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Association between migraine and suicidal behaviors: a nationwide study in the U.S.A

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Abstract

Background—Recent studies show migraineurs are at an increased risk of developing suicidal behaviors, even after controlling for comorbid depression. However, previous research has not examined the impact of psychiatric mood disorders on suicidal behaviors in migraineurs within a nationally representative sample.

Objective—A cross-sectional study was used to investigate the association between migraine and suicidal behaviors and determine whether psychiatric comorbidities modify this association in a nationwide inpatient cohort.

Methods—We analyzed the Nationwide Inpatient Sample of hospitalizations compiled from USA billing data. Migraine, suicidal behaviors, and psychiatric disorders were identified based on the International Classification of Diseases, 9th Revision, Clinical Modification diagnosis codes from hospitalization discharges (2007–2012). Weighted national estimates were used to estimate odds ratios (OR) and 95% confidence intervals (CI).

Results—156,172,826 hospitalizations were included, of which 1.4% had a migraine diagnosis and 1.6% had a diagnosis of suicidal behavior. Migraineurs had a 2.07-fold increased odds of suicidal behaviors (95%CI: 1.96–2.19) compared with non-migraineurs. We repeated analyses after stratifying by depression, anxiety, or posttraumatic stress disorder (PTSD). Among hospitalizations with depression, migraine was associated with a 20% reduced odds of suicidal behaviors (95%CI: 0.76–0.85). Among hospitalizations without depression, migraine was associated with 2.35-fold increased odds of suicidal behaviors (95%CI: 2.20–2.51). In stratified analyses, we noted that among hospitalizations with anxiety, migraineurs had slightly increased odds of suicidal behaviors (OR: 1.07, 95%CI: 1.02–1.13). Among hospitalizations without anxiety, migraine was associated with a 2.06-fold increased odds of suicidal behaviors (95%CI: 1.94–2.20). Similarly, in analyses stratified by PTSD, migraine was not associated with an increased risk of suicidal behaviors (OR: 1.00, 95%CI: 0.94–1.07) among those with PTSD.

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However, the odds of suicidal behaviors were increased among hospitalizations without PTSD (OR: 1.95, 95%CI: 1.84–2.08).

Conclusion—Chronic conditions that do not affect the current hospitalization may not have been reported. The presence of psychiatric diagnoses influences associations of suicidal behaviors with migraine in a national inpatient sample. Migraineurs with diagnosed comorbid psychiatric disorders may be receiving care that mitigates their risk for suicidal behaviors.

Keywords

migraine; suicidal behaviors; posttraumatic stress disorder; depression; anxiety

Introduction

Migraine affects approximately 12% of the general population[1, 2]. An extensive body of literature has demonstrated that migraine is comorbid with several psychiatric disorders including depression, anxiety, and posttraumatic stress disorder (PTSD)[3–6]. Further, recent data support that even after controlling for comorbid depression, migraineurs are at an increased risk of developing suicidal behaviors[7, 8]. Suicidal behaviors include suicidal ideation, suicide plans, and suicidal attempts[9]. The strongest predictors of completed suicide include depression and suicidal behaviors[10, 11]. Thus, examining individuals more likely to exhibit suicidal behaviors is important for identifying those at highest risk of suicide. Further, targeted interventions to prevent suicide should focus on those most likely to develop suicidal behaviors.

While two studies have examined suicide in migraineurs[12, 13], few studies have examined suicidal behaviors (e.g. suicidal ideation, suicide attempts). All of these studies have been relatively small or examined the association in targeted populations, i.e. pregnant women[14], adolescents[15–17] and young adults[4, 18]. Previous cohorts have included clinic[14] and community based[4, 15, 16, 18] samples. To our knowledge, the only previous nationally-representative population based study was done in a population of adolescents[17]. None have examined the association among a nationally representative adult hospital inpatient database sample or the impact of psychiatric mood disorders on the risk of suicidal behaviors in those with migraine. Therefore, our study was designed to examine the association between migraine and suicidal behaviors and the impact of comorbid mood (depression, anxiety) and stress (PTSD) disorders on this association among a nationally representative sample of adult inpatients from 2007 to 2012 in the USA.

