

Original Research

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Twenty-year trends in use of electroconvulsive therapy among homeless and domiciled veterans with mental illness

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Abstract

Background. To examine socioeconomic disparities in use of electroconvulsive therapy (ECT) among homeless or unstably housed (HUH) veterans with mental illness.

Methods. National data from medical records in years 2000 to 2019 on 4 to 6 million veterans with mental illness, including 140 000 to 370 000 homeless veterans served annually from the U.S. Department of Veterans Affairs (VA) healthcare system, were analyzed to examine ECT utilization and changes in utilization over time.

Results. ECT utilization was higher among HUH veterans (58–104 per 1000) than domiciled veterans with mental illness (9–15 per 1000) across years with a trend toward increasing use of ECT use among HUH veterans over time. Among HUH and domiciled veterans who received ECT, veterans received an average of 5 to 9 sessions of ECT. There were great regional differences in rates of ECT utilization among HUH and domiciled veterans with the highest overall rates of ECT use at VA facilities in the Northeast and Northwest regions of the country.

Discussion. ECT is commonly and safely used in HUH veterans in a comprehensive healthcare system, but geographic and local factors may impede access to ECT for veterans who may benefit from this treatment. Efforts should be made to reduce barriers to ECT in the HUH population.

Electroconvulsive therapy (ECT) has a long and controversial history in medicine and in the public consciousness.¹ Before the 1960s, ECT was considered a crude and frightening procedure that was administered without standardization or the benefit of anesthesia, muscle relaxants, or emergency equipment.² However, with the institution of ethical principles and important advances in ECT methods and procedures, ECT has become a safe, accepted form of treatment for mental disorders and is now used in every continent in the world.^{3–5} ECT is now recognized through numerous rigorous clinical trials to be a robust and effective treatment for severe psychiatric conditions such as major depression and schizophrenia.^{6–10} Among patients with treatment-resistant depression, ECT has demonstrated a 60% to 80% response rate and a 50% to 60% remission rate.^{8,10,11} Despite its demonstrated effectiveness and advancements in procedures, ECT is utilized in less than 0.5% of individuals with major depression in the United States, with utilization rates decreasing over time.^{12–14} Underutilization of ECT may be due to increased regulations around ECT; bureaucratic rules on reimbursement; lack of available hospital resources and trained personnel; increased use of transcranial magnetic stimulation and ketamine; and negative perceptions and inaccurate knowledge about ECT.^{12,13,15–21}

While there is stigma associated with ECT treatment in the United States, studies have shown that privately insured patients are more likely to receive ECT than poor, publicly insured, or uninsured patients, suggesting vulnerable populations may actually have more limited access to ECT.¹² Thus, there may be socioeconomic disparities in ECT use, and it may be important to understand availability and utilization of ECT among homeless and unstably housed (HUH) populations. ECT is also a treatment which requires multiple sessions, follow-up care, and arrangements for transportation and other healthcare needs, so there may be barriers to ECT use, and providers may be reluctant to offer ECT to HUH populations. There has been virtually no research on ECT use among homeless adults despite the high prevalence of severe mental illness found in homeless populations, including veterans.^{22–25} The U.S. Department of Veterans Affairs (VA) operates the largest healthcare system in the country serving hundreds of thousands of HUH veterans annually. HUH adults typically face various barriers to care such as uninsurance, brokered healthcare services, difficulties in accessing a regular source of care, and receiving

Table 1. Use of Electroconvulsive Therapy (ECT) Among Domiciled and Homeless Veterans with Mental Illness from 2000 to 2019.

