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Economic Burden of Commercially Insured Patients With Major Depressive Disorder and Acute Suicidal Ideation or Behavior in the United States

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ABSTRACT

Objective: Suicidal ideation or behavior (SIB) is a symptom of major depressive disorder (MDD). This study evaluated health care resource utilization (HRU) and costs of commercially insured adults who had diagnosed MDD with acute SIB (MDSI).

Methods: Adults with MDSI (index date: first SIB claim) and controls without MDD or suicide-related claims (random index date) were identified using *International Classification of Diseases, Clinical Modification, 10th Revision* codes in the OptumHealth Care Solutions, Inc. database (October 2014 to March 2017). Adults with < 12 months of plan enrollment pre-index and/or selected psychiatric comorbidities were excluded. MDSI and control cohorts were matched 1:1 on demographics and comorbidities. HRU and costs were compared between matched cohorts during up to 1 and 12 months post-index (inclusive) using regressions adjusted for baseline costs.

Results: Among patients with MDSI (n = 1,576, mean age = 34 years, 55.6% female), most index events occurred in emergency department (ED; 50.7%) and inpatient (45.2%) settings. The MDSI cohort, compared with the control cohort within 1 and 12 months post-index, respectively, had 157.7 and 28.0 times more inpatient admissions, 16.4 and 5.4 times more ED visits, and 4.9 and 3.2 times more outpatient visits (all $P < .01$). Incremental health care costs per patient per month in the MDSI compared with the control cohort within 1 and 12 months were \$7,839 and \$2,757, respectively (both P values < .01). Inpatient and ED costs constituted 70.6% and 16.5% of the total incremental costs, respectively, within the first month of follow-up.

Conclusions: Among commercially insured adults, MDSI was associated with significant economic burden; inpatient and ED services drove incremental costs of the condition. Further assessment of treatment options for this vulnerable patient population is warranted.

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Major depressive disorder (MDD) is a recurrent psychiatric illness with an estimated 12-month prevalence of 7.8% in 2019.¹ MDD has detrimental consequences on the lives of affected individuals, with approximately 80% of them experiencing difficulties with work, home activities, or social activities as a result of the condition.^{2,3} In 2016, MDD was the second leading condition contributing to years lived with disability and the ninth leading condition contributing to disability-adjusted life-years in the US.⁴

MDD is a risk factor for suicide.⁵ Approximately half of those who attempt suicide have an MDD diagnosis,⁶ and nearly a third of suicide decedents exhibit depressive symptoms.⁷ The risk of suicide attempt is particularly high during major depressive episodes (MDEs): there is a 21-fold increase in the risk of suicide during MDEs relative to periods of remission.⁸ Among adults with an MDE in the past year, based on self-report, 32.1% had suicidal ideation, 11.8% made suicide plans, and 4.3% attempted suicide according to the 2019 National Survey on Drug Use and Health.¹

The national cost of officially reported suicide and suicide attempt was estimated at \$58.4 billion in 2013, and this figure increased to \$93.5 billion after adjusting for suicide event underreporting.⁹ Acute suicidal ideation or behavior (SIB) that accompanies MDD may be associated with a substantial economic burden. However, limited data exist on the health care resource utilization (HRU) and costs of patients diagnosed with MDD and with acute SIB (MDSI). To understand the unmet needs and to improve care for this vulnerable population, an analysis of the economic burden of the condition is warranted. As the majority of the US population (68.0%) has commercial insurance,¹⁰ and SIB has a high prevalence and is increasing rapidly among younger adults,^{1,11-13} our study sought to compare HRU and costs in commercially insured adult employees and family beneficiaries with MDSI versus those without either MDD or SIB.

METHODS

Data Source

The OptumHealth Care Solutions, Inc. insurance claims database was used (data from October 1, 2014, to March 31,

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Clinical Points

- The economic burden of commercially insured patients with major depressive disorder and acute suicidal ideation or behavior (MDSI) is not well documented.
- In this study, patients with MDSI incurred greater health care costs than patients without major depressive disorder; acute care for the suicide-related event drove the incremental costs between cohorts.
- Strategies are needed to identify at-risk patients whose symptoms escalate, as at least in some cases a crisis may be avoided with personalized pharmacologic and non-pharmacologic therapy.

2017). This database contains information on 19.9 million commercially insured beneficiaries nationwide, including claimant demographics, insurance eligibility, and medical and prescription drug claims. Beneficiaries are employees or dependents covered by select Fortune 500 self-insured private payers. The data are available from OptumHealth Care Solutions, Inc., but restrictions apply to the availability of these data, which were used under license for the current study and are not publicly available. The database contains only deidentified information and fully complies with the patient confidentiality requirements of the Health Insurance Portability and Affordability Act (HIPAA). No ethics board review was required.

Study Design

A retrospective matched cohort study design was used. Two cohorts of patients were analyzed: the MDSI cohort and the cohort of patients without either an MDD or an SIB diagnosis (non-MDD cohort).

The study period spanned from October 1, 2014 (12 months before the beginning of the index window), to March 31, 2017 (end of available data). The index window was set to begin on October 1, 2015, the date of the introduction of the *International Classification of Diseases, 10th Revision, Clinical Modification (ICD-10-CM)* coding system, since relative to its predecessor, the *ICD-9-CM* coding system, it permits a more accurate identification of nonfatal suicide attempts and intentional self-harm in claims data.¹⁴ Furthermore, *ICD-9-CM* codes identify SIB events exclusively by external cause codes, but in *ICD-10-CM* some SIB events have diagnosis codes, required by federal mandates for claims reimbursement.¹⁴

For those included in the MDSI cohort, the index date was defined as the date of the first claim with a code for suicide attempt or a code for suicidal ideation. For those included in the non-MDD cohort, the index date was randomly generated to mimic the distribution of time from the study period start to the index date in the MDSI cohort. Patient characteristics were evaluated during the 12-month baseline period preceding the index date. The follow-up period spanned from the index date until the end of continuous eligibility or data availability, and outcomes were described and compared during (1) up to 1 month and (2) up to 12

months of follow-up to evaluate both the short-term/acute and longer-term outcomes associated with the SIB event.

Study Population

Patients were included in the MDSI cohort if they met the following criteria: (1) ≥ 1 claim with a diagnosis of MDD (*ICD-9-CM*: 296.2, 296.3; *ICD-10-CM*: F32 [excluding F32.8], F33 [excluding F33.8]) during the study period (October 1, 2014, to March 31, 2017); (2) ≥ 1 claim with a code for a suicidal ideation or attempt; the latter was defined based on the guidance from the Centers for Disease Control and Prevention,¹⁴ with an added criterion that patients with an intentional self-harm code must have an accompanying suicidal ideation code (*ICD-10-CM*: R45.851) within 30 days (see Table 1 for the list of codes); (3) ≥ 1 claim with a diagnosis of depression (*ICD-9-CM*: 296.2, 296.3, 300.4, 311, 309.0, 309.1; *ICD-10-CM*: F32, F33, F34.1, F43.21) during the baseline period or on the index date. Patients were included in the non-MDD cohort if they had (1) no claims with a diagnosis of MDD and (2) no claims with a code for SIB during the study period.

