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The occurrence of catatonia diagnosis in acute care hospitals in the United States: A national inpatient sample analysis

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ABSTRACT

Objective: Catatonia is a neuropsychiatric disorder that can occur in the setting of many illnesses, but the frequency of catatonia diagnosis among hospitalized patients is poorly characterized. This study reports the occurrence of catatonia diagnosis among acute care hospital discharges in the United States and the cooccurring diagnoses of these patients.

Method: The National Inpatient Sample, an all-payors database of acute care hospital discharges, was queried for patients older than 18 discharged with a diagnosis of catatonia in 2019.

Results: 13,630 encounters among the 30,080,038 adult hospitalizations in the NIS during the study year included a diagnosis of catatonia. Total hospital charges for these admissions were $1.15 billion, with 215,165 cumulative hospital days. In this sample, approximately 60% of admissions had a primary psychiatric discharge diagnosis, while 40% had a primary neurologic or medical discharge diagnosis. Procedures were performed in 36.7% of hospitalizations involving catatonia, of which electroconvulsive therapy was most common.

Conclusions: Catatonia is a rare but costly discharge diagnosis among patients in acute care hospitals. It occurs across the age spectrum and is associated with a range of medical and psychiatric comorbidities. Further research is needed to better characterize the occurrence of catatonia and its optimal treatment.

1. Introduction

Catatonia is a neuropsychiatric syndrome characterized by a range of motor, behavioral, and affective disturbances. [1] Despite an academic literature dating back nearly a century and a half and descriptions of catatonia in ancient times, [2] catatonia is often not recognized in the hospital setting, [3] and most literature descriptions are small case series derived from psychiatric inpatients. [4] Catatonia is a clinical diagnosis for which multiple rating scales exist, generally grading a relatively consistent set of criteria, [5] some of which may be observed and others elicited by the examiner. [6] These include immobility, mutism, stereotyped speech and motor function, and muscle rigidity, but can also involve excitability, impulsivity, and combativeness. [7] Catatonia can be associated with a range of medical complications including deep vein thrombosis, pulmonary emboli, contractures, malnutrition, and pressure ulcers. [8] Moreover, catatonia can progress to a potentially lethal malignant form of the illness which requires rapid psychiatric and critical care treatment. [9] The first-line of treatment of catatonia is benzodiazepines, particularly intravenous lorazepam, [10] which demonstrates effectiveness of nearly 80% in case reports, [11] although no randomized clinical trials of benzodiazepines in the acute treatment of catatonia have been conducted. Refractory cases can be treated with other medications, [12] with electroconvulsive therapy (ECT) providing definitive treatment in many refractory cases. [13]

While prior studies indicate that up to half of catatonia cases in medical and surgical settings may be driven by neuromedical illness, [14–16] relatively little is known about the frequency of catatonia among patients hospitalized in general hospitals, nor about the typical associated diagnoses or comorbidities of the condition. Data from a large sample of acute care hospitalizations would allow for more accurate characterization of catatonia in usual clinical practice and afford a better understanding of the types of associated conditions which may result in the requirement for hospitalization. This study characterizes the occurrence of catatonia diagnosis among hospital discharges in the

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United States in 2019 using a nationally-representative all-payor database of non-federal acute care hospitalizations.

2. Methods

2.1. Data source

This analysis utilized the 2019 edition of the National Inpatient Sample (NIS) from the Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality. The NIS is an all-payer database which samples non-federal community hospitals in the United States. In total 4568 acute care hospitals in 49 states, covering 98% of the US population, are included in the NIS. Under the sampling methodology of the NIS, hospitals are stratified based on geographic region, urban vs. rural location, teaching status, bed size, and ownership, and then 20% of discharges are sampled from within strata without replacement. This allows for weighting of the sampled discharges to produce nationally representative estimates. The NIS includes information about demographics, hospital characteristics, discharge diagnoses, and procedures performed. As this is a de-identified, publicly-available database, this study was determined to be Not Human Subjects Research by the Mass General Brigham Institutional Review Board.

