

A Comparison of Annual Overall and Epilepsy-Related Healthcare Costs Between Adult Patients with Differentially-Controlled Epilepsy

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BACKGROUND

- Epilepsy affects approximately 2.2 million people in the United States and is characterized by recurrent seizures.^{1,3}
- A variety of antiepileptic drugs (AEDs) may be used to treat epilepsy, either alone or in combination.^{1,2}
- Epilepsy accounts for \$9.6 billion per year in direct medical costs in the United States,^{1,3} though the annual cost associated with uncontrolled epilepsy is lacking.

OBJECTIVE

To compare annual overall and epilepsy-related healthcare costs between adult patients (age ≥18 years) with stable and uncontrolled epilepsy.

METHODS

Study Design and Data Source

- A retrospective cohort study using data from Thomson Reuters MarketScan, a commercial HIPAA-compliant administrative claims database. Study period was 1/1/2007-12/31/2009.

Study Population and Study Timeframe

- Patients included in the study were adults aged ≥18 years old, diagnosed with epilepsy, and undergoing treatment with at least one AED^a in 1/1/08-12/31/08 identification (ID) period.

^a AEDs 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 for epilepsy (ICD-9-CM codes of 345.xx or 780.39) in any position at least 30 days apart during the ID period; and

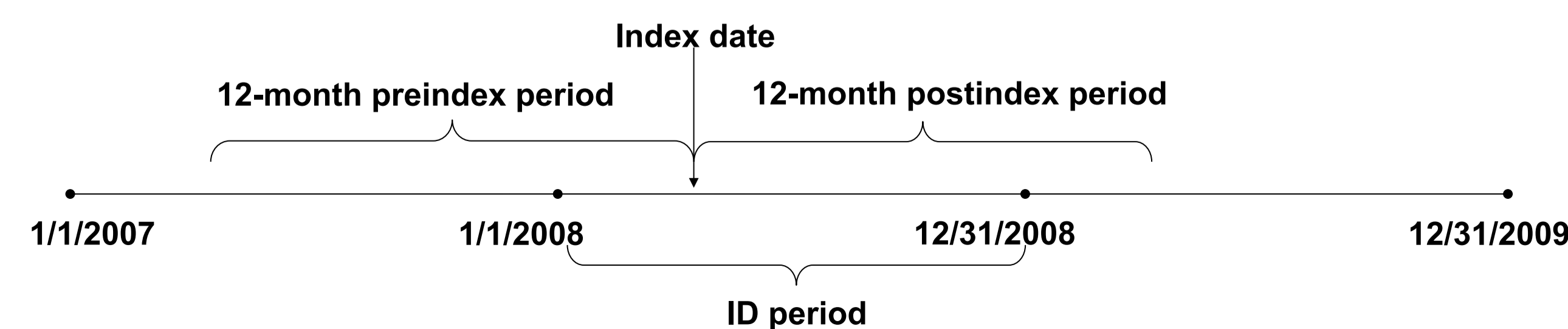
- Cohorts were defined as:

- Stable** - on the same AED therapy (either monotherapy or combination therapy) for ≥12 months;
- Uncontrolled** - added additional AED treatment(s)^b in the ID period (uncontrolled epilepsy).

^b Additional therapy was defined as ≥3 months of baseline therapy, followed by ≥3 months with both baseline and the additional AED.

Exclusion Criteria:

- Diagnosis of neuropathic or chronic pain, evidence of pregnancy, fibromyalgia, bipolar disorder, or migraines during the preindex or postindex period,⁴ or
- <24 months of continuous enrollment; 12 months preindex and 12 months postindex.



Measures

Baseline measures: patient demographics (age, sex, U.S. census regions), usual care physician specialty, number of chronic conditions, Charlson comorbidity index,⁵ and central nervous system (CNS) comorbidities (head injury, brain tumor, cerebrovascular disease/stroke, tuberous sclerosis, and depression/other mood disorders). All pharmacy and medical claims in the 12-month preindex (baseline) period were reviewed to determine the baseline measures.

