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Patterns of Psychotropic Medication Use among Individuals with Traumatic Brain Injury

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Abstract

The relationship between psychotropic medication use and traumatic brain injury (TBI) is not well understood. The objective of this study was to describe patterns of psychotropic medication use during the months before and after TBI and compare with a non-TBI cohort. We conducted a retrospective cohort study using administrative claims data for a commercially insured population from 2008 to 2014, and assessed monthly prevalence of psychotropic medication use by class before and after TBI (or matched index in the non-TBI controls). We tested time trends and quantified rates of increase using autoregressive models, and determined whether TBI impacted psychotropic medication use using difference-in-difference models. Compared with those without TBI ($n = 414{,}708$), individuals with TBI ($n = 207{,}354$) were more likely to receive any psychotropic medication both before (36.9% vs. 19.5%, $p < 0.001$) and after TBI (48.2% vs. 25.7%, $p < 0.001$). Prior to TBI, the rate of monthly increase in use of psychotropic medications in the TBI cohort was three to four times the rate observed in the non-TBI cohort, and was highest for antidepressants in both cohorts. After accounting for between-group and time trends, TBI was associated with increased use of several psychotropic medications including antipsychotics (rate ratio [RR] 1.08; 95% confidence interval [CI] 1.07, 1.09) and anxiolytics (RR 1.05; 95% CI 1.04, 1.06). Patterns of psychotropic medication use differed significantly between individuals with and without TBI. These results suggest that a better understanding of events leading up to and following TBI is needed to elucidate the role psychotropic medications play in the natural history of TBI.

Keywords: administrative claims data; neuropsychiatric disorder; psychotropic medication; TBI

Introduction

Traumatic brain injury (TBI) is a major public health concern, contributing to 2,500,000 emergency department visits and 282,000 hospitalizations in 2013 in the United States.[1] TBI has a significant long-term impact on patients, families, and other stakeholders, because the majority of TBI patients are younger adults, who might live the rest of their lives with chronic sequelae including cognitive, emotional, and functional impairment and disability.[1–4] The most common long-term sequelae of TBI are neuropsychiatric disorders (NPD) such as depression and anxiety, with post-TBI prevalence rates as high as 53% for depression.[5–9]

Relative to individuals without TBI, those with TBI have higher levels of pre-existing NPD, suggesting that NPD may increase risk of TBI.[6,8,10–12] For example, in a large national analysis and relative to non-TBI controls, individuals who subsequently experienced a TBI had higher prevalence of depression, anxiety, bipolar disorder, and schizophrenia during the pre-TBI period.[8] Consistent with high pre-TBI prevalence of NPD, high psychotropic medication use (42%) has been documented during the months prior to TBI in a study conducted among Medicare beneficiaries.[13] Despite the elevated usage of psychotropic medications prior to TBI and increased risk of NPD following TBI, evidence suggests that newly diagnosed NPD following TBI might be undertreated.[13,14]

Considering the relationships among NPD, TBI, and psychotropic medication use, it is of clinical and research importance to better understand the patterns of psychotropic medication use leading up to and following TBI.

By making comparisons with a non-TBI sample, our objective was to highlight differences in prevalence and trends of psychotropic medication use that can inform treatment of individuals with TBI. This study builds on our previous work among Medicare beneficiaries hospitalized with TBI by focusing on a younger population diagnosed with TBI across multiple care domains, and including a non-TBI cohort to produce population-level comparisons. We hypothesized that psychotropic medication use would be higher among individuals with TBI both before and after the TBI event than among individuals without TBI.

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Methods

Study design and data source

We conducted a retrospective cohort study using data from the OptumLabs® Data Warehouse (OLDW), which includes de-identified data from a large United States health plan with claims from commercial and Medicare Advantage (MA) enrollees. The database contains longitudinal health information on enrollees, representing a diverse mixture of ages, ethnicities, and geographical regions across the United States, and is representative of the general commercial/MA market in the geographic area where it operates.[15] The health plan provides comprehensive, full insurance coverage for physician, hospital, and prescription drug services. In the OLDW, anyone ≥89 years of age is assigned an age of 89 years to maintain compliance with the Health Insurance Portability and Accountability Act of compliance. This study involved analysis of pre-existing, de-identified data and was determined exempt from Institutional Review Board approval by the University of Maryland, Baltimore.