Year	Domiciled			Homeless			Comparison of Domiciled and Homeless on any ECT Use	Comparison of Domiciled and Homeless on ECT Sessions		
	Total #	# Receiving ECT	# ECT Sessions per Patient	ECT Use per 1000 Veterans	Total #	# Receiving ECT			# ECT Sessions per Patient	ECT Use per 1000 Veterans
2000	4 294 671	619	6.05	14.41	142 542	88	4.97	61.74	193.94***	1.90
2001	4 658 782	647	6.20	13.89	153 683	121	5.01	78.73	392.08***	3.00
2002	5 014 547	603	6.76	12.03	158 466	98	5.87	61.84	281.37***	1.08
2003	5 205 930	585	7.09	11.24	161 852	107	6.51	66.11	466.67***	.36
2004	5 523 061	550	8.05	9.96	169 085	117	7.04	69.20	491.37***	1.56
2005	5 519 722	569	8.03	10.31	170 159	123	7.70	72.29	521.41***	.13
2006	5 570 359	516	8.88	9.26	172 963	101	7.19	58.39	376.97***	3.40
2007	5 651 040	548	9.14	9.70	180 336	143	8.57	79.30	714.48***	.54
2008	5 764 165	613	8.36	10.63	193 098	178	6.99	92.18	939.71***	4.13*
2009	5 932 208	625	8.15	10.54	214 417	193	8.82	90.01	982.31***	1.20
2010	6 095 379	667	8.38	10.94	239 357	248	8.40	103.61	1369.46***	.00
2011	6 166 188	664	8.56	10.77	266 287	221	8.68	82.99	967.96***	.03
2012	6 243 177	738	8.29	11.82	307 658	271	7.93	88.08	1107.36***	.61
2013	6 252 684	725	8.88	11.60	343 364	308	8.95	89.70	1268.10***	.02
2014	6 343 573	756	8.40	11.92	358 803	363	8.85	101.17	1620.58***	1.07
2015	6 414 380	727	8.65	11.33	370 002	381	8.44	102.97	1799.06***	.24
2016	6 457 386	791	8.45	12.25	373 940	355	7.64	94.94	1440.81***	3.70
2017	6 478 294	830	8.29	12.81	369 557	317	6.76	85.78	1111.47***	11.72**
2018	6 504 730	829	8.79	12.74	361 567	305	7.98	84.36	1063.73***	2.54
2019	6 507 711	889	8.14	13.66	357 163	302	8.39	84.56	981.03***	.36

**P* < .05.
 ***P* < .01.
 ****P* < .001.

services from underfunded organizations.²⁶⁻²⁸ The VA presents a unique opportunity to examine ECT use in an integrated healthcare system where there are fewer barriers to care than other public and private healthcare systems, serving as a national safety net for millions of veterans who are eligible for comprehensive coverage and an array of medical, mental health, and social services.²⁹

We conducted a descriptive study using VA administrative data from 2000 to 2019 to: 1) compare ECT utilization between HUH and domiciled veterans with mental illness and 2) track changes in ECT utilization among both groups over time. We followed trends between and within both groups over two decades. The results may enhance our understanding of how use of ECT has changed and evolved in a national healthcare system for HUH and general mental health service users.

Methods

Administrative data from all veterans with mental illness who used VA healthcare services from 2000 to 2019 were extracted from VA’s Corporate Data Warehouse (CDW). Mental illness was operationalized using ICD-9 codes starting with 290 to 319 and ICD-10 codes starting with F. ECT sessions were identified using CPT

codes (4066F, 90870, and 90871) as well as both ICD-9 (94.26 and 94.27) and ICD-10 (GZB0ZZZ, GZB1ZZZ, GZB2ZZZ, and GZB3ZZZ) procedure codes. In addition, the analyses included not only ECT administered by VA providers, but also ECT administered by approved providers in the community (ie, fee basis claims). These coding procedures were based on previous studies which comprehensively examined ECT in the VA.^{30,31}

HUH veterans were identified using the following methods: 1) ICD-9 (V60.0) and ICD-10 (Z59.0) diagnostic codes for homelessness in inpatient and outpatient records; 2) outpatient stop codes (for HCHV, GPD, and HUD-VASH); 3) inpatient specialty codes (for DCHV and CWT/TR); 4) positive responses to the Homelessness Screener Clinical Reminder; 5) homeless program utilization reported in the Homeless Operations Management and Evaluation System; and 6) Supportive Services for Veteran Families utilization reported by community providers. Veterans with no indication of HUH were presumed to be domiciled. This project was not human subjects research, did not involve contact with any participants, and was conducted as a program evaluation initiative of the VA National Center on Homelessness among Veterans.

First, for each year from 2000 to 2019, analyses determined the total number of patients with any mental health diagnoses, the number of such patients receiving ECT, and the number of ECT

sessions, thereby computing ECT use per 1000 veterans and the average number of ECT sessions per ECT patient. Chi-squares were used to compare ECT use rates between homeless and domiciled veterans in each year, and analyses of variance (ANOVAs) were used to compare the average number of ECT sessions per HUH and domiciled veteran each year.

In addition to assessing annual numbers, data from 2000 to 2019 were also compared by Veterans Integrated Service Networks (VISNs) which cover different regions of the country. Because VISNs had been reorganized several times during the observational period of the study, we based all comparisons between VISNs based on their fiscal year 2017 designation. A two-way ANOVA was used to compare changes in number of persons per 100 000 receiving ECT between domiciled and homeless veterans from 2000 to 2019, with time, housing status, and a time by housing status interaction term entered in the model.