Besides the aforementioned criteria, patients included in the MDSI and non-MDD cohorts were additionally required to meet the following criteria: (1) no claims with a diagnosis of specific psychiatric comorbidities, including bipolar disorder and related conditions, cluster B personality disorder, dementia, intellectual disability, schizophrenia and other non-mood psychotic disorders, and substance-induced mood disorder (see Supplementary Table 1 for the list of codes); (2) no Medicare coverage during continuous insurance eligibility; (3) ≥ 12 months of continuous insurance eligibility prior to the index date; and (4) 18–64 years of age at the index date. Given the fluidity of mental health diagnoses and shared symptoms across psychiatric conditions, patients with certain psychiatric conditions were excluded from the study to minimize the possibility of MDD misidentification. This study focused on commercially insured adults of working age; private payer costs of adults aged 65 and older may be incomplete due to Medicare's covering service costs.

Outcome Measures

Use of MDD-related therapies and evaluations was reported and included use of antidepressants, antidepressant augmentation therapy (ie, anticonvulsants, buspirone, lithium, psychostimulants, select atypical antipsychotics and thyroid hormones [T₃]), psychotherapy, and psychiatric diagnostic evaluations.

HRU and costs were stratified into all-cause, behavioral and mental health-related, and depression-related. Behavioral and mental health-related HRU and costs were identified based on claims with an *ICD-10-CM* diagnosis between F01 and F99. Depression-related HRU and costs were defined as claims with an *ICD-10-CM* diagnosis code among F32.xx, F33.xx, F34.1x, and F43.21.

The following types of health care services were reported: inpatient, outpatient, emergency department (ED), and other services. Total health care costs consisted of medical

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Table 1. List of Diagnosis Codes Used to Identify Acute Suicidal Ideation or Behavior

Selection Criteria and Description	ICD-10-CM Diagnosis Codes
Suicide attempt	T14.91x
Intentional self-harm ^a	
Intentional self-harm due to all mechanisms other than poisoning and asphyxiation	X71.xx through X83.xx
Self-harm due to poisoning by drugs, medications, and biological substances	T36.xx–T50.xx with the sixth character of the code = 2 (except for T36.9, T37.9, T39.9, T41.4, T42.7, T43.9, T45.9, T47.9, and T49.9, which are included if the fifth character of the code = 2)
Self-harm due to toxic effects of nonmedical substances	T51.xx–T65.xx with the sixth character of the code = 2 (except for T51.9, T52.9, T53.9, T54.9, T56.9, T57.9, T58.0, T58.1, T58.9, T59.9, T60.9, T61.0, T61.1, T61.9, T62.9, T63.9, T64.0, T64.8, and T65.9, which are included if the fifth character of the code = 2)
Self-harm due to asphyxiation, suffocation, hanging	T71.xx with the sixth character of the code = 2
Suicidal ideation	R45.851

^aIntentional self-harm codes must be accompanied by a diagnosis of suicidal ideation (ICD-10-CM: R45.851) within 30 days.
Abbreviation: ICD-10-CM = International Classification of Diseases, 10th Revision, Clinical Modification.

and pharmacy costs; medical costs included inpatient, outpatient, ED, and other services costs. HRU and cost outcomes were reported per patient per month (PPPM). Costs were expressed in 2017 US dollars and were measured from the payer's perspective.

Statistical Analysis

Patients in the MDSI cohort were matched 1:1 to patients in the non-MDD cohort using propensity scores. The propensity score was defined as the probability of being in the MDSI cohort and was estimated for each patient using a logistic regression model with the following baseline characteristics as independent variables: age, sex, year of the index date, geographic region, type of health care plan, and score on the Quan-Charlson Comorbidity Index (Quan-CCI), which provides a composite score of mortality risk calculated using diagnosis codes in claims data.¹⁵ The balance of baseline characteristics between cohorts after matching was assessed with standardized differences (< 10% indicated balance).¹⁶

HRU and cost outcomes during the follow-up period were compared between matched cohorts using regression models adjusted for baseline total health care costs. HRU outcomes were compared using generalized estimating equations (GEEs), to account for matched pairs, with Poisson or binomial distribution. Mean cost differences were estimated using GEEs with normal distribution. Given that cost data do not follow normal distribution (ie, they contain only positive values and a large proportion of zeros), 95% confidence intervals (CIs) and *P* values were obtained from nonparametric bootstrap procedures with 500 replications.

RESULTS

Baseline Characteristics

A total of 1,576 patients were included in the MDSI cohort; all were matched 1:1 to the non-MDD cohort (Supplementary Figure 1). The MDSI and non-MDD cohorts were generally well-balanced on demographic characteristics and Quan-CCI scores after matching (Table 2). In the MDSI cohort, mean age was 33.9 years, and 55.6% of patients were female. Almost all index events (95.9%) were identified in a hospital setting (ED: 50.7%; inpatient: 45.2%),

and 4.1% were identified in an outpatient setting. During the baseline period, relative to non-MDD controls, more patients in the MDSI cohort received psychiatric diagnostic evaluations (28.4% vs 2.6%), psychotherapy (34.7% vs 4.9%), antidepressants (57.8% vs 11.5%), and antidepressant augmentation therapy (26.7% vs 9.1%). Patients in the MDSI cohort exhibited higher total health care costs than those in the non-MDD cohort (mean: \$1,032 vs \$550).

Patients were followed for a mean of 7.8 months after the index date in the MDSI cohort and 8.1 months in the non-MDD cohort.

Health Care Resource Utilization

Within the first month post-index date, patients in the MDSI cohort had 157.7 times more inpatient admissions, 258.5 times more inpatient days, 16.4 times more ED visits, 4.9 times more outpatient visits, and 6.1 times more other visits than matched non-MDD controls (all *P* < .001; Figure 1). The odds of having ≥ 1 all-cause inpatient admission were 472.3 times higher, ≥ 1 ED visit 45.1 times higher, and ≥ 1 outpatient visit 7.1 times higher among patients with MDSI than among controls without MDD (all *P* < .001; Supplementary Figure 2A). There were 145 (9.2%) and 1,127 (71.5%) patients in the MDSI and non-MDD cohorts without any inpatient admissions or outpatient visits, respectively (OR [95% CI] = 0.04 [0.03–0.05], *P* < .001). Similar trends were observed for behavioral and mental health-related HRU and depression-related HRU (Supplementary Table 2).