2.2. Data selection and analysis

Encounters with catatonic patients were defined as those which include the *International Statistical Classification of Diseases, Tenth Revision, Clinical Modification* (*ICD-10-CM*) discharge diagnosis codes F06.1 (catatonic disorder due to a known physiological condition) or F20.2 (catatonic schizophrenia). Hospitalizations involving patients aged 19 or older at time of admission were included in the analysis. Comorbidities were classified into diagnostic categories using the Clinical Classifications Software Refined (CCSR) (v2021.2; Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality, Rockville, MD), which groups the raw ICD-10-CM codes into clinically relevant categories. All analyses were conducted on data weighted according to the appropriate NIS discharge weight to obtain nationwide estimates. As the NIS is a survey, all values come with an associated variance derived from the sampling methodology. This variance is used to present sample uncertainty for the overall number of discharges, whereas weighted point estimates are reported for all subsequent analyses. Analyses were conducted using SPSS (version 28; IBM Software, Inc., Armonk, NY).

3. Results

Among the 30,080,038 discharges in the United States among patients older than 18 in the 2019 NIS, an estimated 13,630 (95% CI: 12,822 to 14,437) involved a discharge diagnosis of catatonia (Table 1). There was a predominance of encounters with female patients, who made up 55.5% of discharges which included a catatonia diagnostic code. Median age on admission was 51 years (IQR 32 to 64). Hospitalizations involved patients across the age spectrum (Fig. 1), with age peaks in the 20s and 50s–60s. The racial breakdown of the sample was 55% White, 24.4% Black, 8.8% Hispanic, 3.8% Asian or Pacific Islander, 0.8% Native American, and 4.2% other. More catatonia patients resided in zip codes among the lowest household income quartile (30.3%) than among the highest household income quartile (20.0%). Medicare or Medicaid was the primary payor for 69.2% of discharges, with commercial insurance used for 22.3% of discharges.

Most hospitalizations (91.1%) were non-elective, with patients presenting to the hospital directly in 69.3% of cases and being transferred from other facilities 30.3% of the time. At time of discharge 51.3% of patients were discharged home without in-home services, while 39.5% were discharged to other facilities. In total 165 patients (1.2%) died in hospital. Median length of stay was 10 days (IQR 5 to 18 days), with median hospital charges of $45,239 (IQR $23,310 to $92,300). Encounters which included a diagnosis of catatonia covered a total of 215,165 patient days and were associated with a total cost of $1.15 billion.

Primary discharge diagnoses occurring in at least 100 catatonia hospitalizations are given in Table 2. Of the 22 most common diagnoses, all but 5 are psychiatric diagnoses, representing a variety of psychotic and affective conditions including unipolar depression (with and

Table 1
Demographics of patients with a discharge diagnosis of catatonia in the 2019 NIS.

	n	%
N (95% CI)	13,630 (12,822 to 14,437)	
Age (yrs; median, IQR))	51 (32 to 64)	
Sex		
Male	6065	44.5
Female	7565	55.5
Race		
White	7500	55
Black	3330	24.4
Hispanic	1205	8.8
Asian or Pacific Islander	520	3.8
Native American	105	0.8
Other	575	4.2
Missing	395	2.9
Census division of hospital		
New England	1025	7.5
Middle Atlantic	2075	15.2
East North Central	2000	14.7
West North Central	1005	7.4
South Atlantic	2955	21.7
East South Central	865	6.3
West South Central	965	7.1
Mountain	855	6.3
Pacific	1885	13.8
Population of county of residence		
Central metro county >1 million	5120	37.6
Fringe metro county >1 million	3025	22.2
Metro area 250,000–999,999	2825	20.7
Metro area 50,000–249,000	1010	7.4
Micropolitan	930	6.8
Non-core county	555	4.1
Household income quartile for Pt ZIP code		
1	4125	30.3
2	3200	23.5
3	3245	23.8
4	2730	20
Discharge quarter		
Jan–Mar	3255	23.9
Apr–Jun	3280	24.1
Jul–Sep	3465	25.4
Oct–Dec	3630	26.6
Admission type		
Elective	1200	8.8
Non-elective	12,415	91.1
Primary payor		
Medicare	5580	40.9
Medicaid	3855	28.3
Private insurance	3045	22.3
Self pay	695	5.1
Other	405	3
Admission status		
Not transferred in	9440	69.3
Transferred from acute care hospital	2070	15.2
Transferred from another facility	2060	15.1
Disposition of patient		
Discharged home	6995	51.3
Transfer to short-term hospital	665	4.9
Transfer to other facility type	4720	34.6
Home health care	920	6.7
Against medical advice	145	1.1
Died during hospitalization	165	1.2
Hospital length of stay (median, IQR)	10 (5 to 18)	
Total charges (median, IQR)	$45,239 ($23,310 to $92,300)	

