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Characterizing primary care for patients with major depressive disorder using electronic health records of a US-based healthcare provider

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ABSTRACT

Background: Major depressive disorder (MDD) is predominantly managed in primary care. However, primary care providers (PCPs) may not consistently follow evidence-based treatment algorithms, leading to variable patient management that can impact outcomes.

Methods: We retrospectively analyzed adult patients with MDD seen at Geisinger, an integrated health system. Utilizing electronic health record (EHR) data, we classified patients as having MDD based on International Classification of Disease (ICD)-9/10 codes or a Patient Health Questionnaire (PHQ)-9 score ≥5. Outcomes assessed included time to first visit with a PCP or behavioral health specialist following diagnosis, antidepressant medication switching, persistence, healthcare resource utilization (HRU), and treatment costs.

Results: Among the 38,321 patients with MDD managed in primary care in this study, significant delays between diagnosis with antidepressant prescribing and follow-up PCP visits were observed. There was also considerable variation in care following diagnosis. Overall, 34.9% of patients with an ICD-9/10 diagnosis of MDD and 41.3% with a PHQ-9 score ≥15 switched antidepressants. An ICD-9/10 diagnosis, but not moderately severe to severe depression, was associated with higher costs and HRU. More than 75% of patients with MDD discontinued antidepressant medication within 6 months.

Limitations: The study population was comparable with other real-world studies of MDD, but study limitations include its retrospective nature and reliance on the accuracy of EHRs.

Conclusions: Management of patients with MDD in a primary care setting is variable. Addressing these gaps will have important implications for ensuring optimal patient management, which may reduce HRU and treatment medication costs, and improve treatment persistence.

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Abbreviations

BH	behavioral health
BMI	body mass index
CCI	Charlson Comorbidity Index
CI	confidence interval
ED	emergency department
EHR	electronic health record
GERD	gastroesophageal reflux disease
GI	gastrointestinal
HRU	healthcare resource utilization
IBD	inflammatory bowel disease
IBS	irritable bowel syndrome
ICD-9	International Classification of Disease
IQR	interquartile range
NDRI	norepinephrine-dopamine reuptake inhibitor
PCPs	primary care providers
PHQ-9	Patient Health Questionnaire-9
SD	standard deviation
SNRI	serotonin-norepinephrine reuptake inhibitor
SSRI	selective serotonin reuptake inhibitor
USPSTF	US Preventive Services Task Force

1. Introduction

Major depressive disorder (MDD) is a highly prevalent mental illness and a leading cause of disability (National Institute of Mental Health, 2019). Every year, 17.3 million adults (7.1%) in the United States experience at least 1 episode of major depression (National Institute of Mental Health, 2019; Pilon et al., 2019), placing a considerable burden on the healthcare system. Medical costs associated with MDD were estimated to be $326.2 billion in 2018 (converted to 2020 US dollars) (Greenberg et al., 2021). Despite its significant morbidity and cost, MDD remains underdetected and underdiagnosed (Harman et al., 2006; Unützer and Park, 2012).

Because depression is a leading cause of disability in the United States, the US Preventive Services Task Force (USPSTF) recommends that all adults be screened for depression in primary care to identify patients requiring treatment, with the aim of reducing overall clinical morbidity (Siu et al., 2016). A number of screening instruments are recommended, including the Patient Health Questionnaire-9 (PHQ-9), which includes 9 depression criteria from the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*, and is designed to be self-administered by patients (Savoy and O'Gurek, 2016; Siu et al., 2016). Other options for screening instruments that can be used in a primary care setting include the Hospital Anxiety and Depression Scale and specialist assessments such as the Geriatric Depression Scale for older adults and Edinburgh Postnatal Depression Scale for postpartum and pregnant women (Savoy and O'Gurke, 2016; Siu et al., 2016).

Prior reports have indicated that two-thirds of visits to healthcare providers by patients with MDD occur in a primary care setting (Harman et al., 2006), although this may be an underestimate following the strengthening of the USPSTF recommendation to screen for depression in routine clinical practice (Siu et al., 2016). Therefore, primary care providers (PCPs) shoulder a substantial burden with regard to the diagnosis and initial management of depression.

Despite available guidelines from organizations such as the American Psychiatric and American Psychological Associations (American Psychiatric Association, 2010; American Psychological Association, 2019), MDD continues to be undertreated in the primary care setting, with low treatment effectiveness and persistence reported (National Institute of Mental Health, 2019; Unützer and Park, 2012). For example, the American Psychological Association provides differing treatment recommendations for depression, MDD (± medical or other complications), subthreshold/minor depression (± cognitive impairment/dementia), and persistent depressive disorder (American Psychological Association, 2019). This presents a challenging decision-making process in a primary care setting, where patients often have comorbidities (including other mental health conditions) that may be managed by other providers, and can lead to a fragmented approach to care (Mosher Henke, 2008; Gunn et al., 2012; Grazier et al., 2014). PCPs also face other barriers to adequately treating depression once a diagnosis is made, including patient reluctance to initiate treatment, lack of insurance reimbursement, inadequate experience and training in mental health, and competing clinical demands. (Mosher Henke, 2008; Schumann et al., 2012; Grazier et al., 2014; Colorafi et al., 2017). Furthermore, access to specialist mental health services and behavioral health (BH) services that provide guideline-recommended psychotherapy (eg, cognitive behavioral therapy, supportive therapy, psychodynamic therapy, problem-solving therapy) may be limited (Mosher Henke, 2008; American Psychological Association, 2019). Therefore, understanding the pathways of care followed and experiences of patients diagnosed with depression in primary care is important for understanding whether the expected benefits of screening translate into improved outcomes for patients.