Methods

Study Sample

Our study included adult participants, 18 years of age or older, with hospital discharges in 2007–2012 from the Nationwide Inpatient Sample (NIS) database. The NIS is a database of hospital inpatient stays compiled from billing data across the USA as part of the Healthcare Cost and Utilization Project (HCUP). The HCUP is the largest inpatient healthcare utilization database in the USA and includes approximately 20% of discharges from all nonfederal, acute care hospitals. All hospitals participating in HCUP are included in the

sample. Hospital characteristics, including geographic region, ownership, location, teaching status, and bed size, were used for weighting to account for the survey structure and to create a sample that is representative of U.S. hospital admissions[19, 20].

Standard Protocol Approvals, Registrations, and Patient Consents

As the NIS data are publicly available and do not contain personal identifiers, this study was exempt from review by the Office of Human Research Administration at the Harvard T.H. Chan School of Public Health, Boston, MA.

Demographic Characteristics

Sociodemographic variables including age, sex, race, median household income quartiles, length of stay, and total hospital charges were evaluated. Smoking was identified using International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) diagnosis codes (305.1X, 649.0X, and V15.82).

Migraine

Adult onset migraine diagnoses were based on the ICD-9-CM diagnosis codes (346. XX). Hospitalizations without migraine were composed of hospitalizations without a diagnosis of migraine (ICD-9-CM: 346.XX), tension-type headache (ICD-9-CM: 307.81), and headache (ICD-9-CM: 784.0X and 339.XX)[21].

Suicidal behaviors

Suicidal behaviors were characterized based on ICD-9-CM diagnosis codes and were used to identify hospitalizations with suicidal behaviors, including suicidal ideation (V62.84) and suicide and self-inflicted injury (E950.XX-E959.XX). We did not utilize datasets prior to 2007 as the diagnosis code for suicidal ideation were not used prior to October 2005.

Psychiatric disorders

ICD-9-CM diagnosis codes were used to diagnose psychiatric disorders, including non-psychotic depression (296.82, 301.12, 309.28, 296.2X, 296.3X, 300.4X, 309.0X, 309.1X, 311.XX), anxiety (300.00, 300.01, 300.02, 300.21, 300.22, 300.23, 300.29, 309.21, 300.81, 300.2X, 300.3X, 300.7X, 308.2X, 308.3X), posttraumatic stress disorder (PTSD; 309.81), alcohol or substance abuse (291.XX, 292.XX, 303.XX, 304.XX, 305.XX, 648.3X, 655.5X, 965.0X, V65.42), psychosis (295.XX, 296.XX, 297.XX, 298.XX), and any psychiatric disorder from NIS hospitalization records[22] (Supplementary Table 1).

Statistical Analysis

Our primary unit of analysis was per hospitalization. Repeated hospital discharges are not linked in the NIS database, therefore a patient who was admitted to the hospital multiple times in one year would be counted each time as a separate hospitalization. In all analyses, we used discharge-level sampling weights based on the sampling scheme and provided by the datasets to report national estimates from all USA community hospitals. Adjusted discharge-level sampling weights were applied to each year and the estimates for each year were then merged. We compared the distributions of sociodemographic, psychiatric

characteristics, and hospital characteristics between hospitalizations with and without migraine by performing Wald Chi-square and *t*-tests. We calculated odds ratios (ORs) and 95% confidence intervals (CIs) using multivariable logistic regressions. We also calculated adjusted ORs and 95% CIs with *a priori* confounders including age (continuous), race/ethnicity, median household income quartiles for patient zip code, hospital region (Northeast, Midwest, South, West), hospital location (rural or urban), year, and age-adjusted Charlson Comorbidity Index, which assigns disease weights. Diseases with a weight of one include myocardial infarction, congestive heart failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic pulmonary disease, ulcer disease, mild liver disease, and diabetes, and diseases with a weight of 2 include diabetes with end organ damage, any tumor, leukemia, and lymphoma. Moderate or severe liver disease has a weight of three, and metastatic solid tumor and AIDS have a weight of six. All variables had < 5% missing data except for race/ethnicity. We created missing indicator variables to address missing data for race/ethnicity and median household income quartiles. Total hospitalization charges were adjusted for inflation to reflect 2012 US dollars[23]. An age-unadjusted Charlson Comorbidity Index was calculated by adding separate disease weights, with a Charlson Comorbidity Index score of 0 as the lowest risk attributable to comorbid disease. For calculating an age-adjusted Charlson Comorbid Index, a patient aged ≤ 40 years old is assumed to have the lowest risk of comorbid death attributable to age and each decade of age over 40 adds 1 point to risk (e.g. 50–59 years, 1 point; 60–69 years, 2 points; 70–79 years, 3 points). These points for age are added to the score from the age-adjusted Charlson Comorbidity Index (e.g., 0, 1, 2, 3, etc.)[24–26]. Prior studies have reported migraine is modified by age[27] and sex[28]. Given this, we repeated the primary analysis stratifying by age categories (<50 vs. ≥50 years old) and sex (male vs. female; Supplementary Table 3). Given previous studies have shown psychiatric comorbidities modify the association between migraine and suicidal behaviors[3–7], we repeated the analyses after stratifying participants according to depression, anxiety, or PTSD, respectively. We performed analyses for suicidal ideation and suicide and self-inflicted injury separately and the associations of migraine with suicidal ideation/suicide and self-inflicted injury were similar (data not shown).

