Disease Control Among Patients With Diabetes and Severe Depressive Symptoms

Journal of Primary Care & Community Health
2016, Vol. 7(2) 130–134
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sagepub.com/journalsPermissions.nav
DOI: 10.1177/2150131915627423
jpc.sagepub.com

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Abstract

Objective: Major depressive disorder and type 2 diabetes commonly co-occur and disease control tends to be poorer when both conditions are present. However, little research has examined the disease characteristics of patients with diabetes and more severe depressive symptoms. **Methods:** We report a retrospective observational study of 517 patients with diabetes from 2 primary care centers. Patients with diabetes and moderately-severe/severe depression symptoms (Patient Health Questionnaire [PHQ-9] score >15) were compared with patients with diabetes without moderate or severe depression symptoms (PHQ-9 score <15; the comparison group) with regard to control of diabetes, blood pressure, and lipid parameters. Frequency of HbA1c and PHQ-9 testing were also examined. **Results:** Patients with diabetes and moderately severe/severe depressive symptoms had higher HbA1c (7.56% vs 7.09%), diastolic blood pressure (78.43 vs 75.67 mm Hg), and low-density lipoprotein cholesterol (109.12 vs 94.22 mg/dL) versus the comparison group. Patients with diabetes and moderately-severe/severe depression underwent HbA1c and PHQ-9 testing with similar frequency to the comparison group. **Conclusions:** The presence of moderately severe/severe depressive symptoms was associated with poorer glucose, lipid, and blood pressure control among patients with diabetes. Further research should prospectively examine whether a targeted depression treatment goal (PHQ-9 score <15) in patients with diabetes results in improved control of these important disease parameters.

Keywords

diabetes, depression, major depressive disorder, preventive medicine, cardiovascular disease, lipids

Introduction

The co-occurrence of type 2 diabetes mellitus (T2DM) and major depressive disorder (MDD), demonstrating greater risk for one of these conditions in the presence of the other, has been well described.¹⁻³ Not only a diagnosis of MDD but also the symptoms of depression and their severity are associated with poorer diabetes control, greater cardiovascular risk, and greater mortality among patients with T2DM.⁴⁻⁸ The frequency with which these 2 conditions co-occur, together with their compounding risks suggests that a focused emphasis on the approach to treatment of these comorbid conditions may be necessary, especially in primary care settings where most patients with T2DM are managed.

Little research has examined the disease control of patients with T2DM who have moderately severe or severe depression. Historically, most research that has examined the bidirectional relationship between depression and diabetes has categorized depression as a dichotomous variable, without further investigation into symptom severity.⁹⁻¹¹ Yet,

if the depression symptoms themselves are responsible for poorer health outcomes among patients with diabetes,^{7,8} then the severity of those symptoms may represent a biological gradient of worsening glycemic control with more severe depressive symptoms.

One of the most widely used instruments for screening and assessment of depression in primary care is the Patient Health Questionnaire (PHQ-9). Scores are stratified into categories of mild (5-9), moderate (10-14), moderately severe (15-19), or severe depression symptoms (20-27).^{12,13}

The cross-sectional study reported here describes the disease characteristics of patients with T2DM and moderately severe or severe depression, defined as a PHQ-9 score

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Table 1. Characteristics of Severely Depressed and Nonseverely Depressed Patients.

Variable	PHQ-9 ≥ 15 (n = 97)	PHQ-9 <15 (n = 420)	P (t Test)
Age in years, mean (95% CI)	55.08 (52.38-57.78)	59.65 (58.40-60.91)	.002
Male, n (%)	36 (37.11)	136 (32.38)	.373
Systolic blood pressure in mm Hg, mean (95% CI)	128.71 (124.89-132.53)	128.12 (126.20-130.04)	.790
Diastolic blood pressure in mm Hg, mean (95% CI)	78.43 (76.37-80.49)	75.67 (74.49-76.84)	.022
HbA1c in %, mean (95% CI)	7.56 (7.18-7.94)	7.09 (6.94-7.24)	.023
Percent at HbA1c goal of <7%	52.6	63.6	.032
HDL in mg/dL, mean (95% CI)	45.05 (42.20-47.91)	45.83 (44.42-47.24)	.651
LDL in mg/dL, mean (95% CI)	109.12 (99.23-119.00)	94.22 (90.89-97.55)	.006
PHQ-9, mean (95% CI)	19.46 (18.66, 20.26)	6.52 (6.15, 6.89)	
Insurance status, n (%)			
Sliding fee health care assistance	30 (31.58)	71 (17.32)	.001
Medicaid	21 (22.11)	52 (12.68)	
Medicare	25 (26.32)	180 (43.90)	
Commercial insurance	19 (20.00)	104 (25.37)	
Indian Health Service	0	3 (0.73)	
No. of A1c measurements done, mean (95% CI)	1.94 (1.71-2.16)	1.98 (1.89-2.07)	.741
No. of PHQ-9 measurements done, mean (95% CI)	1.97 (1.66-2.28)	2.14 (1.89-2.38)	.401