The aim of this study was to characterize the care of patients with depression seen by PCPs in an integrated health system. This includes assessments of follow-up care received by patients after being diagnosed with depression, treatment patterns, healthcare resource utilization (HRU), and treatment persistence in an attempt to identify opportunities for improvement in the care provided. In particular, the care of patients with moderately severe and severe depression (PHQ-9 score ≥15) who may require more intensive therapy and referral to specialist BH services in addition to pharmacotherapy was investigated (American Psychiatric Association, 2010).

2. Methods

2.1. Data source

Geisinger (Danville, PA, USA) is an integrated healthcare system currently serving approximately 4.2 million people. Geisinger possesses an extensive electronic health record (EHR) database comprising data from all patients across ambulatory and inpatient sites of care. We utilized this EHR data for this study as well as insurance claims data from the Geisinger Health Plan.

2.2. Study design and patient population

We included adult patients seen within the Geisinger system who had a new diagnosis of MDD between January 1, 2012, and June 30, 2017. Patients had to be aged ≥18 years and enrolled in the Geisinger system for at least 2 years prior to an initial diagnosis of MDD and have completed an outpatient, emergency department (ED) to inpatient, ED-only, or inpatient-only encounter.

An initial diagnosis of MDD was determined using International Classification of Disease (ICD)-9/10 and PHQ-9 scores. ICD-9/10 diagnoses were defined as follows: ICD-9 code of 296.20, 296.21, 296.22, 296.23, 296.24, 296.25, 296.26, 296.30, 296.31, 296.32, 296.33, 296.34, 296.35, 296.36, 300.4, or 311; or ICD-10 code of F32.0, F32.1, F32.2, F32.3, F32.4, F32.5, F32.8, F32.9, F33.0, F33.1, F33.2, F33.3, F33.41, F33.42, F33.9, or F34.1. PHQ-9 scores were grouped by degree of severity, with 0 indicating "no depression present"; 1–4, "minimal or no depression"; 5–9, "mild depression"; 10–14, "moderate depression"; 15–19, "moderately severe depression"; or ≥20, indicating "severe depression" (Kroenke et al., 2001). Analyses of patients with PHQ-9–defined depression included investigating the subset of patients with a PHQ-9 score ≥15, representing moderately severe and severe depression, who were expected to be treated with antidepressant and behavioral therapy (Kroenke et al., 2001; American Psychiatric Association, 2010). Patients without an ICD-9/10 diagnosis of MDD required a PHQ-9 total score of ≥5 to be eligible for the study.

The index date was defined as the first date of diagnosis of incident depression in the study period. To be eligible, patients needed a minimum of 12 months of follow-up data following the index date. Patients with bipolar disorder, schizophrenia or schizoaffective disorder, or brief psychotic disorder were excluded from the study. Patients who were pregnant during the study period—defined as such during the study period or 9 months prior (April 1, 2011, to June 30, 2017)—were also excluded.

2.3. Outcomes

We evaluated several outcomes, including the time from the index date to first PCP and BH visit, antidepressant medication switching, HRU in the first year after the index date, cost, and antidepressant persistence. Antidepressant persistence was defined as the time from the medication start date to the stop date in the patient's EHR, end of follow-up, or a gap of up to 30 days in continuous access to medication. In the event of a 30-day gap in medication access, the stop date was defined as the end of the 30-day gap.

2.4. Statistical analysis

Study patient demographics were summarized using descriptive statistics. Outcomes were analyzed using negative binomial regression, gamma distribution, binary and ordinal logistic regression, or survival analyses (Cox proportional hazards and Kaplan-Meier curves). All statistical analyses were performed using SAS (version 9.4; SAS Institute, Inc. Cary, NC, USA). Individual patients could be represented in both the ICD-9/10 and PHQ-9 cohorts (Fig. 1).

3. Results

3.1. Baseline characteristics and demographics

We identified 38,321 eligible patients; 20,780 had an ICD-9/10 diagnosis of MDD and 20,808 patients had a PHQ-9 diagnosis (PHQ-9 score ≥5) of depression, with some patients included in both populations (**Table 1**; **Supplementary Fig. 1**). Of patients who had a PHQ-9 diagnosis, 6453 (31%) were considered to have moderate depression (score 10–14), 5523 (26.5%) to have moderately severe depression (score 15–19), and 3454 (16.6%) to have severe depression (score ≥20).

Patients with an ICD-9/10 diagnosis had a mean age of 55.0 years compared with 48.1 years in the PHQ-9 ≥15 study population. Both the ICD-9/10 and PHQ-9 ≥15 populations were predominantly female (64.1% and 66.9%, respectively). Almost 50% of the patients with MDD were obese (body mass index [BMI] 30.0–39.9 kg/m^2) or morbidly obese (BMI ≥40 kg/m^2), and mean BMI was comparable between patients with ICD-9/10 and PHQ-9 ≥15 diagnoses.