Within the first 12 months post-index date, patients in the MDSI cohort had 28.0 times more inpatient admissions, 29.7 times more inpatient days, 5.4 times more ED visits, 3.2 times more outpatient visits, and 3.4 times more other visits than matched non-MDD controls (all *P* < .001; Figure 1). Relative to non-MDD controls, patients in the MDSI cohort had 3.6 times higher odds of having ≥ 1 all-cause outpatient visit, 80.2 times higher odds of having ≥ 1 all-cause inpatient admission, and 10.1 times higher odds of having ≥ 1 ED visit (all *P* < .001; Supplementary Figure 2B). There were 69 (4.4%) and 523 (33.2%) patients in the MDSI and non-MDD cohorts without any inpatient admissions or outpatient visits, respectively (OR [95% CI] = 0.10 [0.08–0.13], *P* < .001). These trends were preserved when

Table 2. Baseline^a Demographic and Clinical Characteristics in Matched Cohorts^b

Characteristic	MDSI Cohort (n = 1,576)	Non-MDD Cohort (n = 1,576)	Standardized Difference
Age at index date, ^c mean ± SD [median], y	33.9 ± 14.8 [26.2]	34.5 ± 14.7 [27.0]	4.3%
Female	876 (55.6)	905 (57.4)	3.7%
Year of index date ^c			
2015	328 (20.8)	324 (20.6)	0.6%
2016	1,048 (66.5)	1,043 (66.2)	0.7%
2017	200 (12.7)	209 (13.3)	1.7%
Geographic region			
Midwest	503 (31.9)	528 (33.5)	3.4%
Northeast	423 (26.8)	402 (25.5)	3.0%
South	404 (25.6)	398 (25.3)	0.9%
West	177 (11.2)	189 (12.0)	2.4%
Unknown	69 (4.4)	59 (3.7)	3.2%
Type of health care plan			
Preferred provider organization	1,169 (74.2)	1,170 (74.2)	0.1%
Point of service plan	261 (16.6)	246 (15.6)	2.6%
Indemnity plan (ie, fee-for-service)	139 (8.8)	152 (9.6)	2.8%
Other health care plan ^d	7 (0.4)	8 (0.5)	0.9%
Relationship to health care plan holder			
Employee (ie, health care plan holder)	260 (16.5)	266 (16.9)	1.0%
Retiree	67 (4.3)	78 (4.9)	3.3%
Other employee status ^e	197 (12.5)	215 (13.6)	3.4%
Child	764 (48.5)	748 (47.5)	2.0%
Spouse	277 (17.6)	260 (16.5)	2.9%
Unknown/other ^f	11 (0.7)	9 (0.6)	1.6%
Quan-CCI, ^g score, mean ± SD [median]	0.4 ± 1.1 [0.0]	0.4 ± 1.2 [0.0]	0.6%
Selected treatment and contacts with health care professionals			
Antidepressants	911 (57.8)	181 (11.5)	111.4%
Psychotherapy	547 (34.7)	77 (4.9)	80.7%
Psychiatric diagnostic evaluation	447 (28.4)	41 (2.6)	76.2%
Antidepressant augmentation therapy ^h	421 (26.7)	144 (9.1)	47.1%
Place of service for index event			
Emergency department	799 (50.7)
Inpatient	713 (45.2)
Outpatient/other ⁱ	64 (4.1)
Pharmacy and medical costs (PPPM), mean ± SD [median], \$	1,032 ± 3,208 [260]	550 ± 3,236 [57]	15.0%
Pharmacy costs	131 ± 537 [11]	107 ± 542 [1]	4.6%
Medical costs	901 ± 3,123 [195]	444 ± 3,142 [38]	14.6%
Observation period, mean ± SD [median], mo	7.8 ± 5.1 [6.8]	8.1 ± 4.8 [8.4]	5.1%

^aThe baseline period was defined as the 12-month period prior to the index date.

^bPatients were matched on age, sex, year of the index date, geographic region, type of health care plan, relationship to health care plan holder, and Quan-CCI score. Values are shown as n (%) unless otherwise noted.

^cFor the MDSI cohort, the index date was defined as the date of the first suicidality. For the non-MDD cohort, the index date was randomly generated to mimic the distribution of time from the eligibility start to the first suicidality among the MDSI patients.

^dOther health care plans include locked-in and independent practice association health insurance plan types.

^eOther employee status includes employees on leave of absence, terminated, or employees with COBRA status.

^fOther includes class II dependents (ie, unmarried child or step-child, unmarried grandchild, unmarried brother or sister, parent, step-parent, or grandparent or spouse's parent, step-parent, or grandparent).

^gSee Quan et al.¹⁷

^hIncludes select atypical antipsychotics (ie, aripiprazole, brexpiprazole, olanzapine, quetiapine), anticonvulsants, lithium, non-benzodiazepine GABA-receptor modulators (ie, busiprone), psychostimulants and thyroid hormones. Agents were grouped according to the generic name.

ⁱThe index place of service was "other physician office" for 59.4% of patients, "hospital outpatient" for 25.0% of patients, and "psychiatric facility" for 15.6% of patients. Other places of service included independent laboratory, psychiatrist/psychologist office, clinic, and other. Categories are not mutually exclusive.

Abbreviations: COBRA = Consolidated Omnibus Budget Reconciliation Act; ICD-10-CM = *International Classification of Diseases, 10th Revision, Clinical Modification*; MDD = major depressive disorder; MDSI = major depressive disorder with acute suicidal ideation or behavior; PPPM = per patient per month; Quan-CCI = Quan-Charlson Comorbidity Index; SD = standard deviation.

evaluating behavioral and mental health-related HRU and depression-related HRU (Supplementary Table 2).

Health Care Costs

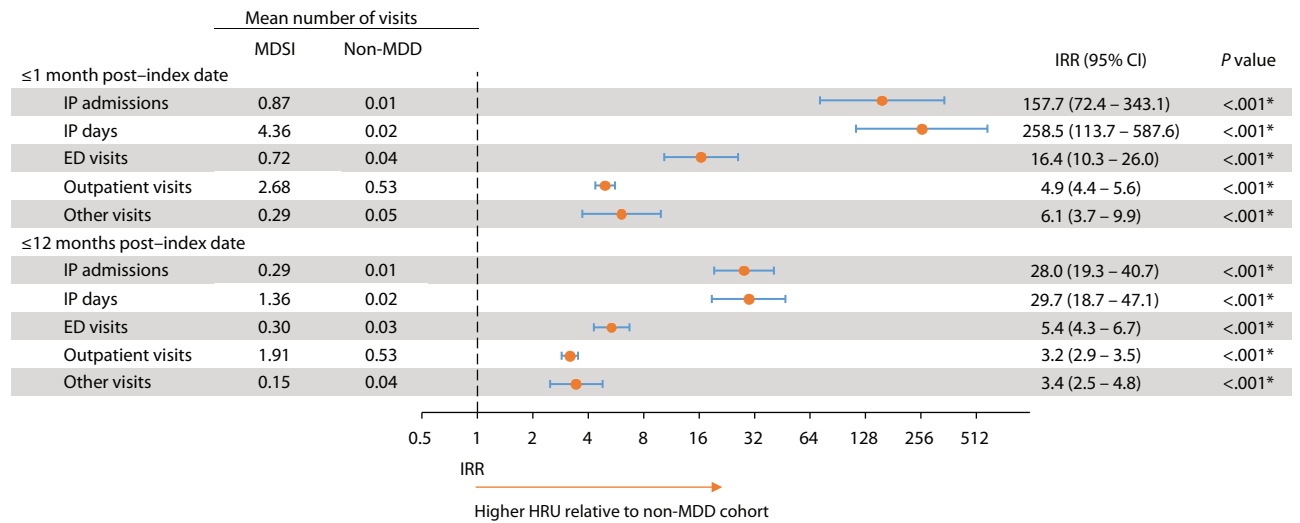
Within the first month of follow-up, patients with MDSI relative to controls incurred \$7,839 higher health care costs PPPM ($P < .001$; Figure 2A). This difference was predominantly driven by higher inpatient (cost

