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Identifying Recipients of Electroconvulsive Therapy: Data From Privately Insured Americans

Samuel T. Wilkinson, M.D., Edeanya Agbese, M.P.H., Douglas L. Leslie, Ph.D., and Robert A. Rosenheck, M.D.

Dr. Wilkinson and Dr. Rosenheck are with the Department of Psychiatry, Yale School of Medicine, New Haven, Connecticut. Dr. Rosenheck is also with the VA New England Mental Illness Research, Education and Clinical Center, West Haven, Connecticut. Ms. Agbese is with the Department of Public Health Sciences, and Dr. Leslie is with the Departments of Public Health Sciences and Psychiatry, all at Pennsylvania State University College of Medicine, Hershey.

Abstract

Objective: Despite the effectiveness of electroconvulsive therapy (ECT), limited epidemiologic research has been conducted to identify rates of ECT use and characteristics of patients who receive ECT. Sociodemographic and clinical characteristics associated with ECT use were examined among patients with mood disorders in the MarketScan commercial insurance claims database.

Methods: Among individuals with major depressive disorder or bipolar disorder, sociodemographic and clinical characteristics of those who received ECT and those who did not were compared by using bivariate effect size comparisons and multivariate logistic regression.

Results: Among unique individuals in the 2014 MarketScan database ($N=47,258,528$), the ECT utilization rate was 5.56 ECT patients per 100,000 in the population. Of the 969,277 patients with a mood disorder, 2,471 (.25%) received ECT. Those who received ECT had substantially higher rates of additional comorbid psychiatric disorders (risk ratio [RR] =5.70 for any additional psychiatric disorder), numbers of prescription fills for any psychotropic medication (Cohen's $d=.77$), rates of any substance use disorder (RR=1.97), and total outpatient psychotherapy visits (Cohen's $d=.49$). The proportion of patients with a mood disorder who received ECT in the West (.19%) was substantially lower than in other U.S. regions (.28%). This difference was almost entirely accounted for by one western state comprising 59.1% of patients in that region.

Conclusions: Use of ECT is exceptionally uncommon and limited to patients with extensive multimorbidity and high levels of service use. ECT utilization is most limited in areas of the country where regulatory restrictions are greatest.

Major depressive disorder is the leading cause of disability worldwide (1) and is associated with significant morbidity and mortality (2). Electroconvulsive therapy (ECT) is an effective therapy for severe major depressive disorder and other mood disorders. Especially among adults with treatment-resistant depression, generally defined as depression that does not remit or respond to one or more standard antidepressant pharmacotherapies (3), ECT stands

out in its effectiveness. Whereas standard antidepressant therapies achieve response with 16%–17% of patients with treatment-resistant depression (4), ECT achieves response rates of 50%–70% with such patients (5). Recent data show that among psychiatric inpatients, ECT is associated with a 46% lower risk of 30-day readmission compared with a matched group of patients with severe depression who did not receive ECT (6).

ECT is thought to be underutilized despite both its demonstrated effectiveness and the significant reductions in its associated cognitive side-effect profile in recent decades (7,8). Despite evidence that it is more effective than other treatments (5,9) for the most common psychiatric disorder (2), recent data suggest that only approximately one in 10 hospitals that provide inpatient psychiatric care even have the capacity to provide ECT (6,7). The underutilization of ECT is thought to reflect a combination of factors, including stigma, risk of cognitive side effects, and restricted access because of limited availability. However, few published studies have examined rates and correlates of ECT use in U.S. samples. Case et al. (10) reported that the total number of hospitals offering ECT has been declining. In international settings, ECT utilization varies widely across regions, with utilization estimates ranging from 1.1 ECT patients per 100,000 people in Poland (11) to 41 ECT patients per 100,000 people in Sweden (12). The most recent utilization estimates for the procedure in the United States date to 1999 or earlier (13) and vary widely by region, ranging from eight ECT patients per 100,000 people in California (14) in 1995 to 42 ECT patients per 100,000 people in New England in the same year (15).