Comorbidities were common in both the ICD-9/10 and PHQ-9 ≥15 groups (median [interquartile range (IQR)] of 3 [1–5] and 3 [2–6], respectively) (**Table 1**; **Table 2**). The most common comorbidities were metabolic disorders (eg, hypertension, hyperlipidemia, type 2 diabetes); psychiatric disorders (eg, anxiety disorder, alcohol/substance use disorder, sleep disorder); and gastrointestinal (GI) disorders (eg, gastroesophageal reflux disease, inflammatory bowel disease, or irritable bowel syndrome). The prevalence of anxiety, substance/alcohol use disorders, GI disorders, sleeping disorders, and asthma was higher in patients with a PHQ-9 score ≥15 versus an ICD-9/10 diagnosis (**Table 2**).

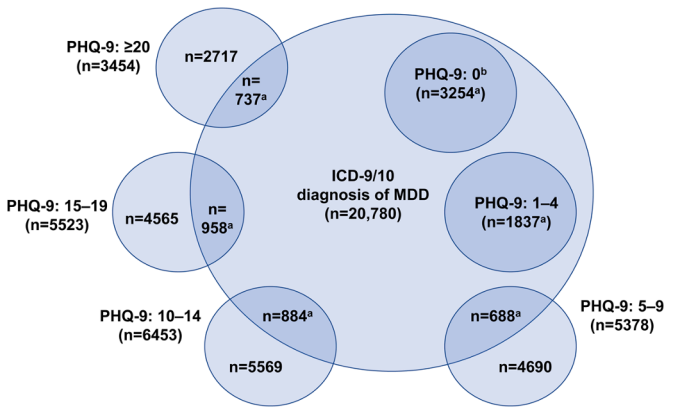

Fig. 1. Cohort distribution by ICD-9/10 diagnosis and PHQ-9 score. [a]Patients with both an ICD-9/10 diagnosis and PHQ-9 score; [b]PHQ-9 0 represents an actual score of 0 and not a missing value. ICD, International Classification of Disease; PHQ-9, Patient Health Questionnaire-9.

3.2. Time to first primary care provider and behavioral health visit

The mean (standard deviation [SD]) delay between the time of initial diagnosis and first postdiagnosis PCP visit was 124 (235) days for the ICD-9/10 diagnosis group and 100–110 (135–150) days for the PHQ-9 diagnosis group (any severity) (Fig. 2**A**). Mean (SD) number of days to first PCP visit following the first antidepressant prescription was 509 (460) days for an ICD-9/10 diagnosis and 485–578 (468–489) days for a PHQ-9 diagnosis (Fig. 2**B**). The median times to first postdiagnosis visit and first post–antidepressant prescription visit were significantly shorter than the means for both groups, and the IQRs were wide (ICD-9/10: median [IQR], 31 [10–116] days and 409 [76–833] days, respectively; PHQ-9 [any severity]: median [IQR], 42–63 [16–137] days and 363–547 [41–960] days).

There was no clear association between PHQ-9 score at the time of diagnosis and time to first visit after first antidepressant prescription. Among patients who were referred to BH, male patients were seen earlier than female patients (**Supplementary Fig. 2**). For patients diagnosed with MDD who were referred to BH (n=3023; 7.9%), advancing age, number of comorbidities at pre-index date, and an ICD-9/10 diagnosis were associated with a significantly longer time to first BH visit (**Supplementary Fig. 2**).

3.3. Medication switches

One-third of patients with an ICD-9/10 diagnosis (5014/14,371; 34.9%) switched antidepressant medication at least once during the study period, with 18.8% of patients (2701/14,371) switching antidepressant medication ≥3 times. However, 41.3% of all patients with a PHQ-9 score ≥15 (2842/6885) switched antidepressant medication at least once during the study period, although a similar percentage of patients (1431/6885; 20.8%) switched antidepressant medication ≥3 times. Median (IQR) time to antidepressant medication switch was 556 (149–1107) days for patients with an ICD-9/10 diagnosis.

Smoking (current), number of prescribed medications, number of pre-index comorbidities, an ICD-9/10 diagnosis, and a PHQ-9 score ≥15 were associated with a significantly higher likelihood of antidepressant medication switching (**Supplementary Fig. 3**). In contrast, advancing age, male sex, and increasing BMI (by kg/m^2) were associated with a significantly lower probability of antidepressant medication switching (**Supplementary Fig. 3**).

3.4. Healthcare resource utilization and cost

An ICD-9/10 diagnosis of MDD was associated with an increase in medication costs within 12 months (relative risk, 2.31; $p<0.0001$). However, a PHQ-9 score ≥15 was associated with a decrease in medication costs within 12 months (relative risk, 0.9030; $p<0.001$).

The number of all medications prescribed prior to index date and pre-existing comorbidities at diagnosis were also associated with increased medication costs during the first year (**Supplementary Fig.**

Table 1
Baseline characteristics and demographics.