As a supplementary analysis, we conducted a logistic regression analysis to examine the association between HUH status on ECT use, adjusting for demographic characteristics, VA service-connection, psychiatric diagnoses, and other clinical variables including the Elixhauser Comorbidity Index³² extracted from the CDW. We used 1 year of data from 2019 to use recent data but avoid historical confounds of the COVID-19 pandemic in 2020; our sample consisted of all HUH veterans with mental illness in 2019 along with a

10% random sample of domiciled veterans with mental illness in that year as a comparison group.

Results

As shown in Table 1, rates of ECT use among domiciled veterans with mental illness have remained relatively consistent from 2000 to 2019 with 9 to 14 veterans receiving ECT per 1000 veterans. Rates of ECT use among HUH veterans with mental illness have been consistently higher from 2000 to 2019 compared with their domiciled counterparts with 58 to 104 HUH veterans receiving ECT per 1000 veterans. In addition, there has been greater variability in ECT use among HUH veterans than domiciled veterans over time, with an upward trend in ECT use observed among HUH veterans (62 per 1000 veterans in 2000 compared with 85 per 1000 veterans in 2010, which is a 37.1% increase). As shown in Figure 1, there was no visual pattern of synchronous increases or decrease in ECT use between HUH and domiciled veterans over time. Among ECT recipients, both HUH and domiciled veterans attended 5 to 9 sessions of ECT on average across years. There was no significant difference in the number of ECT sessions received per person between domiciled and HUH veterans, except for the years 2008 and 2017 in which domiciled veterans received significantly more ECT sessions than HUH veterans (- Table 1).

