1)	
2+	71 (4.1)	38 (9.0)	
<b>No. of days of stay among patients with inpatient hospitalizations, mean (SD)</b>	6.8 (12)	6.4 (10)	0.710
<b>No. of ED visits, n (%)</b>			<.001
0	1,238 (70.8)	252 (59.7)	
1	324 (18.5)	86 (20.4)	
2+	186 (10.6)	84 (19.9)	
<b>No. of office visits, mean (SD) [median]</b>	12.5 (17) [7.0]	17.3 (21) [10.0]	<.001

	Stable n=1,748	Uncontrolled n=422	P Value
<b>Annual Epilepsy-Related<sup>a</sup> Healthcare Utilization</b>			
<b>No. of inpatient hospitalizations, n (%)</b>			<.001
0	1,586 (90.7)	315 (74.6)	
1	106 (6.1)	78 (18.5)	
2+	56 (3.2)	29 (6.9)	
<b>No. of days of stay among patients with inpatient hospitalizations, mean (SD)</b>	6.8 (10)	6.0 (10)	0.512
<b>No. of ED visits, n (%)</b>			<.001
0	1,536 (87.9)	327 (77.5)	
1	148 (8.5)	56 (13.3)	
2+	64 (3.7)	39 (9.2)	
<b>No. of office visits, mean (SD) [median]</b>	2.8 (5) [2.0]	4.7 (9) [3.0]	<.001
<b>No. of EEGs, n (%)</b>			<.001
0	971 (55.5)	220 (52.1)	
1	587 (33.6)	115 (27.3)	
2+	190 (10.9)	87 (20.6)	
<b>No. of brain imaging tests, n (%)</b>			<.001
0	1,493 (85.4)	299 (70.9)	
1	202 (11.6)	87 (20.6)	
2+	53 (3.0)	36 (8.5)	
<b>No. of AEDs, n (%)</b>			n/a
1	1,403 (80.3)	0 (0)	
2	293 (16.8)	343 (81.3)	
3	47 (2.7)	64 (15.2)	
4+	5 (0.3)	15 (3.6)	

<sup>a</sup> Claims with a diagnosis of epilepsy in any diagnosis field; standard deviation [SD]; emergency department [ED]; electroencephalograph [EEG]; antiepileptic drug [AED].

### Adjusted Estimates for Uncontrolled vs. Stable Epilepsy Patients

Outcome Variable	Coefficient <sup>a</sup>	SE	P Value
<b>Mean overall healthcare costs, \$</b>	3,908	2,282	0.087
<b>Mean epilepsy-related healthcare costs, \$</b>	5,744	1,471	<.001
	<b>OR</b>	<b>95% CI</b>	<b>P Value</b>
<b>Risk of inpatient hospitalization</b>	2.48	1.88 – 3.27	<.001
<b>Risk of ED visit</b>	1.34	1.06 – 1.69	0.015
<b>Risk of epilepsy-related inpatient hospitalization</b>	2.58	1.93 – 3.45	<.001
<b>Risk of epilepsy-related ED visit</b>	1.81	1.36 – 2.39	<.001

<sup>a</sup> Adjusted for age, sex, region, usual care physician specialty, no. of chronic conditions, Charlson comorbidity index, and CNS comorbidities; confidence interval [CI]; emergency department [ED]; odds ratio [OR]; standard error [SE].

After adjusting for baseline differences:

- Epilepsy-related costs were \$5,744 greater in uncontrolled vs. stable patients (P<.001).
- The odds of any or epilepsy-related hospitalization or ED visit were greater in the uncontrolled epilepsy group (P<.01).

## LIMITATIONS

- Claims data are collected for the purpose of payment and not research, which may limit the degree to which claims data can accurately capture an individual's medical history and does not capture disease severity measures.
- The study population was a sample of managed care enrollees, which may not be generalizable to a non-managed care national population.
- Epilepsy-related costs account for less than 50% of total observed costs which suggests that comorbid conditions may account for the other costs and/or under-identification of epilepsy-related utilization.

## CONCLUSIONS

- Epilepsy, whether stable or uncontrolled, is associated with significant economic burden.
- Children with uncontrolled epilepsy use significantly more healthcare services than those with stable disease.
- Healthcare costs incurred by children with uncontrolled disease are also significantly greater compared to costs incurred by children with stable epilepsy.
- Children with uncontrolled epilepsy were more likely to have a CNS comorbidity than children with stable epilepsy.
- Better control of seizures and comorbidities in children with uncontrolled epilepsy could lead to significant reduction in overall healthcare utilization and costs.

## REFERENCES

- www.epilepsyfoundation.org;
- IOM (Institute of Medicine). 2012.;
- Cramer J.A., Wang Z, Chang E., et al. *Value Health* 2012; A193.;
- Cramer J.A., Wang Z, Chang E., et al. *Value Health* 2012; A205.;
- Davis KL, Candrilli SD, Edin HM. *Epilepsia*. 2008; 49(3):446-454.;
- O'Malley AS, Pham HH, Schrag D, et al. *Med Care* 2007; 45:562-570.;
- Deyo RA, Cherkin DC, Ciol MA. *J Clin Epidemiol* 1992;45(6):613-619.