Characteristics	ICD-9/10 population (n=20,780)	PHQ-9 score 0 (n=3254)	1–4 (n=1837)	5–9 (n=5378)	10–14 (n=6453)	15–19 (n=5523)	≥20 (n=3454)
Age, years, mean (SD)	55.0 (19.0)	56.3 (18.3)	55.5 (17.1)	54.4 (18.1)	51.2 (17.9)	48.2 (17.2)	47.1 (15.8)
Age, group, years, n (%)							
18–26	1805 (8.7)	279 (8.6)	109 (5.9)	453 (8.4)	684 (10.6)	677 (12.3)	374 (10.8)
27–39	2999 (14.4)	392 (12.0)	250 (13.6)	737 (13.7)	1117 (17.3)	1153 (20.9)	808 (23.4)
40–59	7182 (34.6)	1038 (31.9)	730 (39.7)	1977 (36.8)	2493 (38.6)	2266 (41.0)	1538 (44.5)
60+	8794 (42.3)	1545 (47.5)	748 (40.7)	2211 (41.1)	2159 (33.5)	1427 (25.8)	734 (21.3)
Sex, female, n (%)	13,325 (64.1)	2147 (66.0)	1321 (71.9)	3205 (59.6)	4095 (63.5)	3682 (66.7)	2322 (67.2)
Married, n (%)	7772 (37.4)	1448 (44.5)	803 (43.7)	2579 (48.0)	2893 (44.8)	2300 (41.6)	1308 (37.9)
Alcohol use, n (%)	5654 (27.2)	957 (29.4)	577 (31.4)	1686 (31.3)	2014 (31.2)	1622 (29.4)	1027 (29.7)
Drug use, n (%)	692 (3.3)	59 (1.8)	26 (1.4)	79 (1.5)	125 (1.9)	138 (2.5)	111 (3.2)
Smoking status, n (%)							
Current	7316 (35.2)	974 (29.9)	613 (33.4)	1652 (30.7)	2144 (33.2)	1983 (35.9)	1433 (41.5)
Former	3570 (17.2)	571 (17.5)	287 (15.6)	879 (16.3)	932 (14.4)	750 (13.6)	435 (12.6)
Never	8653 (41.6)	1471 (45.2)	800 (43.5)	2530 (47.0)	2970 (46.0)	2442 (44.2)	1384 (40.1)
Unknown	1241 (6.0)	238 (7.3)	137 (7.5)	317 (5.9)	407 (6.3)	348 (6.3)	202 (5.8)
Number of comorbidities, median (IQR)							
Pre-index date	3 (1–5)	4 (2–6)	4 (2–6)	4 (2–6)	3 (2–5)	3 (2–5)	3 (2–5)
Post-index date	4 (2–6)	5 (3–6)	5 (3–7)	3 (1–5)	3 (1–5)	3 (1–5)	3 (1–5)
CCI at index date, median (IQR)	2 (0–4)	2 (1–4)	2 (0–4)	2 (0–3)	1 (0–3)	1 (0–2)	1 (0–2)

CCI, Charlson Comorbidity Index; ICD, International Classification of Disease; IQR, interquartile range; PHQ-9, Patient Health Questionnaire-9; SD, standard deviation.

Table 2
Comorbidities before index date.

Pre-index comorbidities (>10%)[a], n (%)	ICD-9/10 population (n=20,780)	PHQ-9 score ≥15 (n=8977)
Hypertension	8864 (42.7)	3255 (36.3)
Hyperlipidemia	8604 (41.4)	3837 (42.7)
Anxiety disorders	8169 (39.3)	4964 (55.3)
GI disorders (GERD, IBD, IBS)	7648 (36.8)	3680 (41.0)
Substance/alcohol use disorder	6771 (32.6)	3471 (38.7)
Cancer	6136 (29.5)	2460 (27.4)
Sleeping disorders	5255 (25.3)	3121 (34.8)
Type 2 diabetes	4088 (19.7)	1482 (16.5)
Asthma	3047 (14.7)	1730 (19.3)
Coronary heart disease	2700 (13.0)	749 (8.3)[b]
Fibromyalgia	2690 (12.9)	1385 (15.4)

GERD, gastroesophageal reflux disease; GI, gastrointestinal; IBD, inflammatory bowel disease; IBS, irritable bowel syndrome; ICD, International Classification of Disease; PHQ-9, Patient Health Questionnaire-9.

[a] Comorbidity before index date or a minimum of 2 years prior to the index date.

[b] Less than 10% for PHQ-9 score ≥15.

4). Medication costs were significantly higher for male patients and married patients, and increased with advancing age. Current smokers had significantly lower medication costs in the 12 months following a diagnosis of MDD.

An ICD-9/10 diagnosis of MDD and greater numbers of comorbidities significantly increased the odds of HRU (ED, PCP, and BH visits) (Table 3). A PHQ-9 score ≥15 was not significantly associated with changes in ED visits.

Advancing age was associated with significantly lower odds of ED and BH visits within 12 months of the index date, whereas a greater number of medications prescribed prior to index date was associated with greater odds of a PCP or ED visit (Table 3). A higher BMI increased the odds of a BH visit within 12 months, but decreased the odds of an ED or PCP visit (Table 3). Patients who were married had significantly lower odds of an ED visit, and current or former smokers were less likely to have a PCP visit (Table 3).