Abbreviations: HbA1c, glycated hemoglobin; HDL, low-density lipoprotein; LDL, low-density lipoprotein; PHQ-9, Patient Health Questionnaire.

≥ 15 . This research was undertaken with the intent to describe the baseline level of disease control of patients with T2DM and moderately severe/severe depression in a natural primary care environment and, therefore, could be conceptualized as a quality prevalence study.¹⁴

Methods

Data were collected from electronic medical records of 2 primary care centers in a Midwestern community in the United States. Site A was a large health care system internal medicine clinic and site B was a federally qualified health center serving patients of lower socioeconomic status. Both sites have established procedures for managing patients with T2DM, including recommendations for obtaining PHQ-9 scores, and cardiovascular and diabetes control indicators. Data were gathered regarding the care and disease control measurements (the most recent available values of HbA1c, blood pressure, low-density lipoprotein [LDL] cholesterol, high-density lipoprotein [HDL] cholesterol, PHQ-9 score, the number of times that HbA1c and PHQ-9 measurements were recorded in the medical record and insurance status) of patients with T2DM during the year 2013. We excluded those who were younger than 18 years, or who had ICD-9 (International Classification of Diseases, Ninth Revision) diagnosis of chronic kidney disease, end stage renal disease, renal dialysis, personality disorders, bipolar disorder, psychotic behavior/disorders, other mood disorders, schizophrenia, dementia, and pregnancy at any time during and in the year preceding 2013. The initial sample was composed of 1817 patients with T2DM. We analyzed a

subset of this initial sample, looking only at patients with T2DM who had at least 1 PHQ-9 score ≥ 15 . This represented the portion of the initial sample with moderately severe or severe depression, consistent with the published validation and characterization of PHQ-9 scale scores.^{12,13}

The statistical software package SAS v. 9.4 for Windows was used to calculate summary statistics, differences in means and 95% confidence intervals. The *t* test was used to test for significance of observed differences in the means, and chi-square test was used to test for significance of observed differences among the proportions. Alpha of .05 was used for all tests.

Results

From the initial sample of 1817 patients, 517 patients had a PHQ-9 done during 2013. Of the 517 with a PHQ-9 done, 18.7% had a PHQ-9 score ≥ 15 , resulting in a sample size for the current study of 97 moderately severe/severely depressed patients with T2DM and a comparison group of 420 patients without depression symptoms (PHQ-9 score 0-4), or with mild or moderate depression (PHQ-9 score 5-14) and T2DM (Table 1). Of the 517 patients with a PHQ-9 done, 376 (72.7%) had a preexisting diagnosis of MDD.

Mean HbA1c, percentage of patients not at HbA1c goal of <7%, diastolic blood pressure, and LDL cholesterol for the moderately-severe/severely depressed patients were all significantly higher than those of the comparison group (Table 1). Mean age was significantly lower for the moderately severe/severely depressed group. Mean values for

systolic blood pressure and HDL cholesterol did not differ between groups. There was no significant difference between the moderately severe/severely depressed group and the comparison group in the number of times the PHQ-9 and HbA1c were measured, although the PHQ-9 was administered numerically more frequently in the comparison group. Significantly more patients in the moderately severe/severely depressed group were covered by a sliding fee or Medicaid insurance (53.7%) versus the comparison group (30%).

