

Incremental Economic Burden of Cardiometabolic Disorders Among Patients With Epilepsy

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BACKGROUND

- Epilepsy, a neurological disorder characterized by recurrent seizures, affects approximately 4.3 million adults in the United States (US).¹
- Patients with epilepsy are at an elevated risk of having comorbid conditions that may complicate overall epilepsy management and increase mortality rates.^{2,3}
- A study among a subset of patients with epilepsy showed that those with comorbidities were four times likelier to be hospitalized compared to those without any comorbidities.⁴
- Extensive evidence shows high prevalence and costs of psychiatric comorbidities in patients with epilepsy, but the burden of several nonpsychiatric comorbidities in these patients has not been widely explored.²⁻⁵
- A report by the Centers for Disease Control and Prevention (CDC) suggests that many nonpsychiatric conditions are highly prevalent among adults with epilepsy.⁶
 - Patients with a history of epilepsy had greater prevalence of cardiometabolic disorders (CMDs), heart disease (18.3% vs. 11.3%), hypertension (34.2% vs. 29.0%), prediabetes (7.1% vs. 4.3%), and diabetes mellitus (10.4% vs. 8.7%) compared to those without any history of epilepsy.
- Although evidence showing that more than 80% of health care costs among patients with epilepsy may be nonepilepsy related (i.e., can be linked to prevalence of comorbid conditions), to the best of our knowledge, there are no real-world studies examining economic burden due to the presence of CMDs among patients with epilepsy.

OBJECTIVE

- To examine the prevalence and incremental economic burden of CMDs in a US epilepsy cohort.