A recent study characterizing the use of ECT at a large Veterans Affairs medical center in New England found ECT to be provided to .45% of patients in psychiatric specialty care annually; although the ECT sample was small (N=50), receipt of ECT was strongly associated with higher rates of psychotropic prescription fills compared with patients who did not receive ECT (16). We applied the same methods to a far larger and more representative sample of privately insured patients in this study by using deidentified insurance claims data from the 2014 MarketScan Commercial Claims and Encounters database (IBM Watson Health; henceforth, MarketScan). We examined overall rates of ECT use in 2014 among individuals in the MarketScan sample as a whole and among the subgroup who received a diagnosis of a mood disorder (major depressive disorder or bipolar disorder). In this subgroup, we compared those who received ECT with those who did not on sociodemographic characteristics, psychiatric and comorbid general medical diagnoses, service use, psychotropic medication fills, and geographic region.

METHODS

Data Source

Data for this study were drawn from the MarketScan database. These data are based on insurance claims and other reimbursement processing submitted by providers. The database contains data from privately insured individuals and their dependents and includes information on inpatient and outpatient service use (by Current Procedural Terminology code), outpatient prescriptions, and diagnoses coded according to the *ICD-9*.

Sample

In the MarketScan database in 2014 (total N=47,258,528), we first identified all patients older than age 18 who had a psychiatric diagnosis (*ICD-9* codes 290–319) and those with a mood disorder (major depressive disorder or bipolar disorder, *ICD-9* codes 296.2–296.3 and codes 296.4–296.9, respectively). We further identified the patients who received ECT services (Current Procedural Terminology code 90870) among all patients and among those with a mood disorder.

Measures

Measures addressed sociodemographic characteristics, comorbid general medical and psychiatric diagnoses, service use, and psychotropic medication prescriptions during 2014. Socio-demographic characteristics included gender, age, and whether the patient lived in an urban area during the year. Comorbid diagnoses were based on *ICD-9* codes in MarketScan administrative files. Medical comorbidity was measured overall by the Charlson Comorbidity Index (17) and by individual diagnoses when they were available.

Service use was measured by the proportion of patients in each group with any inpatient mental health treatment during 2014 as well as by the number of medical and surgical outpatient visits, emergency room visits, psychiatric and substance use visits, and total outpatient visits. The proportions receiving psychotropic medication prescriptions filled in 2014 were also calculated from individual claims. Psychotropic medications were classified into six groups: antidepressants; antipsychotics; stimulants; anxiolytics, sedatives, and hypnotics; lithium; and mood stabilizers and anticonvulsants. Patients were also classified by state of residence into four Census regions: Northeast, North-Central, South, and West. The data use agreement does not allow us to name specific states.

Analysis

The goal of the analysis was to compare patients who received ECT with those who did not among patients with a mood disorder diagnosis (major depressive disorder or bipolar disorder). Given the large sample size, all comparisons would have been statistically significant, and p values would have been uninformative. Instead, we identified substantial effect size differences between groups who received ECT and those who did not on the basis of Cohen's d (difference in means divided by the pooled standard deviation) for continuous variables or risk ratios (RRs) for dichotomous variables. Cohen's d values greater than .20 were considered to represent more than small changes, whereas RR values greater than 2.0 or less than .5 were considered to represent sizeable differences. These values are based on conventional definitions of small and medium effect sizes for Cohen's d (18) and on a conventional definition of a "practically" significant effect for relative risk (19).

Multivariate logistic regression was then used to identify characteristics independently associated with receipt of ECT. In these analyses, receipt of ECT was the dichotomous dependent variable. Independent variables were chosen to include characteristics substantially differentiating patients who received ECT and those who did not in the bivariate analyses described earlier, which affected a substantial portion of the sample (>5%). These included total psychotropic prescription fills (dichotomized at the median),

psychotherapy use (any versus none), and whether patients had comorbid psychiatric and substance use disorder diagnoses. Although mean age did not differ substantially between groups in the bivariate analysis (Cohen's $d=.27$), we included it as a dichotomous independent variable (above the median age of 44) on the basis of substantial prior literature indicating that older patients may be more likely to respond to ECT (20,21). Given that rates of ECT utilization were substantially lower in the West than in other U.S. regions, we also included geographic region as a dichotomous independent variable. We did not include inpatient mental health treatment in the logistic regression because patients are often admitted to the hospital for ECT.