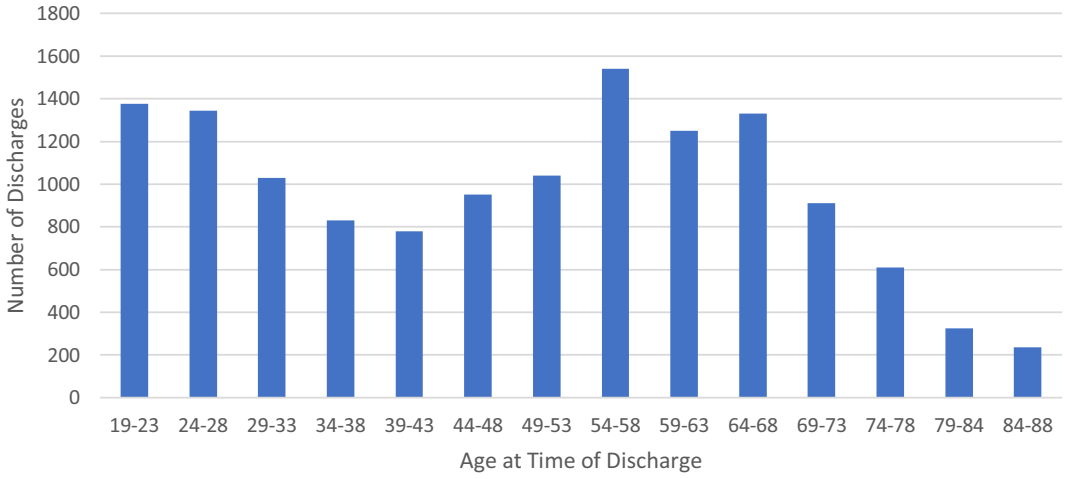

Fig. 1. Age distribution for hospitalizations involving catatonia. Ages are binned into 5-year ranges.

Table 2
Primary discharge diagnoses for hospitalizations involving catatonia. Included in the table are all diagnoses that were recorded at least 100 times among catatonia hospitalizations.

Code	Primary discharge diagnosis	n	%
F202	Catatonic schizophrenia	3465	25.4
F333	Major depressive disorder, recurrent, severe with psychotic symptoms	500	3.7
A419	Sepsis, unspecified organism	470	3.4
F061	Catatonic disorder due to known physiological condition	410	3
F250	Schizoaffective disorder, bipolar type	375	2.8
F332	Major depressive disorder, recurrent severe without psychotic features	315	2.3
F200	Paranoid schizophrenia	310	2.3
F29	Unspecified psychosis not due to a substance or known physiological condition	280	2.1
F319	Bipolar disorder, unspecified	235	1.7
F315	Bipolar disorder, current episode depressed, severe, with psychotic features	230	1.7
F323	Major depressive disorder, single episode, severe with psychotic features	210	1.5
N179	Acute kidney failure, unspecified	210	1.5
F209	Schizophrenia, unspecified	205	1.5
G9341	Metabolic encephalopathy	200	1.5
G9340	Encephalopathy, unspecified	195	1.4
F329	Major depressive disorder, single episode, unspecified	185	1.4
N390	Urinary tract infection, site not specified	185	1.4
F251	Schizoaffective disorder, depressive type	160	1.2
F312	Bipolar disorder, current episode manic severe with psychotic features	145	1.1
F23	Brief psychotic disorder	105	0.8
F259	Schizoaffective disorder, unspecified	105	0.8
F3130	Bipolar disorder, current episode depressed, mild or moderate severity, unspecified	105	0.8

without psychotic features), bipolar disorder (depressed, manic, and unspecified), schizoaffective disorder, and schizophrenia. Among the non-psychiatric diagnoses, two are infectious (sepsis, $n = 440$, 3.4%; urinary tract infection, $n = 185$, 1.4%). Other primary medical diagnoses are acute kidney failure ($n = 210$; 1.5%), metabolic encephalopathy ($n = 200$; 1.5%), and unspecified encephalopathy (n = 200; 1.5%). Grouping all primary diagnoses into CCSR categories reveals that the top 3 diagnostic categories are schizophrenia spectrum disorders (a category which includes the two catatonia codes; $n = 5660$, 41.5%), depressive disorders ($n = 1410$, 10.3%), and bipolar and related disorders ($n = 1095$, 8.0%). Of the remaining 40.2% of cases, most are neurologic or medical diagnoses of a variety of causes (Table S1).