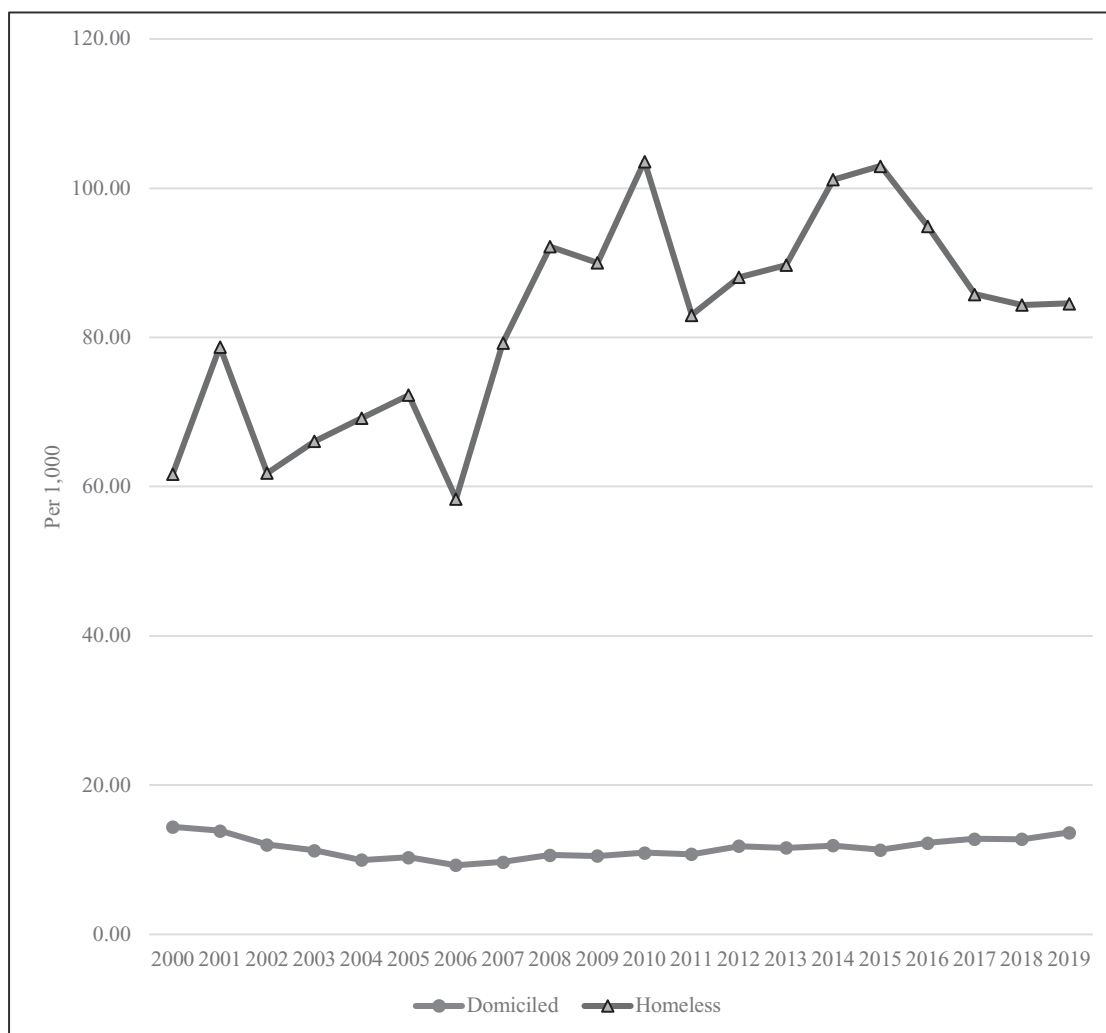


Figure 1. Trends in rates of electroconvulsive therapy (ECT) use among veterans with mental illness from 2000 to 2019.

Table 2. Use of Electroconvulsive Therapy (ECT) by Veterans Integrated Service Networks (VISNs) Among Domiciled and Homeless Veterans with Mental Illness in 2000 and 2019.

VISN	Year 2000			Year 2019			Comparison Between 2019 and 2000		
	ECT Use per 100 000 Among Veterans Overall	ECT Use per 100 000 Domiciled Veterans	ECT Use per 100 000 Homeless Veterans	ECT Use per 100 000 Among Veterans Overall	ECT Use per 100 000 Domiciled Veterans	ECT Use per 100 000 Homeless Veterans	Δ in ECT Use per 100 000 Domiciled Veterans	Δ in ECT Use per 100 000 Homeless Veterans	Test of Difference in Δ per 100 000 Between Domiciled and Homeless
1	18.34	16.23	67.83	23.44	15.90	132.21	-0.33	64.38	15.14***
2	10.19	8.68	40.52	5.69	4.13	23.37	-4.56	-17.15	2.79
4	2.30	2.41	0.00	2.87	2.85	3.04	0.44	3.04	0.26
5	6.63	5.92	18.53	10.84	7.56	51.08	1.64	32.55	10.47**
6	12.13	12.11	12.47	8.78	7.42	29.34	-4.69	16.87	5.13*
7	13.30	13.25	14.34	5.30	4.37	18.07	-8.88	3.73	2.87
8	6.14	5.11	31.55	15.20	12.79	50.60	7.68	19.05	1.85
9	1.29	1.02	6.47	16.14	12.42	68.04	11.40	61.58	24.08***
10	5.45	5.16	14.04	12.42	10.20	43.15	5.04	29.11	10.18**
12	17.82	17.07	33.19	14.38	12.30	47.88	-4.77	14.69	2.39
15	5.02	3.34	40.34	4.88	3.82	22.45	0.48	-17.89	9.20**
16	8.63	8.21	16.35	10.89	8.76	38.96	0.55	22.61	7.60**
17	12.16	11.99	15.44	8.16	6.28	34.95	-5.71	19.52	8.55**
19	6.95	6.72	10.86	4.45	3.68	14.98	-3.04	4.12	1.14
20	100.14	10.08	9.07	19.07	14.49	74.33	4.41	65.26	31.17***
21	6.40	5.79	15.37	4.22	3.93	7.25	-1.86	-8.13	1.28
22	15.09	14.18	28.33	13.40	11.26	36.15	-2.92	7.82	1.99
23	22.64	20.04	84.33	10.31	8.16	49.13	-11.88	-35.20	3.00

Note: Bolded are $\Delta > 5.0$ per 100 000.

* $P < .05$.

** $P < .01$.

*** $P < .001$.

Table 2 describes ECT use by VISNs which represent different geographic areas in 2000 and 2019 (mapped in the Supplementary Figure). There was considerable variability in ECT use by VISNs in both years. In 2019, ECT utilization among veterans with mental illness overall was highest in VISNs 1, 20, 9, and 8 (Northeast, Northwest, Midwest, and Southeast regions, respectively). The VISNs with the higher rates of ECT utilization differed between domiciled and HUH veterans. Among domiciled veterans, ECT use among different VISNs ranged from 1.02 to 20.04 per 1000 veterans in 2000 to 2.85 to 15.90 per 1000 in 2019. Among HUH veterans, ECT use ranged from 0.00 to 84.33 per 1000 HUH veterans in 2000 to 3.04 to 132.21 per 1000 in 2019. Thus, there was greater variability in ECT use among HUH veterans compared with domiciled between VISNs in 2000, but the variability in ECT use was similar between HUH and domiciled veterans in 2019. The total denominator and counts of domiciled and homeless veterans who received ECT by VISN are provided in the Supplementary Table.

