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The Association of Comorbid Depression with Intensive Care Unit Admission in Patients with Diabetes: A Prospective Cohort Study

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Abstract

Background—It is unknown if comorbid depression in patients with diabetes mellitus increases the risk of intensive care unit (ICU) admission.

Objective—This study examined whether comorbid depression in patients with diabetes increased risk of ICU admission, coronary care unit (CCU) admission, and general medical-surgical unit hospitalization, as well as total days hospitalized, after controlling for demographics, clinical characteristics, and health risk behaviors.

Method—This prospective cohort study included 3,596 patients with diabetes enrolled in the Pathways Epidemiologic Follow-Up Study. We assessed baseline depression with the Patient Health Questionnaire-9. We controlled for baseline demographics, smoking, BMI, exercise, hemoglobin A_{1c}, medical comorbidities, diabetes complications, type 1 diabetes, diabetes duration, and insulin treatment. We assessed time to any ICU, CCU and/or general medical-surgical unit admission using Cox proportional-hazards regression. We used Poisson regression with robust standard errors to examine associations between depression and total days hospitalized.

Results—Unadjusted analyses revealed that baseline probable major depression was associated with increased risk of ICU admission (Hazard Ratio (HR) 1.94, 95% Confidence Interval (95% CI)(1.34–2.81)), but was not associated with CCU or general medical-surgical unit admission. Fully adjusted analyses revealed probable major depression remained associated with increased risk of ICU admission (HR 2.23, 95% CI(1.45–3.45)). Probable major depression was also associated with more total days hospitalized (Incremental Relative Risk 1.64, 95% CI(1.26–2.12)).

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Potential Conflicts of Interest: Dr. Katon has received honorariums for lectures from Wyeth, Eli Lilly, Forest, and Pfizer pharmaceutical companies and serves on the Advisory Board for Eli Lilly and Wyeth. Dr. Von Korff has received grant funding from Johnson & Johnson. Dr. Ciechanowski is CEO and founder of Same Page, Inc., a consulting company providing services for improving patient-provider relationships. Dr. Lin has received honorariums from Health Star Communications and Prescott Medical. Drs. Davydow, Russo, and Ludman, and Ms. Oliver, have no potential conflicts of interest to disclose.

Conclusions—Patients with diabetes and comorbid depression have a greater risk of ICU admission. Improving depression treatment in patients with diabetes could potentially prevent hospitalizations for critical illnesses and lower healthcare costs.

INTRODUCTION

Diabetes mellitus is a serious public health burden, accounting for substantial morbidity,[1,2] disability,[3] mortality,[4] and healthcare costs. For a single patient, diabetes and its complications account for up to $3,225 of excess medical costs per hospital day.[5] Moreover, poorly controlled diabetes is a known risk factor for critical medical illnesses such as acute myocardial infarction,[6] heart failure,[7] and sepsis,[8] often requiring admission to an intensive care unit (ICU) for treatment, where medical care costs per day can average up to $3,518 per patient.[9]

In addition to impaired physical health, patients with diabetes frequently have comorbid affective illness. Approximately 11–15% of patients with diabetes mellitus are afflicted with coexisting major depression.[10] As with other chronic medical illnesses, diabetes and comorbid mental disorders such as major depression are bidirectionally related.[11] Major depression can contribute to bio-behavioral risk factors for diabetes such as obesity and sedentary lifestyle, in turn leading to the development of diabetes and its complications, which can ultimately lead to exacerbations of depressive symptoms.[11] In support of this model, comorbid major depression has been found to be associated with poor glycemic control in patients with diabetes,[12] increased risk of macrovascular and microvascular complications,[13] as well as increased healthcare costs relative to patients with diabetes alone.[14] Depression has also been shown to be an independent predictor of increased mortality in patients with type 2 diabetes.[15]