Study participants

The TBI cohort comprised enrollees ≥18 years of age, diagnosed with TBI between January 1, 2009 and June 30, 2012, and meeting inclusion criteria. TBI was defined based the Centers for Disease Control and Prevention (CDC) case definition.[16,17] This definition includes International Classification of Disease, 9th Revision Clinical Modification (ICD-9-CM) codes 800.xx, 801.xx, 803.xx, 804.xx, 850.xx- 854.1x, 950.1-950.3, and 959.01.[18,19] We required continuous enrollment in medical and pharmacy benefits for a minimum of 12 months before TBI and 24 months after TBI to ensure capture of monthly medication use. We searched inpatient and outpatient claims for the presence of TBI, defined as any of the ICD-9-CM codes in any position on the claim, and defined the index date as the date of TBI. In addition to the TBI cohort, a randomly selected non-TBI control cohort was created that included enrollees without a TBI diagnosis who met identical continuous enrollment criteria and were frequency matched 1:2 to the TBI cohort such that the distribution of index years in the control cohort matches that of the TBI cohort. An index date was randomly assigned to the non-TBI controls.

Psychotropic medications

We identified psychotropic medications indicated for the treatment of anxiety, depression, and post-traumatic stress disorder with assistance from a psychiatrist and a pharmacist. We included anticonvulsants, antidepressants, antipsychotics, anxiolytics, benzodiazepines, mood stabilizers and non-benzodiazepine sedative hypnotics. See Appendix for a complete list of included medications. We created 12 30-day periods before and 24 30-day periods after the index date. Next, we searched the prescription drug files for evidence of a medication fill during each period, and created an indicator for receipt of at least one prescription fill for each individual drug, class, and group. We also created a monthly indicator for receipt of any psychotropic medication.

Covariates

Age, sex, race, education, census region, and type of insurance were obtained from the OLDW files. Comorbid illnesses were identified based on the presence of ICD-9-CM codes on any inpatient or outpatient claim. Any comorbidity identified during the 12 months prior to the index date was considered present at baseline.

NPD

We identified the following diagnoses for NPD before and after the index date: mood disorders (bipolar disorder [ICD-9-CM 296.0x, 296.1x, 296.4x – 296.7x, 296.80, 296.81, 296.89]; depression [ICD-9-CM 296.20-296.25, 296.30-296.35, 300.4, or 311]), anxiety disorders (anxiety and panic disorders [ICD-9-CM 300.0x, 300.21, 300.22], post-traumatic stress disorder [ICD-9-CM 309.81]); substance abuse disorders (alcohol dependence disorder [ICD-9-CM 291.xx, 303.xx, 305.0x, 571.0x, 571.2x, 571.3x]; substance dependence disorder [ICD-9-CM 292.xx, 304.x, 305.1x-305.9x]); and psychotic disorders (schizophrenia and schizoaffective disorders [ICD-9-CM 295.0x – 295.4x, 295.6x, 295.7x, 295.9x], other psychoses [ICD-9-CM 297.1x, 298.0x – 298.4x, 298.8x, 298.9x]).

Statistical analysis

Differences in the frequency and distribution of baseline characteristics (defined as the month of the index date) between TBI and non-TBI cohorts were assessed using χ^2 goodness of fit or Student's t tests. We calculated the monthly prevalence of psychotropic medication use (for this study referred to as use) overall and by therapeutic class in the TBI and non-TBI cohorts both before and after the index date, and displayed results graphically. We also calculated average monthly prevalence of use of the most commonly used psychotropics before and after the index date, and displayed results graphically.