In addition, there has been greater change and variability in change in ECT use within VISNs between 2000 and 2019 among HUH veterans than domiciled veterans. Among HUH veterans, changes in ECT use between VISNs ranged from -35.20 to 65.26 per 100 000; the greatest increases in ECT use were observed in VISNs 20, 1, and 9, representing the Northwest, the New England Area, and a southern portion of the Midwest (most of Tennessee and Kentucky), respectively. Among domiciled veterans, changes in ECT use between VISNs ranged from -11.88 to 11.40 per 100 000; the greatest increase in ECT use was observed in VISN

9 with a similar magnitude decrease observed in VISN 23 (representing the upper Midwest, including most of North and South Dakota, Iowa, Minnesota, and Nebraska).

There has been an overall greater increase in ECT use among HUH veterans compared with domiciled veterans over time; this greater increase in ECT use for HUH versus domiciled veterans was statistically significant in 7 VISNs (ie, VISNs 1, 5, 9, 10, 16, 17, and 20). It is worth noting that a significant decrease in ECT use among HUH veterans was observed in VISN 15 (representing a southern portion of the Midwest, including most of Kansas and Missouri) while rate of ECT use among domiciled veterans in that VISN was essentially unchanged. Change in ECT use at the VISN level between domiciled and HUH veterans was significantly and moderately correlated, as the Spearman correlation was .56, $P = .014$.

A supplementary logistic regression analysis of veteran characteristics associated with ECT use in 2019 among domiciled and HUH veterans with mental illness revealed that major depressive disorder and bipolar disorder were most strongly associated with ECT use (Table 3). After controlling for psychiatric diagnoses along with other background characteristics, HUH status was associated with an 86% increased odds of receiving ECT compared with domiciled veterans.

Discussion

This study described rates and trends in ECT utilization among HUH and domiciled veterans with mental illness in the VA health-care system from 2000 to 2019. Surprisingly, there was consistently

Table 3. Logistic Regression of Sociodemographic and Clinical Characteristics Associated with ECT Use Among Domiciled and Homeless Veterans with Mental Illness in 2019 (n = 100 786)

Variable	Adjusted Odds Ratio	95% Confidence Interval	P-Value
Homeless or unstably housed	1.86	1.42–2.43	<.001
Age (reference: 60+)			
17–29	0.45	0.22–0.89	.022
30–39	0.77	0.55–1.07	.119
40–49	1.00	0.73–1.37	1.000
50–59	1.20	0.94–1.54	.140
Race/ethnicity (reference: non-Hispanic white)			
Non-Hispanic black	0.31	0.23–0.41	<.001
Hispanic	0.75	0.51–1.09	.134
Mixed race/other	0.72	0.42–1.21	.209
Female	1.63	1.22–2.18	<.001
Marital status (reference: married)			
Single/never married	1.20	0.90–1.60	.221
Divorced/separated	1.09	0.84–1.42	.496
Widowed	1.05	0.59–1.86	.866
Percent service-connected disability (reference: none/0%)			
10%–40%	0.80	0.58–1.11	.186
50%–100%	1.29	1.03–1.62	.027
Combat exposure	0.93	0.69–1.26	.660
Military sexual trauma	0.99	0.75–1.31	.940
Psychiatric diagnoses			
Major depressive disorder	7.51	5.46–10.35	<.001
Bipolar disorder	4.91	3.99–6.05	<.001
Anxiety disorder	1.40	1.09–1.80	.009
Schizophrenia	3.46	2.75–4.36	<.001
Alcohol use disorder	1.20	0.95–1.51	.123
Drug use disorder	0.96	0.75–1.23	.748
Elixhauser comorbidity index	1.01	1.01–1.02	<.001

Note: The sample consisted of all homeless veterans with mental illness and a 10% random sample of domiciled veterans with mental illness.

higher ECT utilization among HUH veterans than domiciled veterans across years over the past two decades with a trend toward increasing ECT use among HUH veterans, whereas ECT use among domiciled veterans has remained the same. These findings accounted for the growing population of HUH veterans served by VA during the past two decades^{33,34}, and our analysis of recent data found that HUH status was associated with ECT use even after controlling for other sociodemographic and clinical variables, which makes these findings particularly noteworthy.