All analyses were conducted using SAS 9.4 (SAS Institute, Cary, NC, USA) and SAS-callable SUDAAN software (version 11.0.1, RTI International, Research Triangle, NC, USA). Statistical significance was set at two-sided $P<0.05$. Computations were run on the Odyssey cluster supported by the Faculty of Arts & Sciences Division of Science, Research Computing Group at Harvard University.

Results

Sociodemographics are presented in Table 1 and hospital characteristics in Supplementary Table 2. A total of 156,172,826 hospitalizations with a mean age of 57.2 years (Standard Error, SE = 0.1 years) were included. The majority of hospitalizations were female (59.9%), 50 years of age or older (63.7%), and had a self-identified race of white (57.4%). A total of 11.5% of hospitalizations had non-psychotic depression, 4.9% had anxiety, and 0.54% had PTSD. The majority of hospitalizations (63.8%) had 2 or more comorbidities as measured by the age-adjusted Charlson Comorbidity Index. 1.4% of all hospitalizations had migraine. As compared to those without migraine, migraineurs were more likely to be less than 50

years old, female, smokers, and self-identify as white (P<0.0001). Migraineurs were also more likely to have depression, anxiety, or PTSD (P<0.0001) than those without migraine. Those with migraine were more likely to have ≥2 comorbid conditions than non-migraineurs (P<0.0001; Table 1).

Hospitalizations with migraine had statistically significantly increased odds of suicidal behaviors (OR: 2.69; 95%CI: 2.55–2.86; Table 2). After adjusting for confounders (including age, sex, race, median household income quartiles for patient zip code, hospital location, hospital region, year, and age-adjusted Charlson Comorbidity Index), migraineurs had a 2.07-fold increased odds of suicidal behaviors (95%CI: 1.96–2.19; Table 2). Compared to non-migraineurs, migraineurs less than 50 years old had a 2.01-fold increased odds of suicidal behaviors (95%CI: 1.91–2.12), and migraineurs ≥ 50 years old had a 1.66-fold increased odds of suicidal behaviors (95%CI: 1.52–1.80; Supplementary Table 3). Among women, the association followed a similar pattern (migraineurs <50 years: OR: 2.25, 95%CI: 2.13–2.37; migraineurs ≥50 years: OR: 1.60, 95%CI: 1.48–1.72). Among men, migraineurs <50 years had 1.20-fold increased odds of suicidal behaviors (95%CI: 1.10–1.30), and older migraineurs had a 1.68-fold increased odds of suicidal behaviors compared to non-migraineurs (95%CI: 1.43–1.98; Supplementary Table 3).

We repeated the analyses after stratifying hospitalizations according to depression, anxiety, or PTSD, respectively (Table 2). In a stratified analysis among hospitalizations with depression, migraineurs had 20% reduced odds of suicidal behaviors after adjusting for confounders (OR: 0.80, 95%CI: 0.76–0.85). Among those without depression, migraineurs had a 2.35-fold increased odds of comorbid suicidal behaviors (95%CI: 2.20–2.51) after adjusting for sociodemographic characteristics and comorbidities. In a stratified analysis, we noted that among hospitalizations with diagnosed anxiety, migraineurs had 1.07-fold increased odds of suicidal behaviors after adjusting for confounders (95%CI: 1.02–1.13). Among those without anxiety, migraineurs had a 2.06-fold increased odds of comorbid suicidal behaviors (95%CI: 1.94–2.20) after adjusting for confounders. Similarly, in analyses stratified by PTSD status, migraine was not associated with suicidal behaviors (OR: 1.00, 95%CI: 0.94–1.07) among hospitalizations with diagnosed PTSD. However, among hospitalizations without a diagnosis of PTSD, migraine was associated with a 1.95-fold increased odds of suicidal behaviors (95%CI: 1.84–2.08; Table 2).