Time trends in monthly psychotropic use before and after the index date were tested using a first-order linear autoregressive model that corrects for autocorrelated error terms. Also, analyses were run separately by drug class. Because 90-day fills were being captured, the first 2 months of the study period were excluded from time trend analysis. The estimate for the time term was interpreted as the increase in psychotropic medication use for each increase in month. We used these estimates to compare rate of change in use of psychotropic medications between drug classes and cohorts.

To determine whether TBI affected use of psychotropic medications while accounting for temporal changes in psychotropic medication use during the 36 month study period, we implemented a difference-in-differences (DID) approach. We tested differences in psychotropic medication use between the TBI and non-TBI groups as well as between the pre- and post-index periods using generalized estimating equations with a Poisson model. These models permitted us to account for differences in person-time between the pre-index (12 months) and post-index (24 months) periods, while accounting for correlations between repeated measures in standard error estimates. The three primary terms of interest were TBI (i.e., differences between the TBI and non-TBI cohort prior to the index date), post-index (i.e., change in the non-TBI cohort comparing post-index date to pre-index date), and the TBI-post-index interaction term (i.e., the DID term; changes in psychotropic medication use among individuals with TBI following the index date). First, models adjusted only for index date (i.e., the matching variable) were run. Next, we added all covariates and removed those with p values <0.001 (because of large sample sizes) to build the final model. Rate ratios (RtR) and 95% confidence intervals (CI) were reported. All analyses were performed with Stata version 14 (StataCorp. College Station, TX).

Results

There were 207,354 individuals ≥18 years of age diagnosed with TBI and meeting coverage criteria from 2008 to 2014 who were matched to 414,708 non-TBI controls. Compared with those without TBI, individuals with TBI were older – 54.6 (standard deviation [SD] 20.9 years) vs. 49.1 (SD 16.2) years, $p < 0.001$ – and more likely to be female (56.7% vs. 51.7%, $p < 0.001$) (Table 1). Individuals with TBI had a higher burden of comorbid illness than those without TBI ($p < 0.001$ for all comparisons; see Table 1).

Table 1. Baseline Characteristics of Individuals with a Diagnosis of Traumatic Brain Injury (TBI) 2008–2014 and Matched Controls, $N = 622{,}062$

	TBI, n = *207,354*	*No TBI,* n = *414,708*	p *value*[a]
Age, mean (standard deviation)	54.6 (20.9)	49.1 (16.2)	<0.001
Female, *n*(%)	117,463 (56.7)	214,245 (51.7)	<0.001
Race, *n*(%)			<0.001
White	155,382 (75.4)	300,350 (72.9)	
Black	21,972 (10.7)	42,024 (10.2)	
Other	30,000 (14.5)	72,334 (17.4)	
Medicare Advantage, *n*(%)	74,764 (36.1)	71,138 (17.2)	<0.001
Census region, *n*(%)			<0.001
Northeast	27,369 (13.3)	44,961 (10.9)	
South	89,152 (43.3)	187,030 (45.4)	
Midwest	59,108 (28.7)	115,605 (28.1)	
West	30,425 (14.7)	64,526 (15.6)	
Comorbid illness, *n*(%)			
Alcohol dependence and abuse	13,845 (6.7)	2800 (0.7)	<0.001
Alzheimer's and related dementias	13,944 (6.7)	2824 (0.7)	<0.001
Anemia	15,692 (7.6)	12,324 (3.0)	<0.001
Arthritis	57,362 (27.7)	47,065 (11.4)	<0.001
Asthma	18,958 (9.1)	20,153 (4.9)	<0.001
Chronic kidney disease	22,748 (11.0)	14,952 (3.6)	<0.001
Chronic liver disease	7334 (3.5)	2451 (0.6)	<0.001
Chronic obstructive pulmonary disease	25,284 (12.2)	20,313 (4.9)	<0.001
Diabetes	40,077 (19.3)	44,601 (10.8)	<0.001
Heart failure	16,444 (7.9)	7016 (1.7)	<0.001
Hyperlipidemia	89,464 (43.2)	129,465 (31.2)	<0.001
Hypertension	100,698 (48.6)	121,155 (29.2)	<0.001
Ischemic heart disease	33,749 (16.3)	24,531 (5.9)	<0.001
Ischemic stroke	26,597 (12.8)	9739 (2.3)	<0.001

[a]*p* value from χ^2 goodness of fit or Student's *t* test.