Since patients with diabetes are at increased risk for major depression, and depression has been shown to increase the risk of poor glycemic control and greater numbers of complications, depression could represent a potentially modifiable risk factor for costly outcomes such as ICU and non-critical hospitalizations. Hospitalization costs in patients with diabetes account for up to 50% of total medical costs each year.[5] Depression screening programs coupled with quality improvement treatment programs such as collaborative care could lead to reduced healthcare costs and improved outcomes. To our knowledge, no studies have ascertained whether depression independently increases the risk of initial ICU admission. One study found that a history of depression was a risk factor for readmission to an ICU during the same hospital stay.[16] Moreover, prior studies examining the role of major depression in increasing the risk of hospitalization or rehospitalization for a medical illness have had small sample sizes,[17,18] have not been prospective in design,[19,20] or were limited to patients over the age of 60.[19–22]

The Pathways Study was a prospective population-based cohort investigation examining the potential adverse impact of major depression in primary care patients with diabetes. The aim of the current investigation was to utilize the Pathways Epidemiologic Follow-Up Study to extend beyond prior investigations by examining whether comorbid depressive symptoms in patients with diabetes mellitus would increase the risk of any hospitalization for medical illness, and particularly ICU admission. We hypothesized that patients with comorbid depression and diabetes would be at greater risk of any hospitalization, including ICU, cardiac care unit (CCU), and general medical-surgical unit admissions than patients with diabetes alone, after adjusting for baseline demographic, health risk behaviors and clinical characteristics. In addition, we hypothesized that comorbid depression in patients with diabetes would be associated with a greater total number of hospital days for medical illness than patients with diabetes alone.

METHODS

The Pathways Epidemiologic Follow-Up Study was developed by a multidisciplinary team from the University of Washington and Group Health Cooperative (GHC) Research Institute. GHC is an integrated health care system with 30 primary care clinics caring for approximately 523,000 patients in western Washington State. The study protocol was reviewed and approved by institutional review boards at the University of Washington and GHC.

Setting

Nine GHC clinics were selected for this study based on the following three criteria: 1) clinics with the largest populations of patients with diabetes, 2) clinics located within a 40-mile geographic radius of Seattle, and 3) clinics with the greatest amount of ethnic and racial diversity.

Patient Population

The cohort for the Pathways Epidemiologic Follow-Up Study was initially sampled between 2000 and 2002. Patients enrolled in the Group Health Diabetes registry were recruited for the study based on previously described eligibility criteria.[23,24] Permission to review medical records was obtained for 4,128 patients enrolled in the original Pathways study. Nonconsenting patients were more often younger, female, non-white, less educated, had a shorter duration of diabetes, a lower mean body mass index (BMI), a lower mean hemoglobin A1C (HbA_{1C}), and had less medical comorbidity.[25]

Predictor of Interest

The predictor of interest was baseline probable major depression as ascertained by the Patient Health Questionnaire-9 (PHQ-9), [26] which was obtained from a mailed baseline survey. This questionnaire can be utilized as a continuous measure of depressive symptom severity. In addition, patients with a PHQ-9 score ≥ 10 with ≥ 5 symptoms scored as being present for half of the days or more for at least 2 weeks (with one of the symptoms being either depressed mood or anhedonia) have symptoms suggestive of the diagnosis of major depression. Patients with two to four depressive symptoms for more than half the days for at least 2 weeks (with one of the symptoms being either depressed mood or anhedonia) have symptoms suggestive of minor depression. The PHQ-9 threshold for a probable case of major depression has been found to have high sensitivity (73%) and specificity (98%) for the diagnosis of major depression based on structured psychiatric interview.[26]

Potential Confounders

Potential confounders were obtained from the mailed baseline survey, which included questions regarding sociodemographic characteristics (e.g., age, sex, race, educational level, and marital status), diabetes characteristics (age at onset, diabetes type, duration of diabetes, initial treatment prescribed, and type of current treatment), as well as questions regarding height and weight (used to compute BMI), smoking status, and physical activity from the Summary of Diabetes Self-Care Questionnaire.[27] Baseline non-diabetic medical comorbidity was measured with the RxRisk, an automated pharmacy-based data model.[28] Severity of diabetic complications was measured using the Diabetes Complications Severity Index (DCSI), an automated-data derived measure of diabetic complications based on International Classification of Disease-9th Revision diagnostic codes for diabetic complications and laboratory tests.[29] Both RxRisk and DCSI predict subsequent medical costs and mortality.[28, 29] HbA_{1c} was also obtained from medical records.