METHODS

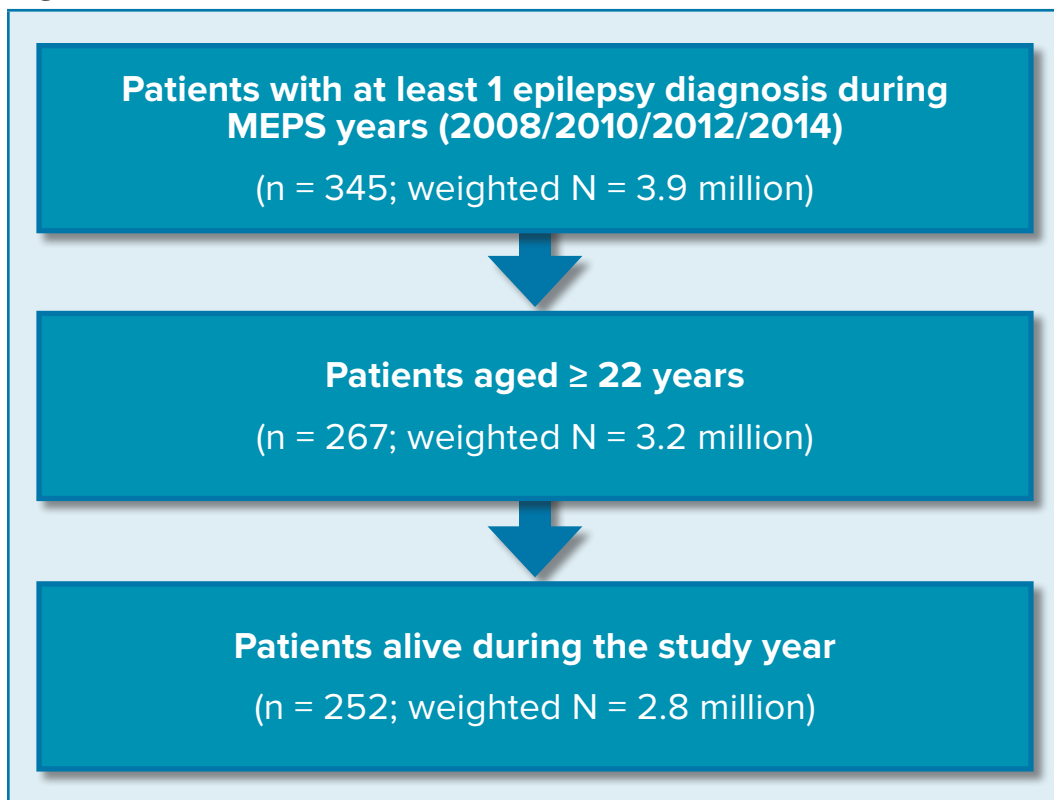
Study Design and Data Source

- This study utilized a cross-sectional, retrospective study design, using pooled data from alternate multiple years (2008/2010/2012/2014) of the Medical Expenditure Panel Survey (MEPS).
 - Data from alternate years were used to obtain unique patients as MEPS follows patients for 1 year after cohort entry.
- MEPS is a nationally representative survey of the US civilian noninstitutionalized population that collects personal and household level information on respondents' sociodemographic characteristics, health status, access to care, clinical diagnoses, and related health care charges and payments.

Patient Selection and Cohorts of Interest

- Patients with epilepsy were identified using ICD-9-CM diagnosis code 345.xx.
 - The analytic sample for this study included adults (aged ≥ 22 years) who were alive during the year they were identified.
- We further divided patients into two cohorts based on the presence of CMDs during the study observation year.
 - CMDs included the following chronic conditions: diabetes, endocrine disorders, hypertension, and heart diseases.
 - These conditions were identified using clinical classification codes (CCC).
 - Although MEPS does not have detailed, 5-digit ICD-9-CM diagnosis codes, it validates self-reported conditions through a sample of medical providers and maps these conditions to 3-digit ICD-9-CM diagnosis codes, which researchers further aggregate to CCC.
 - The following codes were used to identify the CMDs:
 - Diabetes (CCC: 49, 50)
 - Endocrine disorders (CCC: 51)
 - Heart disease (CCC: 96, 97, 100 to 108)
 - Hypertension (CCC: 98, 99)
 - Patients with at least one of the above mentioned conditions were grouped into the CMD cohort, and other patients were grouped into the no CMD cohort.

Figure 1. Patient Selection Criteria



Patient Characteristics

- Demographic characteristics consisted of patients' age (in years: 22-49, 50-64, ≥ 65), sex (male, female), race/ethnicity (white, African-American, and others), and metropolitan region (metro, rural, unknown).
- Socioeconomic characteristics included:
 - Education status: Less than high school education, high school education or above, unknown
 - Poverty status: Poor ($< 100\%$ of federal poverty line [FPL]), low-income ($100\% \leq \text{FPL} < 200\%$), middle-income ($200\% \leq \text{FPL} < 400\%$) and high-income (400% of FPL)
- Clinical characteristics included:
 - Health status categorized into three groups (excellent or very good, good, and fair or poor)
 - Polypharmacy (use of 0-5 drug classes, ≥ 6 drug classes)
 - Number of chronic conditions excluding CMDs (0, 1, ≥ 2)
- Access to care was measured by health insurance status (private, public, and uninsured).

Outcome Measure

- Total annual health care expenditures were calculated by adding expenditures for hospitalizations, emergency room and outpatient visits, prescription drugs, dental care, and other services during the study year.
- Health care costs were updated to 2014 US dollars using the medical care component of the consumer price index.

Statistical Analysis

- Descriptive analyses entailed the tabular display of mean values, medians, ranges, and standard deviations (SDs) of continuous variables of interest and frequency distributions for categorical variables.
- T-tests were used to examine unadjusted subgroup differences in average annual health care expenditures by the presence of CMDs.
- Ordinary least squares (OLS) regression on log-transformed health care expenditures, adjusting for demographic, socioeconomic, and clinical characteristics, was conducted to estimate the magnitude of excess health care expenditures associated with CMDs.
- All analyses were controlled for the complex sample design of MEPS and were conducted using survey-specific procedures in SAS version 9.4 (Cary, NC: SAS Institute, Inc.; 2011).