Table 2. Neuropsychiatric Diagnoses (NPD) and Psychotropic Medication Received during the Twelve Months before and the Twenty-Four Months after Traumatic Brain Injury (TBI) or Matched Index Date for Controls, $N = 622{,}062$

	TBI, n = *207,354*	*No TBI,* n = *414,708*	p *value*[a]
Any NPD pre-TBI	70,795 (34.1)	60,429 (14.6)	<0.001
Any NPD post-TBI	87,138 (42.0)	87,854 (21.2)	<0.001
Any psychotropic medication pre-TBI	76,529 (36.9)	81,054 (19.5)	<0.001
Any psychotropic medication post-TBI	99,863 (48.2)	106,477 (25.7)	<0.001
Depression pre-TBI	34,541 (16.7)	28,422 (6.9)	<0.001
Depression post-TBI	54,315 (26.2)	44,400 (10.7)	<0.001
Anxiety pre-TBI	26,343 (12.7)	25,204 (6.1)	<0.001
Anxiety post-TBI	44,792 (21.6)	43,920 (10.6)	<0.001
PTSD pre-TBI	1716 (0.8)	968 (0.2)	<0.001
PTSD post-TBI	3549 (1.7)	1667 (0.4)	<0.001
Alcohol dependence pre-TBI	13,089 (6.3)	2687 (0.7)	<0.001
Alcohol dependence post-TBI	5737 (2.8)	4112 (1.0)	<0.001
Substance dependence pre-TBI	23,080 (11.1)	16,927 (4.1)	<0.001
Substance dependence post-TBI	14,028 (6.8)	19,933 (4.8)	<0.001
Bipolar disorder pre-TBI	5525 (2.7)	2991 (0.7)	<0.001
Bipolar disorder post-TBI	3590 (1.7)	1982 (0.5)	<0.001
Schizophrenia pre-TBI	1358 (0.7)	722 (0.2)	<0.001
Schizophrenia post-TBI	2418 (1.2)	1106 (0.3)	<0.001
Other psychoses pre-TBI	4337 (2.1)	1171 (0.3)	<0.001
Other psychoses post-TBI	16,860 (8.1)	3604 (0.9)	<0.001

[a]*p* value from χ^2 goodness of fit or Student's *t* test.
PTSD, post-traumatic stress disorder.

Table 2 reports prevalence of NPD diagnoses received as well as any psychotropic medication use over the 12 months before and the 24 months following the index date. Compared with those without TBI, individuals with TBI were more likely to receive any NPD diagnosis before (34.1% vs. 14.6%, $p < 0.001$) and after TBI (42.0% vs. 21.2%, $p < 0.001$). They were similarly more likely to receive any psychotropic medication both before (36.9% vs. 19.5%, $p < 0.001$) and after TBI (48.2% vs. 25.7%, $p < 0.001$). Regardless of TBI status, the most commonly diagnosed NPD both pre- and post-TBI was depression.

Average monthly psychotropic medication use over the 36 month study period is presented in Figure 1 by TBI status. Psychotropic medication use was dominated by antidepressants in both cohorts. In both the TBI and non-TBI cohorts, there was a significant increase in psychotropic medication use approaching the index date (Table 3). Prior to TBI, the rate of monthly increase in use of psychotropic medications in the TBI cohort was three to four times that observed in the non-TBI cohort prior to the index date. Rates of increase for antidepressants were highest in both cohorts. Following the index date, rates of psychotropic medication use in the TBI cohort dropped significantly so that, although still increasing, rates were similar to that observed in the non-TBI cohort.