Discussion

In our study, migraineurs are significantly more likely to have psychiatric disorders, including depression, anxiety, and PTSD than those without migraine. Compared to hospitalizations without migraine, migraineurs had a 2.07-fold increased odds of suicidal behaviors (95%CI: 1.96–2.19). This is comparable to previous studies on the association between migraine and suicidal behaviors, including suicidal ideation and suicide attempts. A recent meta-analysis of 148,977 participants from six studies evaluating the association between migraine and suicidal ideation found a 31% increased odds of suicidal ideation among migraineurs (95%CI: 1.10–1.55) compared with non-migraineurs[7]. In a large Health Maintenance Organization in Michigan, Breslau *et al.* found 2.7-fold increased odds of suicide attempts among participants with migraine and *without* major depression (migraine

without aura: OR: 2.7, 95%CI: 0.7–9.5; migraine with aura: OR: 4.3, 95%CI: 1.2–15.7). Among participants *with* both migraine and major depression, there was an association between migraine and suicide attempts (migraine without aura: OR: 10.9, 95%CI: 3.1–38.6; migraine with aura: OR: 23.2, 95%CI: 8.4–63.8)[18]. In a subsequent longitudinal study, Breslau *et al.* found a 4.43-fold increased odds of suicide attempts among migraineurs as compared to those with no headache history (95%CI: 1.93–10.2)[29].

Our study used ICD-9-CM diagnosis codes to identify hospitalizations with suicidal behaviors. Two previous studies used ICD diagnosis codes to investigate the association between migraine and suicidal behaviors and found similar results. Singhal *et al.* examined associations between chronic illnesses and self-harm (ICD-9 codes E950–E959 and ICD-10 codes X60–X64, X66–X84) and a certified cause of death from suicide (ICD-9 codes 9 E950–E959 and ICD-10 X60–X84). Specifically, among migraineurs there was a reported increased risk of self-harm (rate ratio [RR]: 1.8, 95%CI: 1.7–1.8) and death from suicide (RR: 1.3, 95%CI: 1.0–1.8)[13]. Similarly, Ilgen *et al.* showed an association between migraine and suicide death after controlling for comorbid psychiatric disorders (hazard ratio: 1.34, 99%CI: 1.02–1.77)[12]. Taken together, migraineurs have an increased risk of suicidal behaviors.

In separate analyses performed within strata defined by psychiatric diagnosis, migraineurs without diagnosed depression, anxiety, or PTSD had increased odds of suicidal behaviors (Table 2). Conversely, migraineurs with depression, anxiety, or PTSD diagnoses had reduced or similar odds of suicidal behaviors compared to non-migraineurs with comorbid psychiatric disorder. It is also possible that migraineurs with diagnosed comorbid psychiatric disorders are receiving additional care that may mitigate their risk for suicidal behaviors. In a longitudinal cohort study among migraineurs, a decrease in headache frequency and intensity was associated with decreased depression symptoms after prophylactic treatment[30]. Comorbid anxiety and depression do not influence the medications taken by migraineurs; however, they do influence perceived treatment efficacy and satisfaction[31]. Antidepressant medications have also been shown to be effective in treating migraine and depressive symptoms concurrently, as well as migraine with concurrent anxiety[32, 33]. Migraine chronicity and previously diagnosed disorders may also effect whether individuals sought out medicine or other treatment options and may influence the effects that we see in participants with comorbid depression, anxiety or PTSD. Psychological factors, including anxiety, depression, and anger may also influence headache development, headache pain intensity, and response to treatments[34]. In a study of Brazilian women, migraineurs were more likely to report widespread chronic pain. Additionally, women with either depression or chronic migraines were more likely to report lower scores on the health-related quality of life index[35]. It has also been suggested that although migraine and depression are distinct disorders, migraineurs with comorbid depression may be a genetically unique subset of patients[36]. Patients with more severe depression are at an increased risk of chronic migraine onset. Among participants in the American Migraine Prevalence and Prevention (AMPP) study, the risk of transformation from episodic to chronic migraine increased in a dose-dependent way with depression severity[37]. Additionally, previous studies show that untreated migraines may hinder the remission of depression. In a longitudinal study of

patients with depression and no pharmacotherapy, comorbid migraine was associated with significantly more anxiety and somatic symptoms, and lower remission rates[38].