RESULTS

Sociodemographic Characteristics

In 2014, there were 47,258,528 individuals in the Market-Scan database, of whom 5,525,173 who were older than age 18 had any psychiatric diagnosis (11.7% of all patients). Of these, 2,628 (.05%) received at least one ECT treatment, yielding a rate of 5.56 ECT patients per 100,000 in the general population and .05% of those with psychiatric diagnoses. There were 969,277 individuals (17.5% of those with a psychiatric diagnosis) in the MarketScan database during 2014 who carried a diagnosis of major depressive disorder or bipolar disorder (henceforth, mood disorders). Of these, 2,471 (.25%) received at least one ECT treatment, representing 94.0% of all patients who received ECT. The overall sample of individuals with mood disorders ($N=969,277$) was predominantly female (67.4%), with a mean \pm SD age= 42.9 ± 13.1 (Table 1). Most (87.7%) individuals resided in urban areas.

Geographic Variation

The proportion of patients with a diagnosis of mood disorder who received ECT in the West (.19%) was substantially lower than the proportion in the Northeast (.28%), North-Central (.27%), and South (.27%), which taken together had an ECT rate of .28% (Table 2). This difference was almost entirely accounted for by one western state, which comprised 59.1% of patients in the west region. The ECT utilization rate in this state was 202 ECT patients out of 126,144 individuals with mood disorders (.16%).

Clinical Diagnoses

There were no substantial differences between groups on gender, age, or proportion living in urban areas (Table 1). Compared with patients with mood disorders who did not receive ECT, those who underwent ECT had a higher prevalence of renal disease (2.71% versus 1.31%; $RR=2.06$) and seizures (3.12% versus 1.32%; $RR=2.36$). There were no substantial differences in the prevalence of other general medical conditions ($RR,<2.0$), including insomnia, myocardial infarction, congestive heart failure, peripheral vascular disease, cerebrovascular accidents, chronic obstructive airway disease, hepatic disease, diabetes mellitus, cancer, or pain. There was also no substantial difference in overall Charlson Comorbidity Index between the ECT and non-ECT groups (.68 versus .50; Cohen's $d=.15$).

Comorbid Psychiatric and Substance Use Disorders

Compared with those who did not receive ECT, the ECT group had substantially higher rates of comorbid alcohol use disorder (9.71% versus 4.57%; RR=2.12). Comorbid psychiatric diagnoses were also substantially higher in the ECT group compared with the non-ECT group, including other depressive disorders (80.37% versus 27.90%; RR=2.88), posttraumatic stress disorder (11.53% versus 4.25%; RR=2.71), personality disorders (11.05% versus 1.50%; RR=7.37), schizophrenia (11.45% versus 1.37%; RR=8.33), and other psychiatric diagnoses (17.93% versus 3.14%; RR=5.70).

Service Use

Compared with those who did not receive ECT, those who did had substantially higher levels of service use on measures of inpatient mental health treatment (58.7% versus 9.3%; RR=6.29) and total number of outpatient psychiatric visits (36.7 versus 10.8; $d=1.27$). There were no substantial differences in emergency room visits or medical and surgical visits.

Psychotropic Medication Prescriptions

Total psychotropic medication prescription fills were also substantially higher among the ECT group compared with the non-ECT group (Cohen's $d=.77$). More specifically, the ECT group had substantially higher numbers of prescriptions for antidepressants ($d=.52$); antipsychotics ($d=.69$); and anxiolytics, sedatives, and hypnotics ($d=.52$). Although the numbers of prescriptions differed substantially, the proportions of individuals receiving any psychotropic medications did not substantially differ between the ECT and non-ECT groups (77.3% versus 65.7%; RR=1.18). However, the proportions of individuals receiving antipsychotics (56.9% versus 15.9%; RR=3.58), anticonvulsants and mood stabilizers (38.3% versus 19.1%; RR=2.01), and lithium (19.8% versus 3.3%; RR=6.03) were substantially higher in the ECT group compared with the non-ECT group.