Changes in the average monthly use of the most common individual psychotropic medications from the pre- to the post-TBI periods are displayed in Figure 2. In the TBI cohort, sertraline and citalopram were the most commonly used antidepressants. In the non-TBI cohort, bupropion was also commonly used. Use of gabapentin, trazadone, and zolpidem was elevated in the TBI cohort, with a large increase in gabapentin use observed post-TBI.

Table 4 displays unadjusted and adjusted estimates from the Poisson DID models. Following adjustment for important demographic and clinical variables including diagnoses of NPD and relative to the non-TBI cohort, psychotropic medication use was significantly higher in the TBI cohort pre-index. Largest effect estimates were observed for antipsychotics (RtR 1.37; 95% CI 1.36, 1.39), mood stabilizers (RtR 1.77; 95% CI 1.75, 1.80), and anticonvulsants (RtR 1.81; 95% CI 1.79, 1.82).

Relative to the non-TBI cohort and accounting for between-group differences pre-index and the increasing trend of psychotropic use, TBI was associated with increases in use of antipsychotics (RtR 1.08; 95% CI 1.07, 1.09), anxiolytics (RtR 1.05; 95% CI 1.04, 1.06), mood stabilizers (RtR 1.05; 95% CI 1.05, 1.06), and benzodiazepines (RtR 1.02; 95% CI 1.02, 1.03)

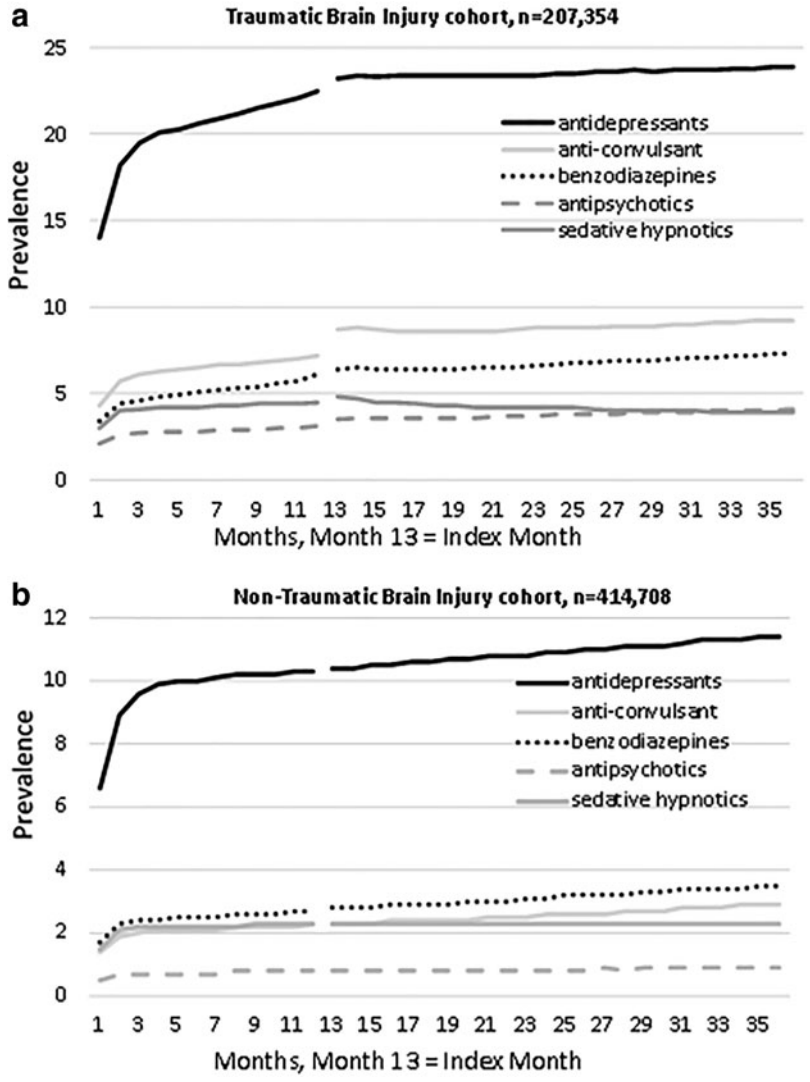

FIG. 1. Average monthly prevalence of psychotropic medication use.