3.5. Treatment persistence

In a pooled analysis of patients with depression (ie, an ICD-9/10 and/or PHQ-9 diagnosis), within 6 months, ≥75% of patients discontinued their first antidepressant, regardless of drug class, but duration of persistence was highly variable for patients with an ICD-9/10 diagnosis (mean [SD] persistence, 197 [123] days) (Fig. 3). Median (IQR) for treatment persistence was 206 (72–325) days in the ICD-9/10 cohort, and 155–160 (56–327) days in the PHQ-9 15–19 and ≥20 cohorts combined.

The number of comorbidities pre-index date and an ICD-9/10 diagnosis were the only variables consistently associated with significantly longer medication persistence across most antidepressant classes. Advancing age was associated with shorter medication persistence for all antidepressant classes. A higher number of medications prescribed prior to index date was also associated with shorter persistence for selective serotonin reuptake inhibitors (SSRIs), serotonin-norepinephrine reuptake inhibitors (SNRIs), and norepinephrine-dopamine reuptake inhibitors (NDRIs), as was being married for SSRIs and tetracyclics, and being a current smoker for NDRIs. Increased BMI also shortened persistence with SNRIs, as did being a former smoker for other medications. A PHQ-9 score ≥15 was not associated with any differences in persistence (**Supplementary Figs. 5–9**).

4. Discussion

Our study identified wide variability and gaps in the postdiagnosis care of patients with MDD treated within an integrated healthcare system. Of note, patients diagnosed with depression in primary care had substantial delays between antidepressant prescribing and subsequent primary care visits. This is problematic, considering that more than three-fourths of patients discontinued their first antidepressant therapy within 6 months of prescribing. Furthermore, antidepressant switching was common in patients with characteristics that may be predictive of a greater engagement with the healthcare system, such as comorbidities, which also may drive HRU and costs.

This is consistent with earlier reports of patients with MDD in the United States receiving treatment in a primary care setting who often received suboptimal or delayed treatment (Unützer and Park, 2012). In addition, patients treated for depression in primary care may be less

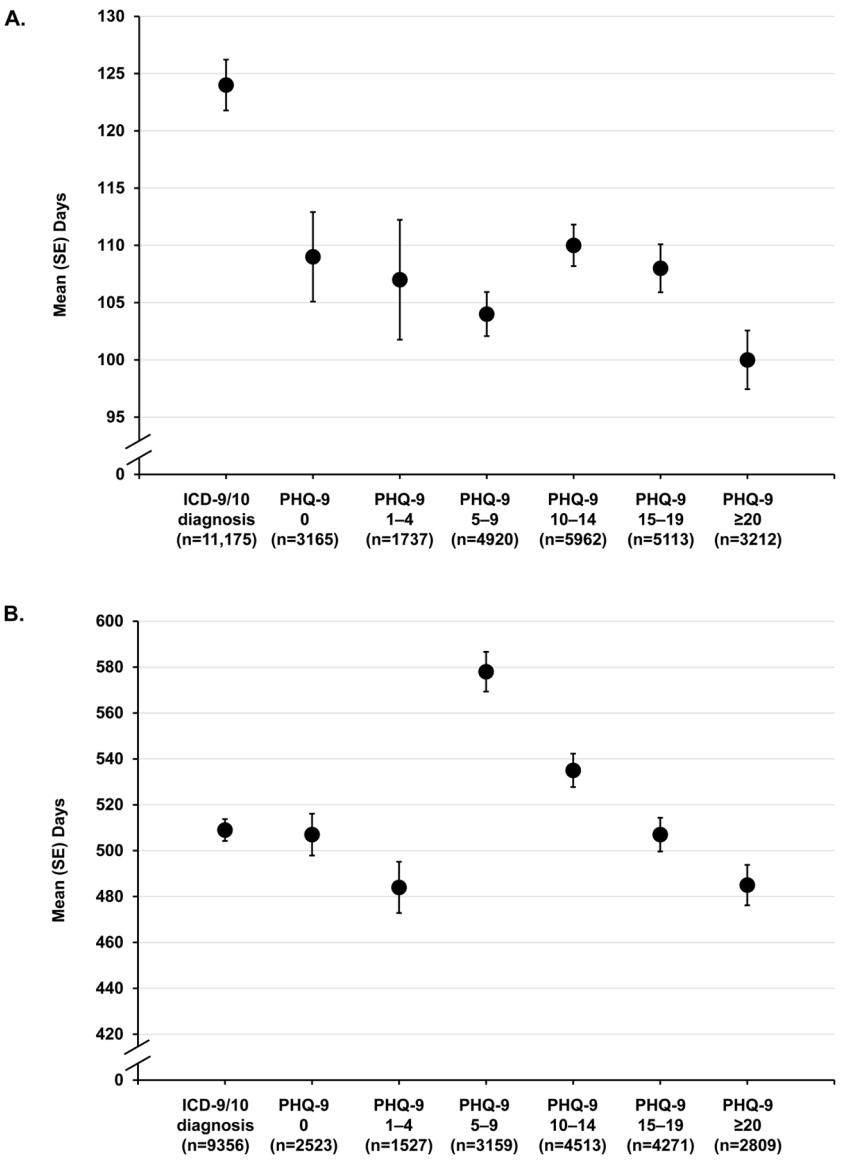

Fig. 2. Number of days to first BH visit following (A) the index date among patients with PCP visit during the study and (B) first antidepressant prescription among patients with PCP visit and antidepressant prescription. BH, behavioral health; ICD, International Classification of Disease; PCP, primary care provider; PHQ-9, Patient Health Questionnaire-9; SE, standard error.