Psychotherapy Visits

Overall, most individuals in both groups received psychotherapy on an outpatient basis (75.8% of the ECT group versus 55.7% of the non-ECT group; RR=1.36). Compared with the non-ECT group, the ECT group had a substantially higher rate of individuals who received services coded as group (14.0% versus 2.7%; RR=5.12) or family (8.5% versus 4.0%; RR=2.12) psychotherapy. The total number of coded outpatient psychotherapy visits among the ECT group was higher than that for the non-ECT group (12.6 versus 5.7; $d=.49$).

Logistic Regression Model

Logistic regression showed that ECT recipients were older (above the median of 44; adjusted odds ratio [OR]=1.73, 95% confidence interval [CI]=1.60–1.88), more likely to have a comorbid psychiatric diagnosis (OR=6.98, CI=5.82–8.38) or a substance use diagnosis (OR=1.44, CI=1.30–1.61), more likely to have received any psychotherapy (OR=2.02, CI=1.84–2.21), and more likely to have above the median number of psychotropic medication fills (OR=2.20, CI=2.01–2.41). Living in the west region was associated with a lower rate of ECT (OR=.79, CI=.71–.88). The logistic regression model yielded a c statistic of .76, indicating a good fit.

DISCUSSION

In this study of privately insured patients, .25% of patients with a diagnosis of a mood disorder received ECT in 2014. The overall ECT utilization rate was 5.56 ECT patients per 100,000 in the population. ECT utilization was associated with older age, greater psychiatric and substance use comorbidity, and greater mental health service use, specifically psychotherapy visits and psychotropic prescription fills. ECT utilization rates were also higher among those living outside the west region.

ECT utilization rates may have declined substantially in recent decades in the United States. Our general population-based utilization rate of 5.56 ECT patients per 100,000 is substantially lower than previous estimates of 42 per 100,000 from a sample in New England in 1995 (15) and is even lower than a study reporting eight per 100,000 from California in the same year (14). This trend is consistent with conclusions from a previous study of inpatient ECT, which reported a marked decline from 1993 to 2009 (10). These contrasts are heightened by the fact that the MarketScan database is composed of individuals with private insurance, a group associated with higher rates of ECT compared with patients with public insurance (6,10).

Additional non-mood disorder, psychiatric comorbid conditions were associated with greater use of ECT, most likely reflecting more severe symptoms and impairment. However, ECT patients were comparable with non-ECT patients in terms of general medical comorbidity, with the exception that ECT patients had higher rates of renal disease. This finding could be due to the higher rate of lithium use in the ECT group, a common medication prescribed for bipolar disorder as well as in the specific context of ECT because of its ability to reduce the risk of relapse after ECT (22). Similar to the findings of a recent study conducted in the Veterans Health Administration (16), ECT patients (when compared with non-ECT patients) had substantially higher rates of personality disorders (RR=7.37) and alcohol dependence (RR=2.12); much higher rates of prescription fills for antipsychotics (RR=3.58), mood stabilizers and anticonvulsants (RR=2.01), and lithium (RR=6.03); and higher prescription fill rates of all psychotropics (Cohen's $d=.77$). ECT thus appears to be used among patients with multimorbidity who have more complicated psychiatric disorders (23), perhaps as a treatment of last resort when clinicians judge other treatment possibilities to have failed.

Of note, our finding that ECT patients in general have more outpatient psychotherapy visits compared with non-ECT patients (Cohen's $d=.49$) belies the traditional belief that ECT patients are too cognitively impaired to engage in psychotherapy. Indeed, with changes over time in stimulus administration, including right unilateral electrode placement and the use of shorter pulse widths, several preliminary studies have suggested that ECT in combination with cognitive-behavioral therapy may be an effective way to improve longer-term outcomes (24–26).

The geographic trend seen in our study suggesting that states in the west region had significantly lower rates of ECT among patients with mood disorders was almost entirely accounted for by lower rates of ECT in one western state and is consistent with data from

earlier studies (14,15,27). This state has one of the strictest legal consent requirements for ECT, requiring three physicians to agree that the procedure is necessary and that a patient has capacity to consent (28).