While we do not know for certain the reasons for the high ECT utilization among HUH veterans which may not be observed among other HUH adults, we theorize that it may be due to high rates of severe mental illness among HUH veterans, the comprehensive VA healthcare system, and the considerable resources and services available to HUH veterans. The VA's federal priority to prevent and end veteran homelessness^{33,35} may have made it comparatively easier for HUH veterans to access ECT compared with HUH patients who are not veterans, although this needs to be explored in further research. Importantly, we found that, on average, most HUH and domiciled veterans attended 5 to 9 sessions of ECT, which is within general recommendations and guidelines that typically suggest for 6 to 12 sessions but also allow for some clients who may respond to fewer than 6 sessions.^{36,37} Thus, we found that many HUH veterans were able to engage with a typical course of ECT treatment which is notable, because many HUH adults experience difficulties with medication adherence.³⁸ Since HUH veterans are more likely to use VA-funded residential care than domiciled veterans, use of residential care may have facilitated greater use of ECT among HUH veterans, and this possibility is worth further exploring. The HUH population is known to often require costly acute healthcare services^{39,40}, and ECT has been found to be a cost-effective treatment for treatment-resistant depression, so ECT may represent an important way to reduce service costs for HUH populations.⁴¹ Since ECT is often accompanied by ancillary support services, arrangements for transportation, healthcare needs, and follow-up care, it may be that these other services help keep HUH veterans engaged with ECT treatment.

Geographic variability in ECT utilization of veterans with mental illness overall in 2019 somewhat mirrored that observed in non-VA healthcare systems, with higher rates found in the Northeast and Midwest among both HUH and domiciled veterans.²⁰ Notably, VISN 17 which encompasses Northern California (including an area where ECT was briefly banned during the 1980s) had relatively low levels of ECT use in both domiciled and HUH veterans despite having relatively high levels of homelessness. This finding may reflect variations in culture or stigma that may make it more challenging for patients to receive ECT. The relatively strong correlation in rates of ECT use between HUH and domiciled veterans suggests that local factors (ie, ECT champions, administrators who facilitate ECT) may account for a large portion of the geographic variation between regions.

Findings of the study have clinical and public health implications. Our results confirm those of another study that ECT can be safely and commonly used in HUH adults experiencing mental illness.⁴² This is an important finding, as HUH adults generally have higher rates of psychiatric illness than their domiciled counterparts^{43,44} and may be in situations that require a more rapid treatment response. Future work is warranted to assess the effect of ECT on a full range of health outcomes in this specific population. If ECT is effective and feasible to administer in this population, the treatment might warrant consideration as a part of a comprehensive approach to treating HUH individuals with mental illness. A taskforce report of the American Psychiatric Association has indicated that ECT should be considered for individuals with major depression, mania, and schizophrenia,⁶ although it remains greatly underused.¹⁴ Given that ECT is often initiated when patients are hospitalized⁴⁵ and that ECT can act relatively rapidly to reduce symptoms of mood and psychotic disorders,^{46–48} ECT may be an important part of treatment of complex patients who experience homelessness.

Several limitations of this study require comment. First, changes in how HUH has been identified and captured may have affected the results. For instance, the population of HUH veterans identified has increased over time likely due to increased screening and funding of homeless programs. Second, we relied on coding of ECT in VA medical records using a combination of indicators to be comprehensive, but some ECT visits may not have been documented or included in our indicators. Third, there were relatively small samples of ECT recipients which affected the stability of estimates on ECT utilization rate, especially comparing rates between VISNs. Finally, our analyses based on administrative databases were not able to include important moderating or mediating factors, such as social support, symptom severity, financial issues, and side effects of ECT. Additional studies using alternative approaches are required to improve our understanding of the effects of these clinical and social issues on both ECT use and homelessness.

Conclusion

National administrative data in the VA healthcare system show that HUH veterans commonly and safely receive ECT at higher rates than domiciled veterans over a 20-year period. Large geographic variability in ECT use suggests that there are local barriers to care that need to be overcome to increase access to this treatment for HUH veterans. Further work is also needed to understand the specific benefits of this treatment on health outcomes of HUH veterans, ways to reduce barriers to ECT, and optimal ways to maximize treatment gains in this population.

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