Table 3
Logistic regression analysis of interactions between patients with MDD and healthcare providers within 12 months of index date.

Characteristic (N=17,834)	ED visit		PCP visit		BH visit	
	Odds ratio (95% Wald CI)	*P* value	Odds ratio (95% Wald CI)	*P* value	Odds ratio (95% Wald CI)	*P* value
Age	0.983 (0.980–0.985)	<0.0001	1.001 (0.998–1.004)	0.5628	0.972 (0.969–0.976)	<0.0001
Sex (male)	1.122 (1.040–1.211)	0.0029	1.055 (0.954–1.168)	0.2964	0.973 (0.880–1.076)	0.5959
BMI	0.990 (0.986–0.994)	<0.0001	0.988 (0.983–0.994)	<0.0001	1.006 (1.000–1.011)	0.0357
Married	0.878 (0.816–0.945)	0.0005	1.012 (0.916–1.119)	0.8148	1.039 (0.943–1.145)	0.4381
Alcohol use	0.851 (0.787–0.920)	<0.0001	1.059 (0.954–1.176)	0.2797	0.973 (0.878–1.080)	0.6095
Smoking status		0.3145		0.0013		0.0042
Current	1.064 (0.982–1.153)	0.1285	0.828 (0.744–0.920)	0.0005	0.848 (0.763–0.943)	0.0022
Former	1.026 (0.924–1.140)	0.6256	0.850 (0.733–0.986)	0.0314	1.011 (0.878–1.163)	0.8793
Never (reference)	-		-		-	
Number of comorbidities pre-index date	1.183 (1.161–1.205)	<0.0001	1.182 (1.148–1.217)	<0.0001	1.089 (1.063–1.116)	<0.0001
Total number of all medications prescribed prior to index date	1.021 (1.014–1.029)	<0.0001	1.155 (1.136–1.174)	<0.0001	1.009 (0.999–1.019)	0.0853
ICD-9/10 diagnosis	4.297 (3.985–4.633)	<0.0001	0.751 (0.672–0.839)	<0.0001	2.230 (2.013–2.471)	<0.0001
PHQ-9 ≥15	1.045 (0.965–1.132)	0.2824	1.132 (1.021–1.255)	0.0189	1.465 (1.325–1.621)	<0.0001

BH, behavioral health; BMI, body mass index; CI, confidence interval; ED, emergency department; ICD, International Classification of Disease; MDD, major depressive disorder; PCP, primary care provider; PHQ-9, Patient Health Questionnaire-9.

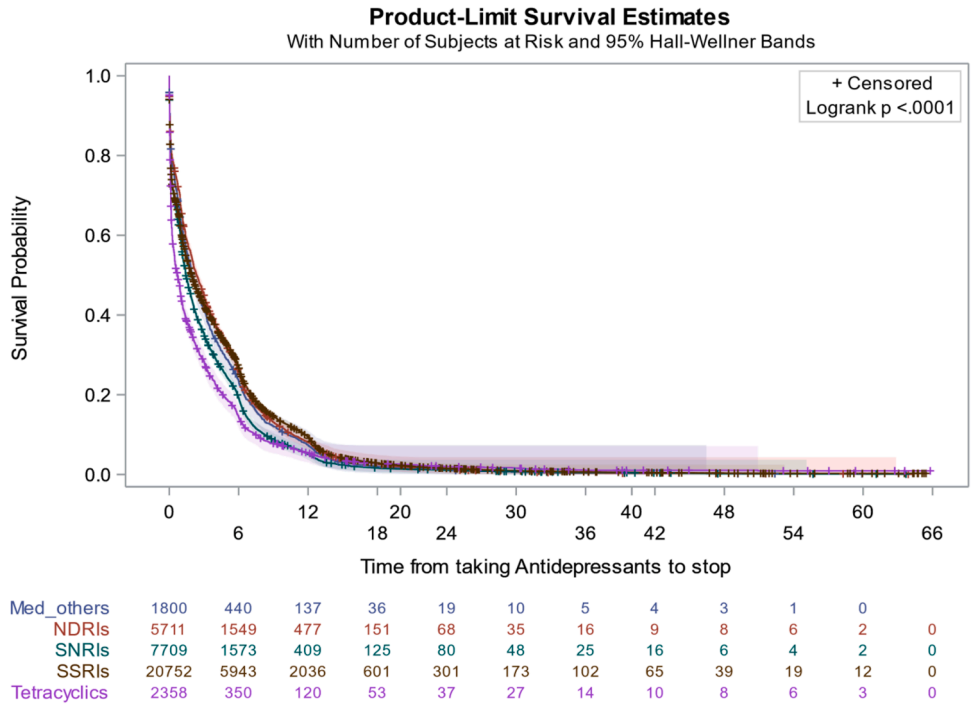

Fig. 3. Treatment persistence by medication class among patients with MDD. Shaded areas represent 95% Hall and Wellner bands. MDD, major depressive disorder; NDRI, norepinephrine-dopamine reuptake inhibitor; SNRI, serotonin-norepinephrine reuptake inhibitor; SSRI, selective serotonin reuptake inhibitor.

likely than patients treated in specialty care to receive treatment consistent with existing guidelines (Unützer and Park, 2012). These gaps may contribute to suboptimal management and potentially poorer clinical outcomes (Kraus et al., 2019). For example, Ghio and colleagues demonstrated that earlier treatment increased the probability of an earlier response to treatment and final remission, as well as reducing depression-related disability to a greater extent (Ghio et al., 2015). Likewise, Bukh and colleagues reported that the probability of remission was halved when treatment was delayed (Bukh et al., 2013).