Discussion

Overall, poorer control of health measures relevant to T2DM treatment, including HbA1c, lipids, and blood pressure, was found in patients with T2DM and moderately severe/severe depression compared to those with milder depression. A significantly greater number of patients in the moderately severe/severely depressed group were above the goal HbA1c of <7% than in the comparison group. The difference of 0.47% in the mean HbA1c between the groups represents a similar HbA1c-lowering potential to several Food and Drug Administration–approved pharmacologic antidiabetic agents,^{15,16} though smaller than the 1% threshold suggested as a clinically meaningful HbA1c reduction when measuring quality of diabetes care (see Table 1).¹⁷ Further, the mean HbA1c of 7.56% in the severely depressed group represents a clinically important deviation from the American Diabetes Association (ADA) recommended goal of <7% for most patients with diabetes¹⁸ increasing these patients' risk for microvascular complications such as retinopathy.^{18,19}

The nearly 15-point elevation of the mean LDL values in the moderately severe/severely depressed group versus the comparison group is of moderate clinical importance. For most diabetes patients without clinical atherosclerotic cardiovascular disease, moderate-intensity statin therapy is recommended with the goal of lowering LDL level by 30% to 50% and thereby, reduce cardiovascular risk.²⁰ Conversely, the presence of severe depression with T2DM appears to be associated with elevation of the LDL level by approximately 16%, taking the cardiovascular risk calculation in the wrong direction. Evidence shows that increasing LDL cholesterol is associated with increased risk for cardiovascular disease such as coronary artery disease and major occlusive vascular events (nonfatal myocardial infarction, death from myocardial infarction, death from coronary heart disease and stroke).²¹⁻²³ Data regarding prescription of medications (including statin therapy) were inconsistently recorded and therefore, we are unable to comment on any potential difference in statin therapy prescribed or taken among the groups in this study. The difference in diastolic blood pressures between the severely depressed and the comparison group is unlikely to be clinically significant.

The significantly lower age among the moderately severe/severely depressed group versus the comparison group is interesting and deserves further study. Others have found a similar association of higher depression ratings among younger patients with diabetes.²⁴ Adaptation to and acceptance of disease, improved adherence and/or improved patient-provider relationships could be just a few of the many possible factors potentially contributing to this association.

The findings in this study suggest that moderately severe/severe depressive symptoms were associated with poorer T2DM disease control and possibly future poorer health outcomes. Further study should prospectively explore the relationship between severe depression symptoms and T2DM disease control markers such as HbA1c, blood pressure, and LDL and ascertain whether targeted treatment of depression to a goal PHQ-9 level can bring about improved control of these important T2DM outcomes. In addition, further study should be devoted to examination of the influence of other factors such as activity level, and dietary and alcohol intake on the relationship of depression symptom severity and T2DM disease control measures as these factors were not measured in our study.

The greater proportion of patients in the severely depressed group with sliding fee or Medicaid suggests an association between severe depression and lower socioeconomic status. This is not a new finding as it has been previously established that lower socioeconomic status is associated with higher rates of diabetes and depression²⁵ and greater severity of depression.²⁶ Low socioeconomic status is also often associated with reduced access to care. However, the similar rate of measurement of PHQ-9 and HbA1c between the severely depressed and comparison groups in our study, when viewed as a proxy for receipt of health care services, may indicate that moderately severe/severely depressed patients in this sample were receiving similar frequency of care.

This was a natural observational study to measure the baseline level of disease control among patients with T2DM and severe depression in a non-specialist primary care environment. The results suggest that moderately severe/severely depressed patients with T2DM may be at significant risk of having poorer diabetes and cardiovascular disease control than patients with T2DM in primary care settings. Despite established procedures for treating T2DM patients, those with more severe depression may be falling through the cracks. Quality improvement interventional studies are warranted in order to better target treatment of patients with T2DM and severe depression.

Limitations

Our study had several limitations. A retrospective design has limitations in the consistency and quality of data available. While an association was shown, the design of the

study prohibits assigning causation. We collected data only from sites A and B and therefore, cannot comment on care that may have been provided from other sources. When narrowing our sample to those diabetes patients with severe depression, our sample size became quite small. We did not collect data regarding prescription of diabetes medications or the specifics of antidepressants and are, therefore, unable to comment on differences in guideline-based pharmacotherapy or medication adherence between severely depressed and non-severely depressed patients. It is known that the presence of depression in diabetes may lead to poorer adherence to treatment,²⁷ which could have been the reason for the difference in HbA1c in this sample. Regardless, efforts to target severe depression symptoms in T2DM patients, including improving adherence, are warranted.

Conclusion

The presence of moderately severe/severe depression symptoms among patients with T2DM was associated with poorer diabetes and cardiovascular disease control outcomes when compared with nonseverely depressed diabetes patients. Further research should prospectively examine whether a targeted depression treatment goal (PHQ-9 <15) in patients with diabetes results in improved control of these important disease parameters.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research was partially funded by the Dean's Fund, College of Health Professions, North Dakota State University.

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