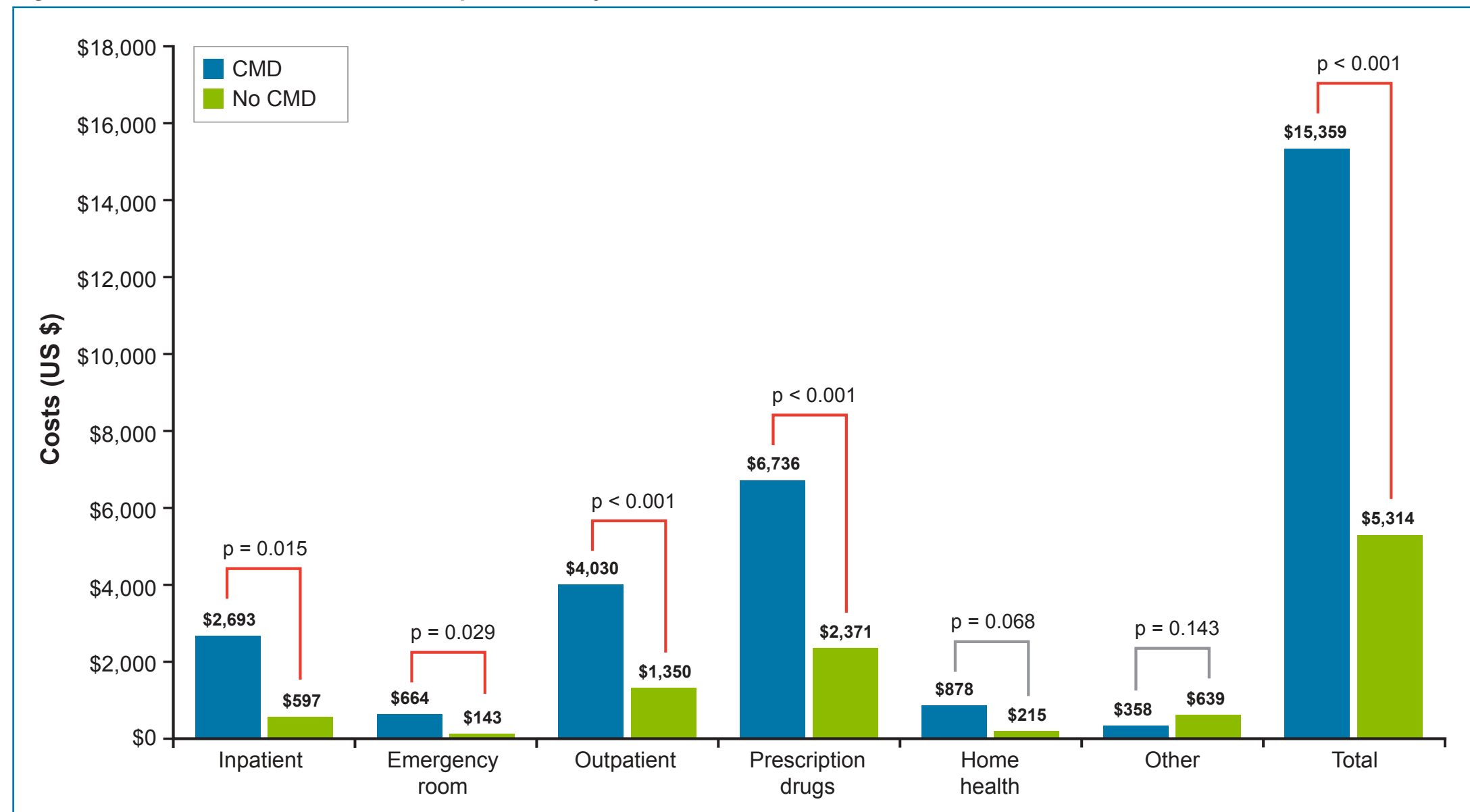
RESULTS

- Overall, 345 patients (weighted N = 3.9 million) had epilepsy during one of the 4 years of pooled data.
 - Of these patients, 252 (weighted N = 2.8 million) were aged ≥ 22 years and were alive during the study year (Figure 1).
- Among adults with epilepsy, more than one-third had comorbid CMDs (weighted percentage = 37.8%).
- Demographic and Clinical Characteristics (Table 1)
 - Patients without CMDs were younger than patients with CMDs (age group 22-49 years: 61.8% vs. 40.1%; $p < 0.001$); however, other demographic characteristics such as gender, race, and metropolitan region did not differ between the two study cohorts.
 - Socioeconomic characteristics measured by poverty status and education were similar between the two study cohorts. Similarly, the two study cohorts did not differ on access to health care (i.e., insurance coverage).
 - Clinical characteristics significantly differed between the two study cohorts.
 - A greater proportion of patients in the CMD cohort had fair/poor health status compared to those in the no CMD cohort (36.2% vs. 15.7%; $p < 0.001$).
 - Similarly, a higher proportion of patients in the CMD cohort had polypharmacy and more chronic conditions than in the no CMD cohort.