The strengths of our study include the use of a large sample size and a nationally-representative population. Despite these strengths, our study has limitations. Suicidal behaviors were classified based on hospital administrative codes; therefore, we cannot distinguish between suicidal ideation, suicidal attempts, and non-suicidal self-inflicted injuries. This may potentially lead to misclassification of suicidal behaviors. Additionally, the use of hospital administrative codes lacks temporal information about these diagnoses and relevant clinical context. ICD-9 codes are collected for billing purposes and rely on accurate discharge coding of medical conditions. Baseline chronic conditions may not be reported if they do not affect current care or reasons for hospitalization, which would result in underestimations of the prevalence of suicidal behaviors and comorbid mood and stress disorders. The under diagnosis of chronic conditions, including migraine, is likely to be non-differential between groups and lead to an attenuation of reported odds ratios towards the null[39]. Furthermore, we did not distinguish between migraine sub-types (with aura vs. without aura), as the coding error for migraine subtypes is higher than the error for migraine[40]. Chronic migraineurs report significantly more emergency department visits and hospitalizations than episodic migraineurs in some studies[41] but not all[42, 43]. Suicidal behaviors among individuals with migraine with aura are consistently higher compared to migraine without aura patients[4, 15, 16, 18, 29]. Suicidal behaviors are most likely underreported due to stigmas associated with psychiatric conditions, which may make our estimates of the comorbidity of migraine and suicidal behaviors more conservative. Our study also may have unmeasured confounding associated with additional risk factors for suicidal behaviors that were not investigated. For example, physical pain conditions, including musculoskeletal, arthritis, fibromyalgia, abdominal, and pelvic pains have previously been associated with suicidal behaviors[44, 45]. Lastly, our use of a cohort of adult hospital inpatients warrants caution when generalizing to community based populations.

Conclusions

Overall, migraine diagnosis was associated with increased odds of suicidal behaviors in a national inpatient sample. However, when analyses were performed within strata defined by psychiatric diagnosis, associations of migraine with suicidal behaviors were inverse or null among those with a diagnosis of depression, anxiety, or PTSD, respectively. It is possible that migraineurs with diagnosed comorbid psychiatric disorders are receiving care, including medication or therapy, that mitigates their risk for suicidal behaviors. Our study identifies high risk populations for suicidal behaviors, which should be further investigated for appropriate screening measures and targeted interventions. Future studies are needed to investigate the effects of comorbid psychiatric disorders, including depression, anxiety, and PTSD, on the association between migraine and suicidal behaviors. Our study highlights the importance of routine hospital screening and expanded research into treatment options for these comorbid conditions.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations

OR	Odds Ratio
CI	Confidence Interval
PTSD	Posttraumatic Stress Disorder
NIS	Nationwide Inpatient Sample
HCUP	Healthcare Cost and Utilization Project
ICD-9-CM	International Classification of Diseases, 9th Revision, Clinical Modification
SE	Standard Error

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Table 1

Baseline characteristics of participants with and without migraine-related hospitalizations (N = 156,172,826)

Characteristics	All participants (N = 156,172,826)		With migraine (N = 2,190,305)		Without migraine (N = 153,982,521)		*P*-value
	N	%	N	%	N	%	
Demographics							
Age, mean (SE), years	57.2 (0.1)		47.0 (0.1)		57.3 (0.1)		<0.0001
Age categories, years							
< 50	56,578,582	36.2	1,269,024	57.9	55,309,559	35.9	<0.0001
≥ 50	99,594,244	63.7	921,281	42.1	98,672,963	64.1	
Sex							
Male	62,465,446	40.0	373,006	17.0	62,092,440	40.3	<0.0001
Female	93,512,367	59.9	1,816,284	82.9	91,696,083	59.5	
Race							
White	89,598,207	57.4	1,395,081	63.7	88,203,126	57.3	<0.0001
Black	18,675,063	12.0	213,962	9.8	18,461,101	12.0	
Hispanic	13,908,300	8.9	143,848	6.6	13,764,452	8.9	
Asian or Pacific Islander	3,120,840	2.0	19,929	0.9	3,100,910	2.0	
Native American	922,436	0.6	10,739	0.5	911,697	0.6	
Other	4,022,803	2.6	41,305	1.9	3,981,498	2.6	
Missing	25,925,177	16.6	365,440	16.7	25,559,736	16.6	
Median household income quartiles for patient zip code							
Quartile 1 (poorest)	44,037,915	28.2	534,928	24.4	43,502,988	28.3	<0.0001
Quartile 2	39,654,825	25.4	547,897	25.0	39,106,927	25.4	
Quartile 3	36,250,515	23.2	550,247	25.1	35,700,268	23.2	
Quartile 4 (wealthiest)	32,217,473	20.6	509,402	23.3	31,708,071	20.6	
Missing	4,012,098	2.6	47,830	2.2	3,964,268	2.6	
Smoking	20,570,488	13.2	416,147	19.0	20,154,342	13.1	<0.0001
Length of stay, mean (SE), day	4.7 (0.02)		3.9 (0.03)		4.7 (0.02)		<0.0001
Psychiatric Characteristics							