Outcome measures:

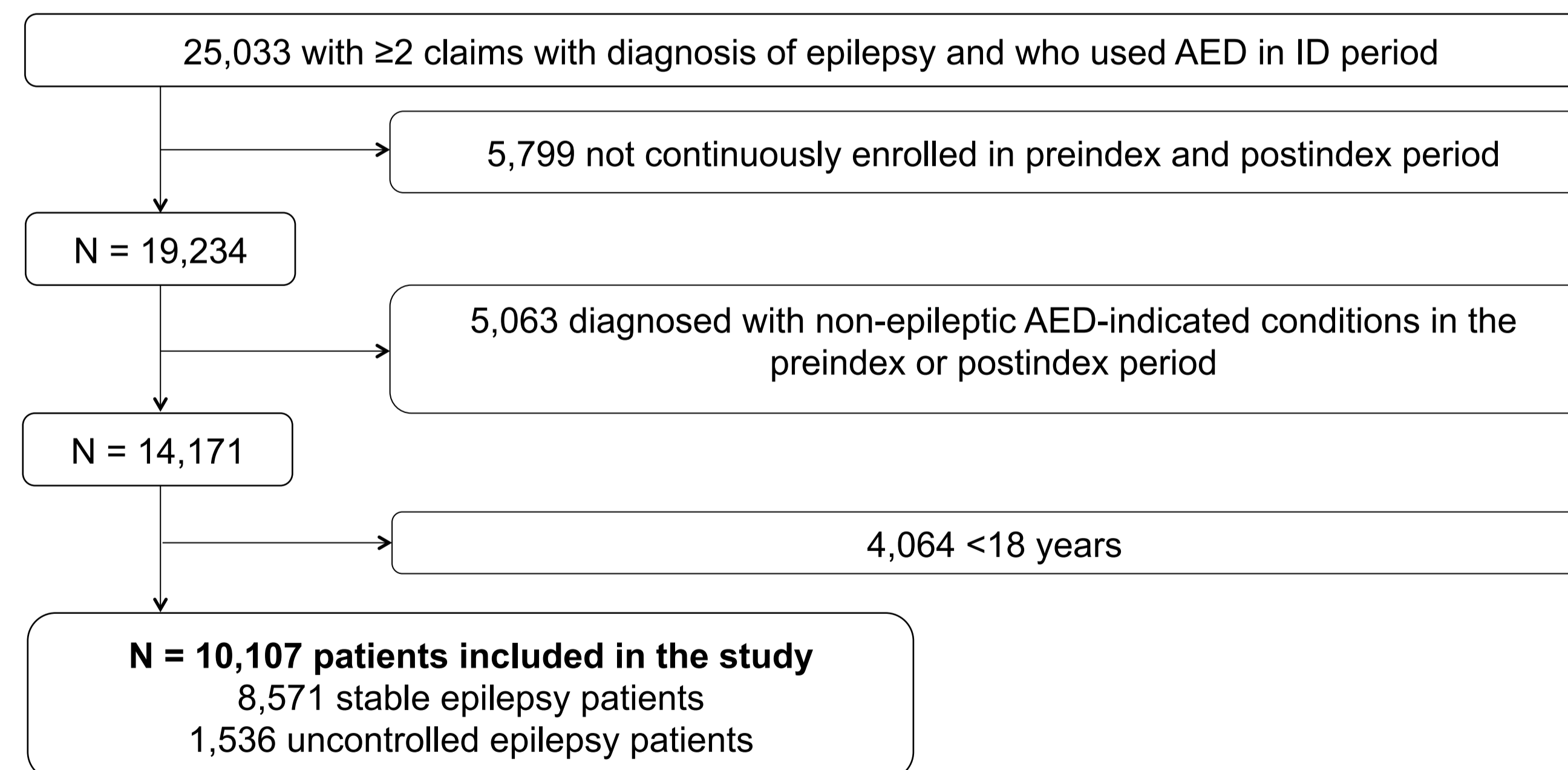
- Annual overall healthcare costs were estimated using pharmacy and medical claims in the postindex year.
- Annual epilepsy-related costs were estimated using claims with epilepsy in any diagnosis field or epilepsy-related tests (AED level, electroencephalographic [EEG], or brain imaging) in the postindex year.

Statistical Analyses

- Descriptive statistics. Chi-square test and t-test were used to compare categorical variables and continuous variables, respectively.
- Analysis of covariance was used to adjust for baseline measures
- All data transformations and statistical analyses were performed using SAS® version 9.2 (SAS Institute, Cary, NC)

RESULTS

Cohort Identification



Demographic and Clinical Characteristics

- 84.8% of patients identified were classified as having stable epilepsy and 15.2% as having uncontrolled epilepsy.
- Mean age was 42.8 years; 43 years for stable and 41.8 years for uncontrolled epilepsy patients
- A greater proportion of uncontrolled epilepsy patients compared to stable epilepsy patients were female (50.7% vs. 47.6%, $P<0.001$)
- 11.4% of patients were from the Northeast, 29.9% from the North Central, 42.3% from the South, and 16.5% from the West; the two cohorts did not differ significantly in geographic distribution
- Stable epilepsy patients received usual care most often from primary care physicians (40.6%), while uncontrolled epilepsy patients received usual care most often from neurologists (39.4%) ($P<0.001$).