Notably, patients diagnosed with MDD had a shorter time to first BH visit following the index date if they were older (per year of age), had comorbidities, had a high number of medications pre-index date, or had an ICD-9/10 diagnosis. Earlier reports have suggested that older patients may be aware of age-related factors that can lead to depression, such as loneliness and boredom, which could in turn drive engagement with healthcare professionals, reducing follow-up times (Stark et al., 2018). In addition, patients who are older, have prior comorbidities, or have polypharmacy may have higher HRU overall, suggesting that an earlier BH visit may be a function of greater engagement with the healthcare system rather than of necessarily being identified as being at higher risk of poor outcomes (Glynn, 2011). Likewise, healthcare professionals may be better acquainted with patients who have comorbidities, and potentially more vigilant with the overall management of their health. For example, knowledge of particular comorbidities, such as chronic diseases, and being associated with an increased risk of depression (Huang et al., 2010) may result in formal screening for depression among patients with comorbidities and more active engagement with and management of their medication. Screening of patients with comorbidities for depression may also be a confounding factor that leads to a formal ICD-9/10 code diagnosis rather than a PHQ-9 diagnosis, explaining the similarities in adherence patterns between these populations. However, more research is required to better understand potential factors underlying this finding.

The finding that men attended BH visits earlier than women is also consistent with previous reports of treatment patterns by sex. While women have higher rates of hospitalization for depression, they are 18% less likely than men to be hospitalized after presenting at an ED (Rost et al., 2011). In addition, men are more likely to receive specialist mental health services in addition to primary care support if they have poorer perceived mental health status, comorbid anxiety, or self-reported acceptability barriers, while these factors do not seem to affect access to specialist services for women (Gagné et al., 2014). Men also have been found to be more likely to be prescribed antidepressant therapy (Lytsy et al., 2019), suggesting that the intensity of care received by men with depression is often higher than that received by women overall.

A number of other reasons may underpin the delay in follow-up PCP and BH visits, with a key factor being barriers to patient scheduling of future visits (Colorafi et al., 2017). In particular, financial issues, availability of appointments, scheduling conflicts, perceived lack of physician concern, stigma, and convenience of accessing treatment have previously been identified as barriers to patients arranging follow-up (Colorafi et al., 2017; Stark et al., 2018; Whitebird et al., 2013). Furthermore, physicians have reported non–patient-related factors, such as reimbursement, the scarcity of mental health resources, and poor communication from healthcare service providers as barriers to earlier follow-up for patients with depression (Whitebird et al., 2013). Accordingly, if accessibility, affordability, and acceptability of care can be enhanced, these may prove to be effective mechanisms for reducing delays in subsequent visits from patients with depression (Colorafi et al., 2017). Alternatively, it has been suggested that delays in treatment could be due to patients' perceived lack of need (Roberts et al., 2018).

Antidepressant medications were also frequently switched, suggesting that treatment was not successful or well tolerated for a high proportion of patients, although the rates of medication switching in this study were consistent with those previously reported (Mars et al., 2017; Milea et al., 2010; Wu et al., 2013). It is unclear from the data available whether these switches were due to a lack of efficacy or tolerability, but it is reasonable to suggest that the increased risk of switching in patients with comorbidities may be linked to an interaction with their underlying conditions and any associated treatments. Likewise, as noted in other studies, treatment cost and HRU are generally more closely correlated with the presence of comorbidities and number of medications received than severity of depression (ie, higher PHQ-9 scores) (Robinson et al., 2016).

The low persistence rates at 6 months observed in this study (45%–54%) were consistent with rates noted in other studies (Bushnell et al., 2016; Ereshefsky et al., 2010; Jung et al., 2015; Keyloun et al., 2017), highlighting the need for earlier follow-up after a patient is diagnosed with MDD to ensure appropriate therapy is offered in a timely manner. The decreased rate of treatment persistence with age observed in this study, which is contrary to other studies that specifically examined SSRI or SNRI therapy (Bushnell et al., 2016; Wu et al., 2013), may also reflect greater engagement of older versus younger patients with the primary healthcare system, thereby facilitating earlier medication switching in response to a lack of treatment efficacy or tolerability. Earlier follow-up visits may also provide an opportunity for PCPs to support patients receiving suboptimal treatment (Henke et al., 2009; Unützer and Park, 2012), thus potentially preventing premature treatment discontinuation.