The data presented here are also consistent with other suggestions that the rate of ECT utilization is declining and that ECT is limited to patients with multimorbidity and high levels of service and medication use, just as was observed in the Veterans Health Administration study (16). Such a decline and limited use are problematic, given the considerable evidence that ECT is the most effective therapy for treatment-resistant depression (5), can rapidly reduce suicidal ideation (29), and may be associated with a lower rate of 30-day psychiatric hospital readmission (6). Given the marked improvements in the cognitive side-effect profile of ECT in recent decades (right unilateral site and shorter pulse width) (8,30,31), there is much room for improvement in making this effective treatment more widely available to a broad range of appropriate patients. Further research is needed to confirm temporal trends in ECT utilization in the United States and to identify the reasons for underuse of this effective treatment.

Several methodological limitations require comment. Despite the large overall sample from which the ECT patients were selected (N=47,258,528), the MarketScan database is drawn from employees of large companies and health plans and may not be representative of health care utilization patterns of employees from medium and smaller firms; from self-employed, privately insured individuals; or from publicly insured patients. Furthermore, our study was limited to data from 2014. Hence, inferences about temporal trends in ECT utilization, more specifically that ECT usage is declining, are made from comparisons with previously published reports and thus need to be confirmed by future studies that directly compare ECT utilization over time using the same sampling procedures. Additionally, information regarding the type of ECT administered (bitemporal versus right unilateral) is not available in the claims data. Finally, the data are based on an insurance claim-based data set, which does not include important clinical information such as length of depressive episode, clinical response to ECT, psychotic versus nonpsychotic depression, or failed antidepressant trials.

Despite these limitations, these findings extend those seen in a single-site Veterans Health Administration study (16) showing that ECT use is exceptionally rare, with substantial differences between those who use ECT and those who do not among patients with a mood disorder diagnosis. Similar to a recent report on inpatient ECT (10), our findings suggest that ECT utilization may have further decreased since the most recent reports. Further epidemiological research confirming temporal trends and ECT utilization patterns are needed to better understand the apparent underuse of this effective treatment and its restriction to use as a treatment of last resort.

CONCLUSIONS

Overall, our data demonstrate that among privately insured individuals, use of ECT is exceptionally uncommon and is limited to patients with extensive multimorbidity and high levels of service use. ECT utilization is also most limited in areas of the country where regulatory restrictions are greatest.

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Demographic, clinical, and service use characteristics of privately insured adults with mood disorders^a

TABLE 1.

Variable	Non-ECT group ^b (N=969,277)		ECT group (N=2,471)		Risk ratio	Cohen's d
	N	%	N	%		
Demographic characteristic						
Male	315,132	32.6	806	32.6	1.00	
Age (years), M±SD	42.96±13.6		46.36±12.4			.27
Urban area resident	850,347	87.7	2,183	88.3	1.01	
Comorbid medical condition						
Seizures	12,794	1.3	77	3.1	2.36	
Insomnia	43,230	4.5	170	6.9	1.54	
Myocardial infarction	4,846	.5	17	.7	1.38	
Congestive heart failure	8,917	.9	32	1.3	1.41	
Peripheral vascular disease	14,248	1.5	65	2.6	1.79	
Cerebrovascular accident	22,972	2.4	107	4.3	1.83	
Chronic obstructive airway disease	99,351	10.3	326	13.2	1.29	
Hepatic disease	30,629	3.2	105	4.3	1.34	
Diabetes mellitus	92,760	9.6	334	13.5	1.41	
Renal disease	12,698	1.3	67	2.7	2.06	
Cancer	32,083	3.3	110	4.5	1.36	
Any pain diagnosis	228,652	23.6	655	26.5	1.12	
Musculoskeletal pain	346,517	35.8	1,119	45.3	1.27	
Charlson Comorbidity Index (M±SD) ^c	.50±1.18		.68±1.26			.15
Psychiatric diagnosis						
Other depression (dysthymia)	270,428	27.9	1,986	80.4	2.88	
Posttraumatic stress disorder	41,194	4.3	285	11.5	2.71	
Anxiety disorder	380,538	39.3	1,595	64.6	1.64	
Adjustment disorder	85,490	8.8	237	9.6	1.09	
Personality disorders	14,539	1.5	273	11.1	7.37	
Schizophrenia	13,279	1.4	283	11.5	8.33	