Annual All-Cause Health Care Costs (Figure 2)

- Mean (SD) all-cause annual health care expenditures during the study year were \$15,360 (\$870) among patients with epilepsy and CMD versus \$5,314 (\$391) among patients with epilepsy but no CMD ($P < 0.001$).
- Mean (SD) inpatient costs were \$2,693 (\$402) among patients with epilepsy and CMD versus \$597 (\$205) among patients with epilepsy but no CMD ($P = 0.015$).
 - Annual health care costs for emergency room visits, prescription drugs, and home health services were significantly greater in the CMD cohort versus no CMD cohort.
- Multivariable OLS regression that adjusted for patient demographic, socioeconomic, and clinical characteristics indicated that patients with comorbid CMDs had 45% ($\beta = 0.372$; $\exp[\beta] = 1.45$; $P < 0.001$) higher expenditures than patients without CMDs.

Figure 2. All-Cause Annual Health Care Expenditures by Cohort



DISCUSSION

- Using nationally representative survey data, this study highlighted the elevated prevalence of CMDs among patients with epilepsy.
- Despite similar demographic and socioeconomic characteristics, patients with epilepsy and CMDs had significantly greater annual total health care costs compared to those without CMDs.
- Measures of general health status, polypharmacy, and a number of other chronic conditions that were significantly poorer in the CMD cohort may be associated with the increased costs in these patients.
- The potential burden of comorbid CMDs should be considered by providers in the comanagement of chronic conditions in patients with epilepsy.
- Further research is needed to generate greater understand the reasons behind increased health care costs among patients with epilepsy with comorbid CMDs.
- Key limitations included the following:
 - This study used survey data and thus may have inherent limitations associated with survey databases such as recall bias and inaccuracy of self-reported measures such as prescription drug use.
 - No information was available on epilepsy severity, which may have confounded the relationship between presence of CMDs and increased health care costs.
 - Although we pooled 4 years of data, the sample sizes were relatively small to conduct statistical matching to balance the two study cohorts. However, we conducted OLS regressions adjusting for several patient characteristics to account for confounding.

Table 1. Demographics and Clinical Characteristics by Cohort

	Epilepsy and CMD		Epilepsy and No CMD		P Value
	n	Wt. col %	n	Wt. col %	
Age groups					
22-49 years	43	40.1	111	61.8	< 0.001
50-64 years	32	35.3	39	35.6	
≥ 65 years	22	24.6	5	2.6	
Gender					
Female	57	53.3	86	51.3	0.698
Male	40	46.7	69	48.7	
Race					
White	51	68	83	74.6	0.208
African-American	12	8.7	21	6.6	
Other	34	23.3	51	18.8	
Metropolitan region					
Metro	63	65.2	87	62	0.797
Rural	10	13.3	21	13.8	
Unknown	24	21.5	47	24.2	
Education					
Less than high school	13	9.4	13	7.5	0.497
High school or above	21	24.7	34	21.1	
Unknown	63	65.9	108	71.4	
Poverty status					
Poor	26	26.5	39	19.5	0.049
Low-income	28	23.9	42	16.1	
Middle-income	22	20	40	30.7	
High-income	21	29.7	34	33.7	
Insurance coverage					
Private	40	47.9	75	60.2	0.060
Public	49	42.3	60	30.1	
Uninsured	8	9.7	20	9.7	
Health status					
Excellent/very good	20	24.1	59	43.8	< 0.001
Good	37	39.7	64	40.5	
Fair/poor	40	36.2	32	15.7	
Polypharmacy					
< 6 drug classes	53	49.3	151	97.7	< 0.001
≥ 6 drug classes	44	50.7	4	2.3	
Number of chronic condition excluding CMDs					
0	33	29.2	115	73.8	< 0.001
1	30	33.1	28	19.2	
≥ 2	34	37.7	12	7.0	

col = column percent; Wt. = weighted.

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