Table 3. Parameter Estimates[a] for Time Trends in Psychotropic Medication Use among Individuals with and without Traumatic Brain Injury (TBI) before and after Index Date, $N = 622{,}062$

	TBI	*No-TBI*	*TBI*	*No-TBI*
	12 Months pre-index	*12 Months pre-index*	*24 Months post-index*	*24 Months post-index*
Antidepressants	0.30, $p < 0.001$	0.07, $p < 0.001$	0.03, $p < 0.001$	0.04, $p < 0.001$
Anticonvulsants	0.11, $p < 0.001$	0.03, $p < 0.001$	0.03, $p < 0.001$	0.03, $p < 0.001$
Benzodiazepines	0.14, $p < 0.001$	0.03, $p < 0.001$	0.03, $p < 0.001$	0.03, $p < 0.001$
Antipsychotics	0.04, $p < 0.001$	0.02, $p < 0.001$	0.02, $p < 0.001$	0.006, $p < 0.001$
Sedative hypnotics	0.04, $p < 0.001$	0.01, $p < 0.001$	-0.03, $p < 0.001$	NA[b]

[a]From linear first-order autoregressive model.
[b]No change over 24 months.

(Table 4). Use of antidepressants increased slightly but significantly (RtR 1.01; 95% CI 1.00, 1.01, $p < 0.001$). Use of sedative hypnotics decreased (RtR 0.94; 95% CI 0.93, 0.94).

Discussion

In this large national analysis and relative to non-TBI controls, the prevalence of psychotropic medication use was more than twice as high among individuals with TBI, with antidepressants being the most common medications. Further, relative to non-TBI controls, individuals with TBI had different patterns of psychotropic medication use both before and after TBI. Even accounting for group differences and the increasing trend of psychotropic medication use, usage of most psychotropic medications increased slightly following TBI.

Patterns of psychotropic medication use differed between the TBI and non-TBI cohort in three important ways. First, regardless of when it was measured, psychotropic medication use was higher in the TBI cohort than in the non-TBI cohort. This makes intuitive sense because the prevalence of NPD is higher among individuals with TBI.[8] Second, although psychotropic use increased in both cohorts over the months prior to the index date, the rate of increase was faster in the TBI cohort for all psychotropics. Finally, and notably, the monthly rate of increase in psychotropic use slowed significantly following TBI, whereas in the non-TBI cohort the monthly rates of psychotropic use remained essentially unchanged post-index date. We have previously reported that monthly incidence rates of depression and other NPD following TBI remained elevated compared with non-TBI rates, even up to 24 months post-injury, suggesting that more people need treatment but fewer are receiving it.[8,10,13] This interpretation is supported by previous studies that have found decreased antidepressant treatment of depression following TBI.[14]

A sharp increase in antidepressant use was noted in the months leading up to TBI. There were also slower but significant increases in use of other psychotropic medications that were four times higher than in the non-TBI cohort during the same period. Increasing psychotropic use leading up to TBI was also observed in a study of Medicare beneficiaries hospitalized with TBI.[13] Prior studies have reported that psychotropic medications, and particularly antidepressants, are risk factors for falls in older adults, and our results suggest that examination of this association in younger populations may be warranted.[20–22]

Although antidepressant use did not increase following TBI when compared with the pre-TBI period, and accounting for differences over time, other psychotropic medication use did increase. In fact, significant increases in use of anxiolytics, antipsychotics, and mood stabilizers were observed. This suggests that new NPD following TBI are being treated with medications other than antidepressants. Another interesting finding is that after accounting for group differences and the time trend, sedative hypnotic use decreased following TBI, even though sleep disturbances are known to increase during this same period.[23,24] A rapidly expanding body of research highlights the importance of sleep to recovery from TBI, and suggests that sleep disturbances are key treatment targets within TBI populations.[23,24]