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Variable	Non-ECT group ^b (N=969,277)		ECT group (N=2,471)		Effect size	
	N	%	N	%	Risk ratio	Cohen's d
Other psychiatric diagnosis	30,435	3.1	443	17.9	5.70	
Alcohol dependence	44,296	4.6	240	9.7	2.12	
Cocaine use disorder	2,035	.2	7	.3	1.33	
Cannabis use disorder	5,525	.6	17	.7	1.21	
Sedative use disorder	4,071	.4	28	1.1	2.72	
Amphetamine use disorder	1,939	.2	5	.2	1.03	
Hallucinogen use disorder	194	0	0	-	0	
Any substance use disorder	86,444	8.9	435	17.6	1.97	
Service use						
Any mental health inpatient treatment	90,530	9.3	1,451	58.7	6.29	
Emergency room visits (M±SD)	.55±1.69		1.02±2.81			.20
Medical and surgical visits (M±SD)	11.78±14.66		14.60±15.32			.19
All outpatient visits (M±SD)	22.61±21.16		51.31±32.11			1.06
Psychiatric or substance use outpatient visits (M±SD)	10.83±13.48		36.71±25.39			1.27
Psychotropic medication prescriptions (M±SD)						
Antidepressant	3.70±5.20		7.06±7.43			.52
Antipsychotic	.89±2.81		4.13±6.05			.69
Anxiolytic, sedative, or hypnotic	2.36±4.76		5.38±6.69			.52
Stimulant	.57±2.35		.75±2.49			.07
Lithium	.18±1.24		.94±2.66			.37
Anticonvulsant or mood stabilizer	1.12±3.11		2.28±4.09			.32
All psychotropics (M±SD)	8.82±11.56		20.54±18.08			.77
Proportion receiving psychotropic prescriptions						
Antidepressant prescriptions	515,752	53.2	1,716	69.5	1.31	
Antipsychotic prescriptions	153,921	15.9	1,405	56.9	3.58	
Anxiolytic, sedative, and hypnotic prescriptions	354,174	36.5	1,530	61.9	1.69	
Stimulant prescriptions	82,873	8.6	347	14.0	1.64	

Variable	Non-ECT group ^b (N=969,277)		ECT group (N=2,471)		Effect size	
	N	%	N	%	Risk ratio	Cohen's d
Lithium	31,792	3.3	489	19.8	6.03	
Anticonvulsant and mood stabilizer	184,744	19.1	946	38.3	2.01	
All psychotropics	635,846	65.7	1,911	77.3	1.18	
Proportion receiving psychotherapy						
Psychotherapy as outpatient	540,178	55.7	1,872	75.8	1.36	
Psychotherapy as inpatient	6,300	.7	191	7.7	11.89	
Family psychotherapy (outpatient)	38,674	4.0	209	8.5	2.12	
Group psychotherapy (outpatient)	26,558	2.7	347	14.0	5.12	
Number of psychotherapy visits (M±SD)						
Psychotherapy, outpatient	5.74±10.70		12.62±16.51			.49
Psychotherapy, inpatient	.02±.44		.49±3.89			.17
Family psychotherapy, outpatient	.19±1.79		.32±2.18			.06
Group psychotherapy, outpatient	.26±2.55		1.49±5.82			.27

^aECT, electroconvulsive therapy

^bThe non-ECT group comprised those in the MarketScan database with a diagnosis of major depressive disorder or bipolar disorder who did not receive ECT.

^cPossible scores range from 0 upward, with no theoretical upper limit; higher values indicate a greater number of and more severe medical comorbidities.

TABLE 2.Geographic variation of ECT utilization rates among privately insured adults with a mood disorder^a

U.S. region ^b	Non-ECT group	ECT group	% receiving ECT
Northeast	226,567	633	.28
North-Central	196,311	535	.27
South	306,649	842	.27
West	213,411	397	.19

^aSource: 2014 MarketScan database. ECT, electroconvulsive therapy^bOf the data, 2.5% were missing.

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