difference = \$5,532) and ED (cost difference = \$1,292; all $P < .001$) costs.

Within the first 12 months of follow-up, patients with MDSI relative to controls incurred \$2,757 higher health care costs PPPM ($P < .001$; Figure 2B). The main drivers of this cost difference were greater inpatient (mean cost difference = \$1,750), outpatient (mean cost difference = \$512), and ED (mean cost difference = \$434; all $P < .001$) costs.

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Figure 1. Health Care Resource Utilization in Matched Cohorts^a, per Patient per Month^{b,c}



^aPatients were matched on age, sex, year of the index date, geographic region, type of health care plan, relationship to health care plan holder, and Quan-CCI score.

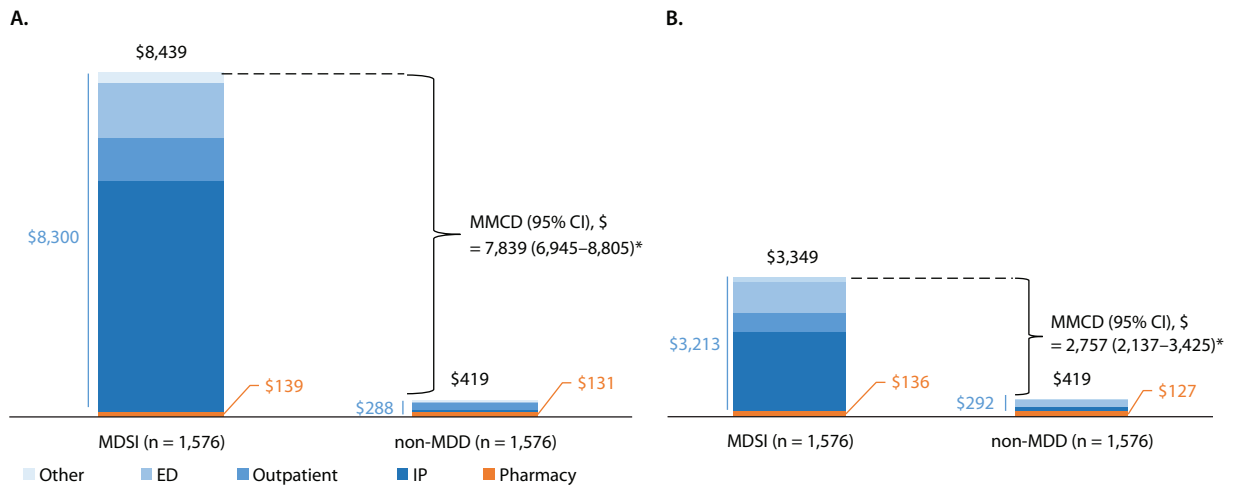
^bIRRs, 95% CIs, and P values were estimated using adjusted Poisson regressions. Total costs in the baseline period were used as the covariate in adjusted models.

^cThe assessment period included the index date, which occurred in an inpatient setting for 45.9% of patients with MDD and suicidal ideation or suicide attempt, explaining a substantial difference in inpatient admissions and days between the cohorts.

*Statistically significant at the 5% level.

Abbreviations: CI = confidence interval, ED = emergency department, HRU = health care resource utilization, IP = inpatient, IRR = incidence rate ratio, MDD = major depressive disorder, MDSI = major depressive disorder with acute suicidal ideation or behavior, Quan-CCI = Quan-Charlson Comorbidity Index.

Figure 2. Health Care Costs (2017 USD) in Matched Cohorts^a (A) ≤ 1 Month After Index Date and (B) ≤ 12 Months After Index Date, per Patient Per Month^b



^aPatients were matched on age, sex, year of the index date, geographic region, type of health care plan, relationship to health care plan holder, and Quan-CCI score.

^bCost differences were estimated using adjusted ordinary least squares regressions. Total costs in the baseline period were used as the covariate in adjusted models. 95% CIs and P values were obtained using non-parametric bootstrap procedures.

*Statistically significant at the 5% level.

Abbreviations: CI = confidence interval, ED = emergency department, IP = inpatient, MDD = major depressive disorder, MDSI = major depressive disorder with acute suicidal ideation or behavior, MMCD = mean monthly cost difference, Quan-CCI = Quan-Charlson Comorbidity Index.

Mean monthly behavioral and mental health-related costs constituted 66.6% and 53.3% of the mean monthly total health care costs of patients with MDSI within the first month and within the first 12 months. Mean monthly depression-related costs constituted 52.8% and 39.5%, respectively (Supplementary Table 3).

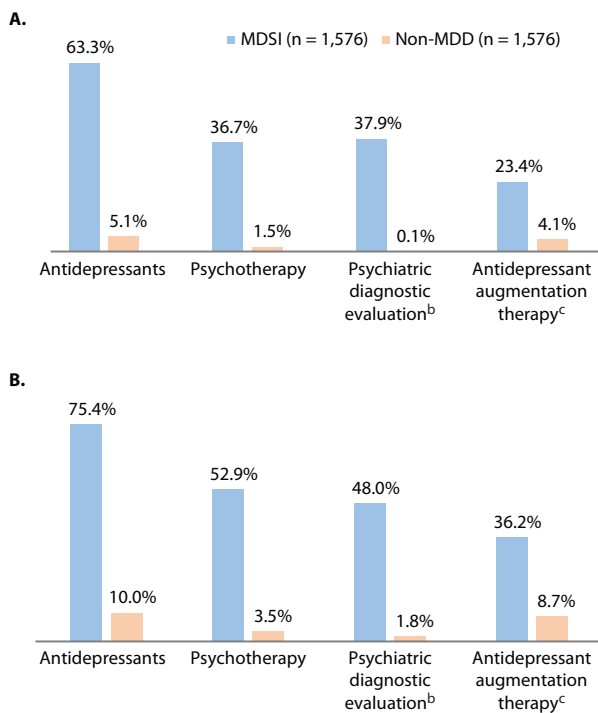
Use of MDD-Related Therapies

Within the first month and within the first 12 months post-index, respectively, 63.3% and 75.4% of patients in the MDSI cohort used antidepressants, 36.7% and 52.9% received psychotherapy, 37.9% and 48.0% received psychiatric diagnostic evaluation, and 23.4% and 36.2% used

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Figure 3. Patients Using MDD-Related Therapies and Evaluations in Matched Cohorts^a (A) ≤ 1 Month After Index Date and (B) ≤ 12 Months After Index Date



^aPatients were matched on age, sex, year of the index date, geographic region, type of health care plan, relationship to health care plan holder, and Quan-CCI score.