Expanding the diagnoses to all primary and secondary discharge diagnoses for all patients with catatonia reveals an extensive list of comorbidities (Table S2). Among conditions expected to be chronic, and not caused by a present catatonic episode, include essential hypertension (33.1%), hyperlipidemia (20.0%), gastro-esophageal reflux disease (13.6%), hypothyroidism (11.7%), type 2 diabetes mellitus (9.0%), and epilepsy (6.7%). Diagnoses more likely to be caused by an acute catatonic episode include dehydration (16.3%), hypokalemia (15.8%), acute kidney failure (12.3%), hyperosmolarity and hypernatremia (8.5%), constipation (8.4%), and tachycardia (8.1%). Psychiatric comorbidities (based on CCSR categories) include schizophrenia spectrum and psychotic disorders (17,855 diagnoses, of which 13,745 are catatonia codes) anxiety disorders (4520 diagnoses), depressive disorders (4245 diagnoses), bipolar disorders (3035 diagnoses), neurocognitive disorders (2700 diagnoses), and neurodevelopmental disorders (1130 diagnoses). Table 3 lists psychiatric diagnoses by CCSR categories, and the top 4 codes contributing to each category. In total 115 patients had a discharge diagnosis list containing both catatonia codes (F06.1 and F20.2).

In total, 5005 encounters (36.7%) involved at least one procedure (Table 4). The most frequent procedures were electroconvulsive therapy (1380 encounters, 10.1%), lumbar puncture (875 encounters, 6.4%), and electroencephalogram (630 encounters; 6.4%). Invasive supportive procedures included central line insertion (490 encounters, 3.6%), mechanical ventilation (470 encounters, 3.4%), and gastronomy tube placement (410 encounters, 3.0%). Brain MRI was utilized in 55 encounters (0.4%).

4. Discussion

In this study, catatonia is a rare condition, diagnosed in less than 0.05% of general hospital discharges in 2019. Critically, up to 40% of patients in our sample of general hospital encounters experienced catatonia in the setting of non-psychiatric primary diagnoses including epilepsy, toxidromes, encephalitis and hypothyroidism. It is therefore essential to recognize catatonia as a potential complication or comorbidity of a host of neuromedical illnesses beyond the typical psychiatric causes diagnosed in most prior studies predominantly focusing on psychiatric inpatients. This observation of primary diagnostic diversity also has implications for catatonia management, as the underlying neuromedical diagnosis may impact response to benzodiazepines or ECT, and full resolution of catatonia often requires treatment of the underlying illness. [17,18] Furthermore, delirium was diagnosed in 630 hospitalizations (4.6%) involving catatonia. While by definition under DSM-5 criteria catatonia and delirium may not be diagnosed at the same time, evidence increasingly suggests a high degree of comorbidity between delirium and catatonia, especially in intensive care settings, with

Table 3
Discharge diagnoses for hospitalizations involving catatonia. Included are all primary and secondary discharge diagnoses. Bolded rows are CCSR categories, and under each category are individual *ICD-10-CM* codes contributing to that category. The top 4 codes are included for each category.