Baseline Comorbidity Characteristics

	Stable N=8,571	Uncontrolled N=1,536	All N=10,107	P Value
Mean No. of chronic conditions (SD)	2.2 (1.5)	2.7 (1.7)	2.3 (1.6)	<0.001
Mean Charlson comorbidity index (SD)	0.5 (1.3)	0.7 (1.5)	0.6 (1.3)	<0.001
No. with ≥1 CNS comorbidity (%)	1,304 (15.2)	400 (26.0)	1,704 (16.9)	<0.001
Head injury	61 (0.7)	20 (1.3)	81 (0.8)	0.017
Brain tumor	298 (3.5)	95 (6.2)	393 (3.9)	<0.001
Cerebrovascular disease/stroke	537 (6.3)	195 (12.7)	732 (7.2)	<0.001
Tuberous sclerosis	14 (0.2)	6 (0.4)	20 (0.2)	0.065
Depression and other mood disorders	544 (6.3)	167 (10.9)	711 (7.0)	<0.001

- Uncontrolled patients had significantly more chronic conditions on average compared to stable patients ($P<0.001$)
- A significantly higher proportion of uncontrolled epilepsy patients had a head injury, brain tumor, cerebrovascular disease/stroke, and depression and other mood disorders ($P<0.02$).

Postindex Annual Healthcare Costs

	Stable N=8,571	Uncontrolled N=1,536	All N=10,107	P Value
Postindex Annual Overall and Epilepsy-Related Healthcare Costs				
	Mean (Standard Deviation) [Median]			
Overall healthcare cost, \$	13,839 (31,355.1) [6,789]	23,238 (42,893.8) [11,380]	15,414 (33,745.5) [7,481]	<0.001
Medical cost, \$	9,214 (30,074.8) [2,457]	15,842 (40,998.8) [4,286]	10,324 (32,256.5) [2,684]	<0.001
Inpatient hospitalizations cost, \$	2,818 (20,329.0)	6,196 (28,166.9)	3,332 (21,735.5)	<0.001
ED visits cost, \$	316 (1,007.0)	542 (1,455.2)	350 (1,090.0)	<0.001
Outpatient (non-ED) services cost, \$	5,379 (14,863.8) [2,024]	8,458 (23,059.1) [3,347]	5,895 (16,560.6) [2,189]	<0.001
Pharmacy cost, \$	4,349 (5,084.9) [2,814]	7,247 (6,410.7) [5,708]	4,789 (5,408.4) [3,228]	<0.001
Epilepsy-related overall healthcare cost, \$	5,511 (11,729.6) [2,647]	12,399 (25,772.9) [6,256]	6,558 (14,955.9) [3,128]	<0.001
Epilepsy-related ^a Medical cost, \$	2,751 (11,028.7) [348]	7,257 (25,201.8) [1,003]	3,436 (14,220.8) [399]	<0.001
Epilepsy-related ^a inpatient hospitalizations cost, \$	1,543 (10,047.1)	4,610 (23,528.9)	2,009 (13,072.9)	<0.001
Epilepsy-related ^a ED visits cost, \$	142 (622.0)	295 (969.9)	166 (688.5)	<0.001
Epilepsy-related ^a outpatient (non-ED) services cost, \$	1,065 (3,095.1) [312]	2,352 (5,304.6) [748]	1,261 (3,551.2) [349]	<0.001
AED cost, \$	2,760 (3,360.8) [1,591]	5,142 (4,110.1) [4,072]	3,122 (3,588.3) [1,929]	<0.001

^a Claims with a diagnosis of epilepsy in any position; Emergency department [ED].

- In the postindex period, uncontrolled epilepsy patients incurred statistically significantly greater costs than did stable patients ($P<0.001$):
 - Overall healthcare costs were \$23,238 vs. \$13,839 per patient-year (PPY)
 - Epilepsy-related costs were \$12,399 vs. \$5,511 PPY.
 - Of epilepsy-related costs, \$7,257 vs. \$2,751 PPY were medical, and \$5,142 vs. \$2,760 PPY were for AEDs ($P<0.001$).
- After adjusting for age, sex, region, usual care physician specialty, number of chronic conditions, Charlson comorbidity index, and CNS comorbidities:
 - Overall healthcare costs were greater in the uncontrolled compared to stable patients: \$7,187 (standard error [SE]: \$967; $P<0.001$), and
 - Epilepsy-related healthcare costs were also significantly greater in the uncontrolled compared to stable patients: \$6,023 (SE: \$4069; $P<0.001$).

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.
- Healthcare costs incurred by patients with uncontrolled disease are significantly greater compared to costs incurred by patients with stable epilepsy.
- Patients with uncontrolled epilepsy were more likely to have a CNS comorbidity than patients with stable epilepsy.

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