^bIdentified based on claims with CPT codes for psychiatric diagnostic evaluations with or without medical services and psychotherapy (CPT codes: 90791, 90792, 90785, 90801, 90802).

^cIncludes anticonvulsants, buspirone, psychostimulants, select atypical antipsychotics (aripiprazole, brexpiprazole, olanzapine, quetiapine), thyroid hormones (T₃), and lithium. Agents were grouped according to the generic name.

Abbreviations: CPT=current procedural terminology, MDD=major depressive disorder, MDDSI=major depressive disorder with acute suicidal ideation or behavior, Quan-CCI=Quan-Charlson Comorbidity Index.

antidepressant augmentation therapy (Figure 3). The use of MDD-related therapies and evaluations, as expected, was consistently lower in the non-MDD cohort.

Within the first month post-index, there were 264 (16.8%) and 1,408 (89.3%) patients in the MDDSI and non-MDD cohorts, respectively, without pharmacologic or non-pharmacologic therapy or mental health evaluations (ie, none of these treatment modalities). Within the first 12 months, these numbers were 172 (10.9%) and 1,252 (79.4%) in the MDDSI and non-MDD cohorts, respectively.

DISCUSSION

To the best of our knowledge, this study is the first to evaluate the economic burden of patients with MDDSI. In this study, most index events occurred in a hospital setting, reflecting acute care required for patients at imminent risk of suicide. Given this finding, substantially higher health care costs incurred in the MDDSI cohort relative to the non-MDD cohort, particularly in the first month after the

SIB event, are not surprising. Nonetheless, these costs are important to quantify and discuss. In the year preceding the SIB event, nearly half of the MDDSI cohort had no evidence of antidepressant use and almost two-thirds no evidence of psychotherapy. Coupled with the fact that the economic burden is concentrated in the provision of acute care, this finding highlights the need for better strategies for the timely identification and treatment of patients with MDD whose symptoms are escalating, as at least in some cases a crisis may be avoided with personalized pharmacologic and non-pharmacologic therapy. Substantial economic burden associated with MDDSI persisted in the year following the SIB event. Patients with MDDSI incurred total health care costs of \$3,349 PPPM during this time. Although this study did not have a control cohort of patients with MDD and without SIB, the aforementioned estimate can be contrasted with an estimate from the literature of \$816 PPPM (2015 USD) among a population of patients with MDD initiated on antidepressants.¹⁸ This contrast suggests that the majority of the incremental burden associated with MDDSI may be attributable to SIB as opposed to MDD.

This study is timely given the emerging evidence of negative effects of the COVID-19 outbreak and the associated social isolation and economic consequences on psychological health.^{19,20} The situation of at-risk patients could be further exacerbated by the disruption of face-to-face health care.²¹ As a result, SIB may increase among vulnerable groups²² and strategies for suicide prevention need urgent consideration. While the social stigma related to talking about depression and suicidal ideation is less than in the past, it still exists. Primary health care providers should strive to integrate basic mental health services into outpatient primary care, proactively engage patients in discussions about their mental health, and, as needed, be prepared to screen for and directly discuss suicide risk. Doing so could improve the early identification of at-risk patients and provide an opportunity to propose available treatment options before symptoms escalate and patients present to an inpatient or ED setting for an SIB event. Continuity of care is also critical. In the year following the SIB event, nearly one-quarter of patients with MDDSI had no evidence of antidepressant use while nearly half had no evidence of psychotherapy. While the reasons treatment may not have been received are unknown, physicians should strive to implement strategies to ensure patients are periodically reevaluated, treatment options are discussed, and personalized treatment plans are created to mitigate poor outcomes in this complex patient population.

Among adults with an MDE in the past year, based on self-report, 32.1% had suicidal ideation, 11.8% made suicide plans, and 4.3% attempted suicide,¹ while in our study, 2% of patients with MDD had a claim for SIB. This gap in reported prevalence of SIB among MDD patients likely supports the assumption that a risk of underreporting of SIB in claims data exists due to stigma, perception of accidental injury, liability concerns, or billing guidelines. Furthermore, our study looked exclusively at beneficiaries with commercial insurance, while the prevalence of SIB may be higher

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among vulnerable populations, including the uninsured or Medicaid beneficiaries.¹¹ Future studies should assess outcomes among patients with MDD and acute SIB with Medicaid coverage.

Tools, such as the Suicide Intent Scale,²³ can be used to measure the seriousness of the intent to die and predict the risk of subsequent suicidal behavior.²⁴ However, this information is not available in health insurance claims, which made it challenging to identify if self-inflicted harm was carried out with an intent to die. This potential limitation was, however, mitigated by requiring that patients with codes of intentional self-harm alone were included only if they had an accompanying diagnosis of suicidal ideation.

The health care costs captured in the present study reflect the private payer's perspective and do not include patient out-of-pocket and societal costs, such as work productivity loss and costs of caregivers. As the overall economic burden of patients with MDSI extends beyond the direct health care costs reported in the current study, further research is warranted to provide a comprehensive assessment of these additional costs.

Limitations

The present study is subject to some limitations. The study population included patients with commercial insurance, and results may not be generalized to patients with other types of insurance (eg, Medicaid) or the uninsured, who may

be more vulnerable and at risk of SIB. Among commercially insured patients, there may be underinsured patients with insufficient funds to cover out-of-pocket costs or copay. Their access to pharmacologic and non-pharmacologic interventions may be limited, contributing to the high share of acute care in the economic burden of MDSI. The study period was narrow, driven by the end of data availability in 2017; future studies with more recent data, including data during the COVID-19 global pandemic, and a broader study population are warranted to confirm and detail our findings. Pharmacy claims data do not account for medication dispensed being taken as prescribed and do not include medications purchased over-the-counter or obtained as samples; thus, the use of MDD-related pharmacologic therapies may be misestimated. Lastly, despite the use of matching and multivariable adjustments, the observational nature of the study makes results vulnerable to unmeasured confounders.

CONCLUSIONS

Acute SIB in patients with MDD carries a significant HRU and cost burden. This burden is driven by acute care for the suicide-related event and persists for up to a year after it. Strategies are needed to improve treatment options and quality of care for patients with MDD whose symptoms escalate.