Code	n	%	Description
MBD001	**17,855**		**Schizophrenia spectrum and other psychotic disorders**
F202	8115	59.5%	Catatonic schizophrenia
F061	5630	41.3%	Catatonic disorder due to known physiological condition
F29	800	5.9%	Unspecified psychosis not due to a substance or known physiological condition
F200	755	5.5%	Paranoid schizophrenia
MBD005	**4875**		**Anxiety and fear-related disorders**
F419	3075	22.6%	Anxiety disorder, unspecified
F411	665	4.9%	Generalized anxiety disorder
F940	555	4.1%	Selective mutism
F410	275	2.0%	Panic disorder [episodic paroxysmal anxiety]
MBD002	**4245**		**Depressive disorders**
F329	2120	15.6%	Major depressive disorder, single episode, unspecified
F333	625	4.6%	Major depressive disorder, recurrent, severe with psychotic symptoms
F332	575	4.2%	Major depressive disorder, recurrent severe without psychotic features
F323	325	2.4%	Major depressive disorder, single episode, severe with psychotic features
MBD003	**3035**		**Bipolar and related disorders**
F319	1740	12.8%	Bipolar disorder, unspecified
F315	325	2.4%	Bipolar disorder, current episode depressed, severe, with psychotic features
F312	190	1.4%	Bipolar disorder, current episode manic severe with psychotic features
F3130	165	1.2%	Bipolar disorder, current episode depressed, mild or moderate severity, unspecified
NVS011	**2700**		**Neurocognitive disorders**
F05	630	4.6%	Delirium due to known physiological condition
F0390	475	3.5%	Unspecified dementia without behavioral disturbance
F0280	335	2.5%	Dementia in other diseases classified elsewhere without behavioral disturbance
G309	250	1.8%	Alzheimers disease, unspecified
MBD012	**1540**		**Suicidal ideation/attempt/intentional self-harm**
R45851	1540	11.3%	Suicidal ideations
MBD007	**1440**		**Trauma- and stressor-related disorders**
F4310	810	5.9%	Post-traumatic stress disorder, unspecified
F449	105	0.8%	Dissociative and conversion disorder, unspecified
F445	100	0.7%	Conversion disorder with seizures or convulsions
F4320	65	0.5%	Adjustment disorder, unspecified
MBD014	**1330**		**Neurodevelopmental disorders**
F79	335	2.5%	Unspecified intellectual disabilities
F909	315	2.3%	Attention-deficit hyperactivity disorder, unspecified type
F840	220	1.6%	Autistic disorder
F70	95	0.7%	Mild intellectual disabilities

Table 4
List of procedures performed in at least 1% of hospitalizations involving catatonia.

Procedure	n	%
Any procedure	5005	36.7%
Electroconvulsive therapy	1380	10.1%
Lumbar puncture	875	6.4%
Electroencephalogram	630	4.6%
Central line insertion	490	3.6%
Mechanical ventilation	470	3.4%
Gastrostomy tube placement	410	3.0%
Intubation	410	3.0%
Enteral feeding	270	2.0%
RBC transfusion	170	1.2%
Renal dialysis	160	1.2%

some studies estimating that up to 30% of patients with delirium may exhibit features of catatonia and vice versa [19–21]. Recognition of this overlap also has important implications for management, as benzodiazepines can worsen delirium, and antipsychotics, which are often used to manage sequelae of delirium, may worsen catatonia or lead to the development of lethal catatonia. The overlap of delirium and catatonia may represent an indication for alternative agents such as NMDA receptor antagonists. [12,22] That said, the data in this study do not allow us to say whether the delirium and catatonia were strictly contemporaneous, but merely that they were both diagnosed at some point during a hospital encounter.

Examining psychiatric diagnoses among patients with diagnoses of catatonia reveals a diagnostic pattern of psychotic disorders as most frequent (by nearly 4×), followed by anxiety disorders, depressive disorders, and bipolar disorder. Notably, while older teaching erroneously held that catatonia was necessarily a manifestation of schizophrenia, [23,24] more recent literature has found the prevalence of catatonia to be highest in bipolar disorder followed by schizophrenia and major depressive disorder. [4] The limited choice of ICD-10 codes for diagnosing catatonia likely contributes to the discrepancy between our findings and prior literature: the two catatonia diagnostic codes (F06.1 and F20.2) are classified under psychotic disorders using the CCSR categories, and the billing code F20.2, is specifically labeled as "catatonic schizophrenia." As a result there is no obvious ICD-10-CM code for a diagnosis of catatonia due to bipolar disorder, for example, which is neither classified under schizophrenia nor as a physiologic condition in the eyes of most clinicians (which might merit a diagnosis of F06.1 "catatonic disorder due to a known physiological condition"). Thus, schizophrenia may be over-represented in our sample because clinicians felt compelled to use the F20.2 "catatonic schizophrenia" ICD-10 code for catatonia secondary to other psychiatric conditions.