Strengths of this study include a large national sample of individuals with TBI, detailed longitudinal drug information, and a non-TBI comparison group. Our DID analysis controlled for differences in psychotropic medication use between the TBI and non-TBI

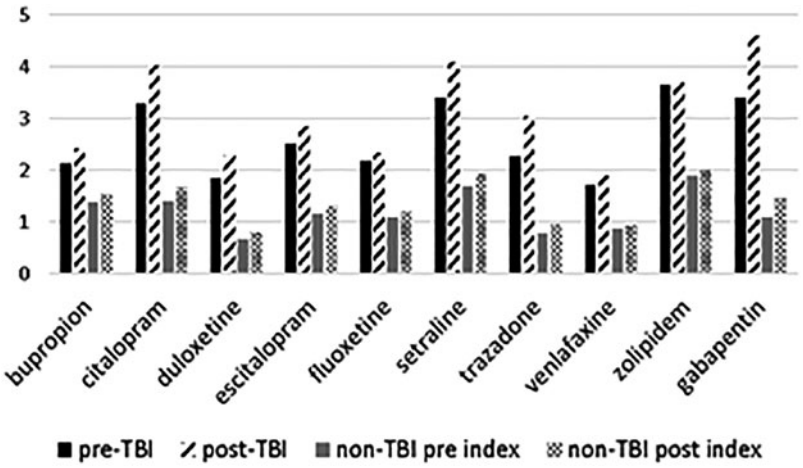

FIG. 2. Average monthly prevalence of the most commonly used psychotropic Medications, by pre/post and traumatic brain injury status.

Table 4. Rate Ratios (95% Confidence Intervals) of the Association between Traumatic Brain Injury (TBI) and Psychotropic Medication Use before and after Index Date, $N = 622{,}062$

	Unadjusted[a]	*Adjusted*[b]
Antidepressants		
TBI vs. non-TBI cohort pre-index	2.09 (2.08, 2.10)	1.15 (1.14, 1.15)
Post vs. pre-index in non-TBI cohort	1.13 (1.12, 1.13)	1.07 (1.07, 1.07)
Post-index in TBI cohort (DID)	1.03 (1.03, 1.04)	1.01 (1.00, 1.01)[c]
Antipsychotics		
TBI vs. non-TBI cohort pre-index	3.88 (3.83, 3.93)	1.37 (1.36, 1.39)
Post vs. pre-index in non-TBI cohort	1.15 (1.15, 1.16)	1.11 (1.11, 1.12)
Post-index in TBI cohort (DID)	1.17 (1.16, 1.18)	1.08 (1.07, 1.09)
Anxiolytics		
TBI vs. Non-TBI cohort pre-index	2.40 (2.36, 2.44)	1.17 (1.15, 1.19)
Post vs. pre-index in non-TBI cohort	1.09 (1.08, 1.10)	1.01 (1.00, 1.02)[d]
Post-index in TBI cohort (DID)	1.09 (1.08, 1.10)	1.05 (1.04, 1.06)
Mood stabilizers		
TBI vs. non-TBI cohort pre-index	3.24 (3.19, 3.28)	1.77 (1.75, 1.80)
Post vs. pre-index in non-TBI cohort	1.11 (1.11, 1.12)	1.11 (1.10, 1.11)
Post-index in TBI cohort (DID)	1.07 (1.06, 1.08)	1.05 (1.05, 1.06)
TBI vs. non-TBI cohort pre-index	2.05 (2.03, 2.06)	1.17 (1.16, 1.18)
Post vs. pre-index in non-TBI cohort	1.27 (1.26, 1.27)	1.16 (1.16, 1.17)
Post-index in TBI cohort (DID)	1.06 (1.06, 1.07)	1.02 (1.02, 1.03)
Sedative hypnotics		
TBI vs. non-TBI cohort pre-index	1.93 (1.92, 1.95)	1.25 (1.24, 1.26)
Post vs. pre-index in non-TBI cohort	1.06 (1.06, 1.07)	0.97 (0.97, 0.97)
Post-index in TBI cohort (DID)	0.95 (0.94, 0.95)	0.94 (0.93, 0.94)
Anticonvulsants		
TBI vs. non-TBI cohort pre-index	3.11 (3.09, 3.13)	1.81 (1.79, 1.82)
Post vs. pre-index in non-TBI cohort	1.25 (1.25, 1.26)	1.07 (1.07, 1.07)
Post-index in TBI cohort (DID)	1.10 (1.10, 1.11)	1.00 (0.99, 1.01)[e]