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Editor's Note: We encourage authors to submit papers for consideration as a part of our Focus on Suicide section. Please contact Philippe Courtet, MD, PhD, at pcourtet@psychiatrist.com.

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Supplementary Material

Article Title: Economic Burden of Commercially Insured Patients With Major Depressive Disorder and Acute Suicidal Ideation or Behavior in the United States

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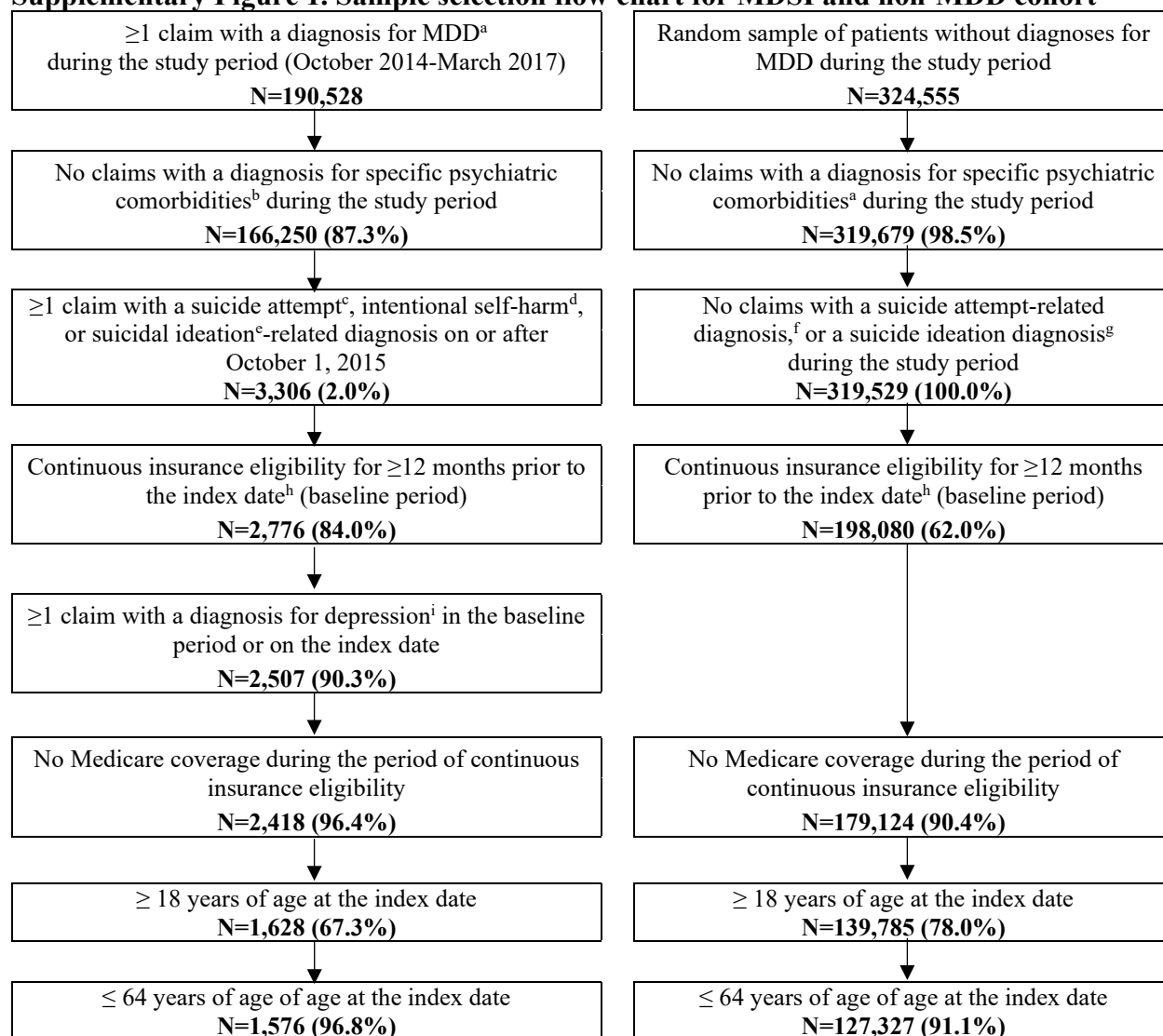
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1. [Figure 1](#) Sample selection flow chart for MDSI and non-MDD cohort
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Disclaimer

This Supplementary Material has been provided by the author(s) as an enhancement to the published article. It has been approved by peer review; however, it has undergone neither editing nor formatting by in-house editorial staff. The material is presented in the manner supplied by the author.

Supplementary Figure 1. Sample selection flow chart for MDSI and non-MDD cohort



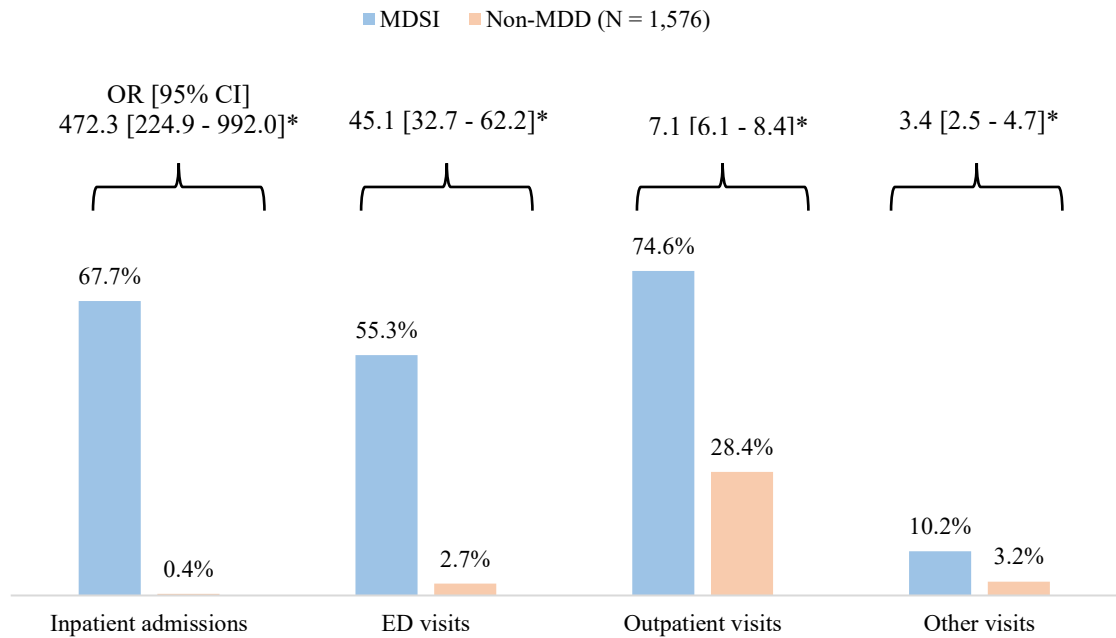
Abbreviations: ICD-9-CM/ICD-10-CM = International Classification of Disease, Ninth/Tenth Revision, Clinical Modification; MDD = major depressive disorder; MDSI = major depressive disorder with acute suicidal ideation or behavior.