Some of the racial disparities between this sample and the general population may also be partially explained by this diagnostic nosology challenge. For instance, non-White patients are more likely to be diagnosed with psychotic disorders relative to mood disorders, [25] which may explain some of their striking overrepresentation among catatonia cases relative to their proportion in the overall population. Racial bias, disparities in access to care, and other structural and societal factors likely also play a strong role in differential diagnosis and outcomes in historically-marginalized populations. [26]

While the NIS does not include information about medication treatments, procedural information indicates severe illness in many patients with catatonia. Approximately 10% of patients were treated with ECT, a slightly higher rate than the 8.3% previously reported for primary catatonic patients using the 2002–2017 NIS. [27] We are unable to assess whether ECT was performed during these hospitalizations due to illness refractory to medications, or due to clinical acuity requiring an rapid response, e.g. in the case of malignant catatonia. Relatively few diagnostic procedures were performed, with the utilization of lumbar punctures (6.4%) exceeding that of electroencephalogram (4.6%) or brain MRI (0.4%). While there is not a standardized approach to diagnostic procedures in the diagnosis of catatonia, they are often used to rule out alternative diagnoses whose symptoms may overlap with catatonia features or to examine possible neurological causes of catatonia, including encephalitis and autoimmune disorders. The higher rate of lumbar punctures could point to the growing recognition of autoimmune encephalitidies leading to catatonia in both adolescents and adults. [18,28]

Strengths of this study include its large nationally representative sample from all payor databases. [29] Additionally, inclusion of all catatonia codes, whether primary or secondary, allows for understanding of comorbidities of catatonia. The limitations of the study are inherent in its design as a retrospective observational cohort study derived from billing records. [30] For a hospitalization to be included in this study the discharging team must have accurately identified and coded for catatonia, and so cases that were not recognized or

misdiagnosed are misrepresented as non-cases. One retrospective chart review by expert clinicians found that only 59% of cases that could be consistent with catatonia were diagnosed with catatonia by the treatment team, [3] and a second study of neurologists in the emergency department found substantial under recognition of catatonia in that setting. [31] That lower rate may indicate substantial failure to diagnose which could be addressed through the use of validated catatonia scales; [5,7] however, claims data do not allow for a differentiation of failure to diagnose and failure to code and thus caution is warranted. One systematic review has found a positive predictive value for discharge mental health diagnoses matching a reference standard of 76%, [32] but the rate of diagnoses being made clinically but not reflected in discharge billing codes is unknown. Furthermore, the NIS only includes acute care hospitals, and so cases seen at other facilities (including freestanding psychiatric hospitals, rehabilitation hospitals, or federal healthcare facilities) are not included. This precludes comparisons to literature rates of catatonia which include cases treated in psychiatric facilities. Moreover, the fraction of catatonia cases treated exclusively in those facilities vs. in general hospitals is unknown. The NIS includes discharges and does not individually identify patients, and so if a patient was treated for catatonia more than once in the study year or was treated at multiple acute care hospitals that individual may be counted more than once among NIS discharges. This precludes comparisons to prevalence studies tracking individual patients. Finally, as noted above, conclusions may be limited by the inherent limitations of specific billing codes connected to ICD-10 nosology or by the inability to establish the temporal order in which the conditions coded for in a given encounter occurred. [32].

5. Conclusions

Catatonia is rarely diagnosed among community hospital discharges in the United States, but is associated with significant psychiatric and medical comorbidity. In contrast to studies of catatonia in psychiatric inpatients, among general hospital discharges, over 40% of cases of catatonia are due to underlying neuromedical illnesses. Further research is needed into the diagnosis and treatment of catatonia among patients in medical hospitals, including prospective trials and retrospective analyses not limited to billing records. Limitations of our present nosological schemas, especially ICD-10, which was used in this database, may hamper the recognition of this reversable condition, and so incorporation of more nuanced diagnostic schemas for catatonia as is present in ICD-11 may enhance care.

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CRediT authorship contribution statement

James Luccarelli: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing. **Mark Kalinich:** Conceptualization, Methodology, Formal analysis, Visualization, Writing – review & editing. **Thomas H. McCoy:** Methodology, Validation, Writing – review & editing. **Carlos Fernandez-Robles:** Writing – review & editing. **Gregory Fricchione:** Conceptualization, Writing – review & editing. **Felicia Smith:** Supervision, Writing – review & editing. **Scott R. Beach:** Conceptualization, Supervision, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

MK is employed by and has equity in Watershed Informatics, whose work is unrelated to catatonia. THM receives research funding from the Stanley Center at the Broad Institute, the Brain and Behavior Research Foundation, National Institute of Mental Health, National Human Genome Research Institute Home, and Telefonica Alfa. The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Data availability

Data is publically available at: https://www.hcup-us.ahrq.gov/db/nation/nis/nisdbdocumentation.jsp

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.genhosppsych.2022.05.006.

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