[a]Adjusted for index date.
[b]Adjusted for age, sex, race, census region, Medicare coverage, Alzheimer's disease, anemia, arthritis, chronic pulmonary disease, diabetes, heart failure, hyperlipidemia, ischemic heart disease, ischemic stroke, hypertension, kidney disease, liver disease, and the following neuropsychiatric disorders pre- and post-TBI: depression, anxiety, substance dependence, alcohol dependence, bipolar disorder, schizophrenia, and other psychoses.
[c]$p < 0.001$; [d]$p = 0.07$; [e]$p = 0.95$.
DID, difference-in-differences.

cohorts as well as pre-index date, in addition to potential confounding variables including multiple NPD diagnoses. We were thus able to estimate the impact of TBI on psychotropic medication use in the TBI cohort. Further, this analysis is the first to examine patterns of psychotropic medication use in a commercially insured and MA population. At the same time, results must be interpreted in light of limitations to our study design. Most important, we were unable to determine the clinical indication for the observed medication fills. This is especially important for some of the medications we examined such as gabapentin, which has multiple indications and has recently been used for sleep difficulties.[25] As is standard practice in pharmacoepidemiology, we used prescription fills as a proxy for medication use.[26,27] Claims data do not contain information on medication use, but filled prescriptions have been shown to correlate well with self-reported medication use.[26–29] Although information on dosage and duration is available in claims data, we chose not to examine these variables, because of the already complex and detailed analysis. Compared with individuals without TBI, those with TBI were older, more likely to be female, and had a higher burden of comorbid illness. Although these differences likely exaggerated the differences in psychotropic medication use between cohorts, results from our DID models would not be affected. Data for this study were derived from commercial insurance and MA claims; therefore, results may not generalize to other important populations such as individuals receiving Medicaid or veterans benefits. Finally, we were unable to assess mechanisms or severity of TBI, history of TBI, and other important clinical characteristics of injury and were missing information on comorbidities that may have been associated with psychotropic medication use, such as seizure disorder.

Results from this study suggest several avenues for future research. First, the rapid rate of increase in psychotropic use (more than three times higher than in non-TBI controls) during the months preceding TBI requires further investigation. Claims data do not provide indications for medication use, but newly diagnosed NPD, increased NPD severity, or an acute health event could have spurred the increase in rates. Therefore, examining rates of NPD and other diagnoses and events such as hospitalizations during the months preceding TBI would increase understanding of drivers of the observed psychotropic medication use. Next, the significantly lower rate of use after TBI is important from a clinical standpoint, especially given the increase in incidence of NPD after TBI.[5–7] Finally, although psychotropic medication use has been reported to be a risk factor for falls and fractures among older adults, results from our study suggest that this association should be investigated in younger populations.[20–22] Future research should also seek to understand whether sleep disturbances are under-recognized post-TBI or whether non-pharmacological approaches are being employed, consistent with recommended clinical practice.[23,24]

Conclusion

In conclusion, psychotropic medication use was more than double among individuals with TBI compared with non-TBI controls, with antidepressants being the most common medications. Patterns of psychotropic medication use differed significantly between individuals with and those without TBI. These results suggest that a better understanding of events leading up to and following TBI is needed to elucidate the role that psychotropic medications play in the natural history of TBI.

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Author Disclosure Statement

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Supplementary Material

Supplementary Appendix

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