Notes:

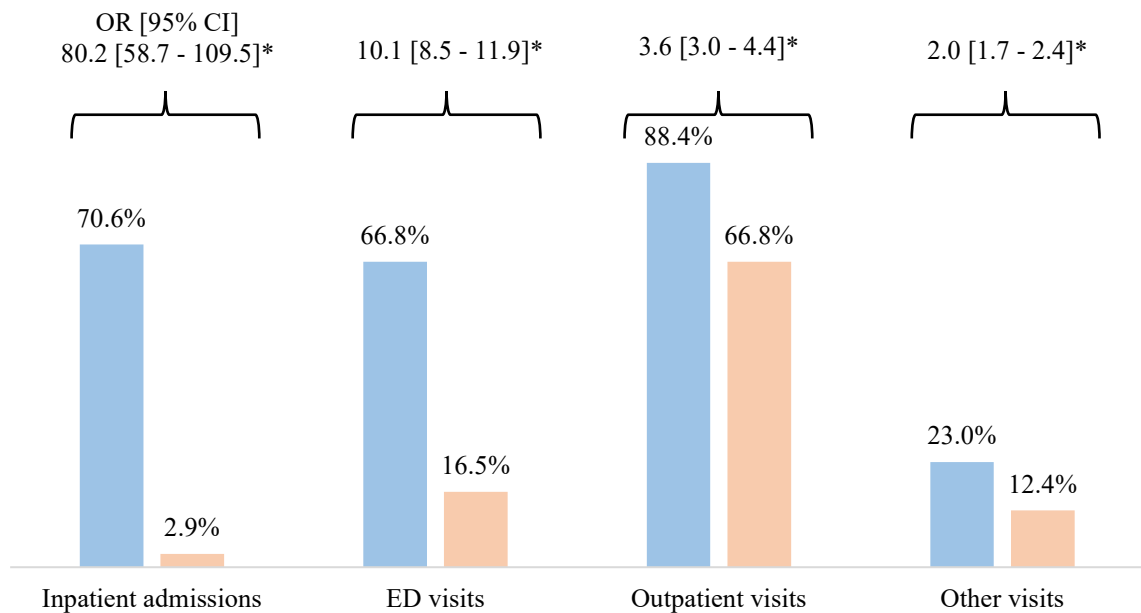
- MDD was identified using ICD-9-CM codes 296.2x, 296.3x and ICD-10-CM codes F32.xx (excluding F32.8), F33.xx (excluding F33.8)
- See Table S1 for the list of codes for specific psychiatric comorbidities.
- See Table 1 for the list of codes used to identify suicide attempt.
- See Table 1 for the list of codes used to identify intentional self-harm.
- See Table 1 for the list of codes used to identify suicide ideation.
- Suicide attempt-related diagnosis defined as any ICD-10-CM diagnosis code for a suicide attempt or intentional self-harm in Table 1, as well as any ICD-9-CM code for suicide or self-inflicted injury (ICD-9-CM: E95x.x [excluding E959.x]).
- Suicide ideation defined as a suicidal ideation diagnosis (ICD-9-CM: V62.84; ICD-10-CM: R45.851)
- For the MDSI cohort, the index date was defined as the date of the first suicidality. For the non-MDD cohort, the index date was randomly generated to mimic the distribution of time from the study period start to the first suicidality among the MDSI patients.
- Depression defined as ICD-9-CM: 296.2x, 296.3x, 300.4x, 311.xx, 309.0x, 309.1x; ICD-10-CM: F32.xx, F33.xx, F34.1x, F43.21.

Supplementary Figure 2. Patients with all-cause medical services in matched cohorts^a (A) ≤ 1 month after index date and (B) ≤ 12 months after index date^b

A



B



Abbreviations: CI = confidence interval; ED = emergency department; MDD = major depressive disorder; MDSI = major depressive disorder with acute suicidal ideation or behavior; OR = odds ratio

Notes:

*: indicates $p < 0.001$

- Patients were matched on age, sex, year of the index date, geographical region, type of healthcare plan, relationship to healthcare plan holder and Quan-CCI.
- ORs, 95% CIs, and p-values were estimated using adjusted logistic regressions. Total costs in the baseline period were used as the covariate in adjusted models.

Supplementary Table 1: List of diagnosis codes used to identify psychiatric comorbidities used for exclusion

Selection Criteria	ICD-9-CM Diagnosis Codes	ICD-10-CM Diagnosis Codes
Bipolar disorder and related conditions	296.0x, 296.1x, 296.4x, 296.5x, 296.6x, 296.7x, 296.8x, 301.13	F30.xx, F31.xx, F34.0, F06.31, F06.32, F06.33, F06.34,
Cluster B personality disorder	301.3x, 301.5x, 301.59, 301.7x, 301.81, 301.83	F60.2x, F60.3x, F60.4x, F60.81
Dementia	290.xx, 294.1x, 331.0x, 331.1x, 331.2x	F01.xx, F02.xx, F03.xx, G30.xx, G31.0x, G31.1x
Intellectual disability	317.xx, 318.xx, 319.xx	F70.xx, F71.xx, F72.xx, F73.xx, F78.xx, F79.xx
Schizophrenia and other non-mood psychotic disorders	293.81, 293.82, 295.xx, 297.xx, 298.1x, 298.3x, 298.4x, 298.8x, 298.9x, 301.22	F06.0x, F06.2x, F20.xx, F21.xx, F22.xx, F23.xx, F24.xx, F25.xx, F28.xx, F29.xx
Substance-induced mood disorder	291.89, 291.9x, 292.84, 292.9x	F10.14, F10.24, F10.94, F11.14, F11.24, F11.94, F13.14, F13.19, F13.94, F14.14, F14.24, F14.94, F15.14, F15.24, F15.94, F16.14, F16.24, F16.94, F18.14, F18.24, F18.94, F19.14, F19.24, F19.94

Abbreviations: ICD-9-CM = International Classification of Diseases, Ninth Revision, Clinical Modification; ICD-10-CM = International Classification of Diseases, Tenth Revision, Clinical Modification.