4.1. Limitations

We examined the care being provided for a large cohort of patients with MDD utilizing both EHR and claims data. Although we observed several notable trends, these data have several limitations. First, we partly defined MDD based on ICD codes, which have been shown in previous studies to not always accurately identify patients with MDD (Fiest et al., 2014). To supplement this identification, we used PHQ-9 scores. Focusing on these discrete individual factors alone may not lead to the call to action required to optimize care (Levis et al., 2019), and despite efforts to have all patients screened for depression at every primary care visit, compliance with this standard was not 100% during the study period. These limitations mean that we may have missed or misclassified incident cases of depression. Additionally, because patients could have both a qualifying PHQ-9 score and an ICD diagnosis, we were precluded from making robust direct comparisons between the 2 cohorts. Also, HRU, cost, and persistence data could be derived only from the subset of patients with claims data available in the Geisinger Health Insurance database, so detailed analysis of these outcomes was limited. Furthermore, this study was performed in a US setting, which may limit its generalizability. However, the findings are broadly similar to those reported in international settings in terms of inconsistent follow-up after a diagnosis of depression and poor adherence to treatment (Vuorilehto et al., 2016).

4.2. Future directions

Additional studies are required to understand why follow-up is delayed after patients are diagnosed with MDD, which may be particularly relevant for identifying and understanding the characteristics of the subset of patients who appear to experience comparatively long delays. For example, a short duration of treatment persistence and a long delay before subsequent follow-up may be reflective of a depressive episode rapidly resolving without any perceived need for further support; alternatively, it may reflect the symptoms of MDD, making it more difficult for patients to attend follow-up visits or persist with treatment.

Investigating whether delays in attending BH visits are a result of delayed implementation of guideline-recommended treatment in a primary care setting or the result of structural barriers to accessing treatment, such as a lack of appointment availability, could have an immense impact on reducing variability among patients with MDD who are managed in primary care. Such analyses also may identify opportunities for BH specialists to improve communication with PCPs or raise awareness of the utility of BH visits for managing patients with depression.

Likewise, understanding the key differences between patients receiving a PHQ-9 or ICD-9/10 diagnosis of depression and how that influences treatment is of interest given the moderate overlap between the 2 systems (Löwe et al., 2004). This suggests that a substantial proportion of patients with depression may not be diagnosed if relying on a single screening instrument, especially if the definition of depression is rigid.

5. Conclusions

Access to BH support is often highlighted as an area of unmet need for patients with MDD, particularly because BH support is recommended alongside antidepressant therapy in this patient population. Much attention and resources are often focused on diagnosis, access to healthcare, and therapeutic options, but a holistic approach may be required to improve overall outcomes. Despite the availability of clinical practice guidelines and algorithms to guide the care of patients with MDD, their care in a large integrated healthcare system is highly variable, with gaps between current and optimal care. Our work highlights potential targets for improving the care of patients with MDD. Optimizing the care of patients with MDD throughout their treatment journey may improve outcomes and reduce HRU.

Authors contribution

Sharon Larson had the idea for the study, drafted the first version of the paper, contributed substantially to the conceptualization and design of the study, revised the text for important intellectual content and approved the final version of the paper. Andrei Nemoianu contributed substantially to the conceptualization and design of the study, revised the text for important intellectual content and approved the final version of the paper. Debra F. Lawrence contributed substantially to the conceptualization and design of the study, revised the text for important intellectual content and approved the final version of the paper. Melissa A. Troup contributed substantially to the conceptualization and design of the study, revised the text for important intellectual content and approved the final version of the paper. Michael R. Gionfriddo contributed to the design of the study, interpretation of data, and drafting and approval of the manuscript. Bobak Pousti contributed substantially to the conceptualization and design of the study, revised the text for important intellectual content and approved the final version of the paper. Haiyan Sun conducted the analyses, contributed substantially to the conceptualization and design of the study, revised the text for important intellectual content and approved the final version of the paper. Faisal Riaz contributed substantially to the conceptualization and design of the study, revised the text for important intellectual content and approved the final version of the paper. Eric S. Wagner contributed substantially to the conceptualization and design of the study, revised the text for important intellectual content and approved the final version of the paper. Lambros Chrones contributed substantially to the conceptualization and design of the study, revised the text for important intellectual content and approved the final version of the paper. Maelys Touya contributed substantially to the conceptualization and design of the study, development of study protocol and analysis plan and interpretation of results.

Declaration of Competing Interest

Sharon Larson was an employee of Geisinger Health System at the initiation of the study and completed the work under contract between Geisinger and the Jefferson University College of Population Health. Andrei Nemoianu was an employee of Geisinger Health System at time of study. Debra F. Lawrence is an employee of Takeda Pharmaceuticals U.S.A., Inc. Melissa A. Troup is an employee of Geisinger Health System. Michael R. Gionfriddo was an employee of Geisinger Health System at time of study. Bobak Pousti was an employee of Geisinger Health System at time of study. Haiyan Sun was an employee of Geisinger Health System at time of study. Faisal Riaz is an employee of Takeda Pharmaceuticals U.S.A., Inc. Eric S. Wagner is an employee of Geisinger Health System. Lambros Chrones is an employee of Takeda Pharmaceuticals U.S.A., Inc. Maelys Touya is an employee of Lundbeck LLC.

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Supplementary materials

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