Characteristics	All participants (N = 156,172,826)		With migraine (N = 2,190,305)		Without migraine (N = 153,982,521)		*P*-value
	N	%	N	%	N	%	
Non-psychotic depression	17,961,784	11.5	611,861	27.9	17,349,923	11.3	<0.0001
PTSD	840,338	0.54	54,429	2.4	785,909	0.51	<0.0001
Anxiety	7,670,389	4.9	276,417	12.6	7,393,972	4.8	<0.0001
Alcohol or substance abuse	27,493,377	17.6	532,712	24.3	26,960,665	17.5	<0.0001
Psychosis	11,106,021	7.1	325,802	14.9	10,780,219	7.0	<0.0001
Any psychiatric disorder	48,238,790	30.9	1,164,806	53.2	47,073,984	30.6	<0.0001
Age-adjusted Charlson Comorbidity Index							
0	40,306,974	25.8	757,824	34.6	39,549,150	25.7	<0.0001
1	16,262,416	10.4	532,438	24.3	15,729,978	10.2	
≥2	99,603,436	63.8	900,042	41.1	98,703,393	64.1	

Rounded components may not add up to the rounded sum due to weighting and rounding.
Percentages may not add up to 100% due to rounding, or missing data.

Abbreviations: SE, standard error; PTSD, Posttraumatic stress disorder

Table 2

Association between migraine and suicidal behaviors by psychiatric disorder status (N = 156,172,826)

Suicidal behaviors	With migraine (N = 2,190,305)	Without migraine (N = 153,982,521)	OR (95% CI)	
			Unadjusted	Adjusted[a]
No suicidal behavior	2,097,808	151,505,167	Reference	Reference
Suicidal behavior	92,497	2,477,354	2.69 (2.55, 2.86)	2.07 (1.96, 2.19)
Stratified by depression				
With depression (N = 17,961,785)				
No suicidal behavior	556,429	15,962,426	Reference	Reference
Suicidal behavior	55,433	1,387,497	1.15 (1.08, 1.21)	0.80 (0.76, 0.85)
Without depression (N = 138,211,041)				
No suicidal behavior	1,541,379	135,542,741	Reference	Reference
Suicidal behavior	37,064	1,089,857	2.99 (2.80, 3.20)	2.35 (2.20, 2.51)
Stratified by anxiety				
With anxiety (N = 7,670,390)				
No suicidal behavior	255,719	7,061,486	Reference	Reference
Suicidal behavior	20,698	332,487	1.72 (1.63, 1.82)	1.07 (1.02, 1.13)
Without anxiety (N = 148,502,437)				
No suicidal behavior	1,842,089	144,443,681	Reference	Reference
Suicidal behavior	71,799	2,144,868	2.63 (2.46, 2.80)	2.06 (1.94, 2.20)
Stratified by PTSD				
With PTSD (N = 840,339)				
No suicidal behavior	40,500	608,209	Reference	Reference
Suicidal behavior	13,929	177,701	1.18 (1.11, 1.25)	1.00 (0.94, 1.07)
Without PTSD (N = 155,332,488)				
No suicidal behavior	2,057,308	150,896,959	Reference	Reference
Suicidal behavior	78,568	2,299,653	2.51 (2.36, 2.67)	1.95 (1.84, 2.08)

Individual cell counts may not add up to the global cell counts because of rounding and the differences arising from variance computations when using the discharge weights. Percentages may not add up to 100% due to rounding, missing data, or data falling into categories too small to report.

Abbreviations: OR, odds ratio; CI, confidence interval; PTSD, Posttraumatic stress disorder

[a]Adjusted for age (continuous), sex, race, median household income quartiles for patient zip code, hospital location, hospital region, year, and age-adjusted Charlson Comorbidity Index.