Supplementary Table 2. Behavioral and mental health-related and depression-related healthcare resource utilization

HRU per patient per month	≤1 month post-index		≤12 months post-index	
	MDSI cohort (N = 1,576)	Non-MDD cohort (N=1,576)	MDSI cohort (N = 1,576)	Non-MDD cohort (N=1,576)
Behavioral and mental health-related^a resource utilization				
Inpatient admissions				
Had ≥ 1 inpatient admission, n (%)	1,052 (66.8)	0 (0.0)	1,081 (68.6)	2 (0.1)
Number of admissions, mean ± SD [median]	0.85 ± 1.15 [1.00]	0.00 ± 0.00 [0.00]	0.27 ± 0.95 [0.09]	0.00 ± 0.00 [0.00]
Number of days, mean ± SD [median]	4.31 ± 5.38 [4.00]	0.00 ± 0.00 [0.00]	1.31 ± 2.97 [0.47]	0.00 ± 0.06 [0.00]
ED visits				
Had ≥ 1 ED visit, n (%)	793 (50.3)	0 (0.0)	862 (54.7)	5 (0.3)
Number of ED visits, mean ± SD [median]	0.60 ± 0.77 [1.00]	0.00 ± 0.00 [0.00]	0.20 ± 0.54 [0.08]	0.00 ± 0.01 [0.00]
Outpatient visits				
Had ≥ 1 visit, n (%)	1,019 (64.7)	34 (2.2)	1,209 (76.7)	120 (7.6)
Number of visits, mean ± SD [median]	2.16 ± 3.06 [1.00]	0.04 ± 0.33 [0.00]	1.30 ± 2.36 [0.60]	0.05 ± 0.54 [0.00]
Other visits				
Had ≥ 1 visit, n (%)	116 (7.4)	0 (0.0)	180 (11.4)	4 (0.3)
Number of visits, mean ± SD [median]	0.25 ± 1.54 [0.00]	0.00 ± 0.00 [0.00]	0.11 ± 0.70 [0.00]	0.00 ± 0.01 [0.00]
Depression-related^b resource utilization				
Inpatient admissions				
Had ≥ 1 inpatient admission, n (%)	1,004 (63.7)	0 (0.0)	1,029 (65.3)	0 (0.0)
Number of admissions, mean ± SD [median]	0.80 ± 1.12 [1.00]	0.00 ± 0.00 [0.00]	0.25 ± 0.92 [0.08]	0.00 ± 0.00 [0.00]
Number of days, mean ± SD [median]	4.11 ± 5.32 [3.00]	0.00 ± 0.00 [0.00]	1.22 ± 2.91 [0.41]	0.00 ± 0.00 [0.00]
ED visits				
Had ≥ 1 ED visit, n (%)	700 (44.4)	0 (0.0)	732 (46.4)	0 (0.0)
Number of ED visits, mean ± SD [median]	0.52 ± 0.73 [0.00]	0.00 ± 0.00 [0.00]	0.16 ± 0.53 [0.00]	0.00 ± 0.00 [0.00]
Outpatient visits				
Had ≥ 1 visit, n (%)	808 (51.3)	2 (0.1)	996 (63.2)	9 (0.6)
Number of visits, mean ± SD [median]	1.51 ± 2.61 [1.00]	0.00 ± 0.13 [0.00]	0.88 ± 2.08 [0.25]	0.00 ± 0.03 [0.00]
Other visits				
Had ≥ 1 visit, n (%)	78 (4.9)	0 (0.0)	100 (6.3)	0 (0.0)
Number of visits, mean ± SD [median]	0.14 ± 0.94 [0.00]	0.00 ± 0.00 [0.00]	0.06 ± 0.53 [0.00]	0.00 ± 0.00 [0.00]

Abbreviations: ED = emergency department; HRU = healthcare resource utilization; MDD = major depressive disorder; MDSI = major depressive disorder with acute suicidal ideation or behavior; SD = standard deviation

Notes:

- Behavioral and mental health-related HRU were identified based on claims with an ICD-10-CM diagnosis between F01 and F99 (inclusive).
- Depression-related HRU were identified based on claims with an ICD-10-CM diagnosis codes: F32.xx, F33.xx, F34.1x, F43.21.

Supplementary Table 3. Behavioral and mental health-related and depression-related healthcare costs

Healthcare cost (US \$2017) per patient per month, mean ± SD [median]	≤1 month post-index		≤12 months post-index	
	MDSI cohort (N = 1,576)	Non-MDD cohort (N=1,576)	MDSI cohort (N = 1,576)	Non-MDD cohort (N=1,576)
Behavioral and mental health-related pharmacy and medical costs^a	5,622 ± 8,504 [3,408]	14 ± 314 [0]	1,786 ± 5,064 [689]	11 ± 139 [0]
Psychiatric pharmacy costs^b	54 ± 183 [0]	4 ± 36 [0]	46 ± 119 [2]	4 ± 29 [0]
Behavioral and mental health-related medical costs	5,568 ± 8,485 [3,371]	10 ± 312 [0]	1,739 ± 5,061 [630]	7 ± 136 [0]
Inpatient costs	3,667 ± 7,368 [1,408]	0 ± 0 [0]	1,061 ± 4,260 [226]	0 ± 1 [0]
ED costs	998 ± 2,106 [0]	0 ± 0 [0]	280 ± 1,117 [4]	0 ± 8 [0]
Outpatient costs	657 ± 2,121 [75]	10 ± 312 [0]	307 ± 1,733 [43]	6 ± 133 [0]
Other costs	246 ± 2,107 [0]	0 ± 0 [0]	91 ± 702 [0]	0 ± 3 [0]
Depression-related pharmacy and medical costs	4,455 ± 7,292 [2,554]	1 ± 14 [0]	1,324 ± 4,244 [469]	1 ± 7 [0]
Antidepressant pharmacy costs	17 ± 65 [0]	1 ± 10 [0]	18 ± 58 [0]	1 ± 6 [0]
Depression-related medical costs^c	4,438 ± 7,288 [2,552]	0 ± 10 [0]	1,306 ± 4,243 [462]	0 ± 4 [0]
Inpatient visits	3,109 ± 6,648 [617]	0 ± 0 [0]	883 ± 3,937 [143]	0 ± 0 [0]
ED visits	759 ± 1,855 [0]	0 ± 0 [0]	210 ± 1,065 [0]	0 ± 0 [0]
Outpatient costs	426 ± 1,511 [0]	0 ± 10 [0]	165 ± 563 [15]	0 ± 4 [0]
Other costs	144 ± 1,000 [0]	0 ± 0 [0]	49 ± 466 [0]	0 ± 0 [0]

Abbreviations: ED = emergency department; MDD = major depressive disorder; MDSI = major depressive disorder with acute suicidal ideation or behavior; SD = standard deviation

Notes:

- a. Behavioral and mental health-related medical costs were identified based on claims with an ICD-10-CM diagnosis between F01 and F99 (inclusive).
- b. Psychiatric pharmacy costs included the following classes of agents: antidepressants, anticonvulsants, antipsychotics, benzodiazepines, lithium, miscellaneous treatments used for ADHD, non-benzodiazepine GABA-receptor modulators (i.e., busiprone), psychostimulants, sleep aids and thyroid hormones.
- c. Depression-related medical costs were identified based on claims with an ICD-10-CM diagnosis codes: F32.X, F33X, F34.1, F43.21.