Outcomes of Interest

We report on all ICU, CCU, and general medical-surgical unit hospitalizations that occurred over a 3 year period beginning in March 2003, other than admissions due to mental health conditions (with the exception of delirium or dementia). All eligible hospitalizations were for a minimum of 24 hours. Although enrollment into the Pathways Study began in March 2001, we could not differentiate the type of hospital admission (i.e., ICU, CCU, or general medical-surgical unit) due to lack of location codes for the first two years. Additionally, depression can be a prodromal symptom of failing health or secondary to downward trajectory of medical illness. For these reasons, we do not report on any hospitalizations that occurred in the first two years of the study. Information regarding hospital admission was obtained via automated data abstraction. We also obtained information regarding total inpatient healthcare costs from automated data abstraction. GHC's cost accounting system assigns budget-based costs instead of charges (i.e., the costs of providing the services) for healthcare services provided at GHC facilities. Healthcare services provided at non-GHC facilities are assigned the cost paid by GHC. Time to any hospitalization was censored at the end of the study, death, or the time of disenrollment.

Statistical Analysis

We used one-way analysis of variance (ANOVA) to examine univariate associations between continuous baseline demographic and clinical characteristics and no depression or probable major or minor depression. We used χ^2 tests to ascertain univariate associations between categorical baseline variables and no depression or probable major or minor depression. We also computed the mean total inpatient healthcare costs (with 95% Confidence Intervals (95% CIs)) for each depression group over the 3 year follow-up period.

In order to examine potential associations between probable major or minor depression and hospitalizations, we used Cox-proportional hazards regression models. First, we tested the effect of baseline probable major or minor depression on time to first hospitalization without adjustment, using the group without baseline depression as the reference group. We then added three groups of potential confounding variables to the regression model, including demographic variables (i.e., age, sex, race, marital status, and education), clinical variables including RxRisk scores (categorized into quartiles), DCSI scores, baseline HbA_{1c}, duration of diabetes, type 1 diabetes diagnosis, and whether or not the patient was taking insulin, and self-care characteristics such as BMI, smoking status, and sedentary lifestyle, as well as enrollment status in the Pathways randomized controlled trial[30] (which attempted to improve depression outcomes of patients with depression and diabetes), in order to adjust for potential intervention effects on reducing the risk of hospitalization in the regression model. We used these proportional hazards models to examine potential associations between baseline probable major or minor depression and time to first ICU, CCU, and/or general medical-surgical unit admission. We tested the proportionality assumption for each of the proportional hazards models and found that none of the models were in violation.

To examine the effects of probable major or minor depression on the total number of hospital days for medical illnesses, we first calculated the proportion of hospitalized patients among depression groups and tested these proportions using χ^2 tests. We then used one-way ANOVA models with Bonferroni corrections for multiple comparisons to examine associations between baseline depression status and the total number of days hospitalized among the entire cohort as well as only among those hospitalized; because the total number of hospitalized days was non-normally distributed across the depression groups, we log-transformed hospitalized days for this analysis. Next, we used Poisson regression models with robust standard errors to adjust for potential confounders. The regression models were developed in a similar fashion to the proportional hazards models, beginning with an

unadjusted model followed by the addition of demographics, then baseline clinical characteristics, and finally baseline self-care characteristics as well as enrollment status in the randomized controlled trial. As a sensitivity analysis, we also used zero-inflated negative binomial regression models to adjust for potential confounding variables.[31] Since we found no differences in the results between the two methods, we will report the results of the Poisson models. Analyses were performed with appropriate components of the IBM SPSS Statistics 18 (SPSS Inc., Chicago, IL, USA) and STATA 11 (Stata Corporation, College Station, TX, USA) statistical software programs.

RESULTS

Of the 4,128 patients who consented for medical record review, 231 died and 298 disenrolled from GHC during the first 2 years of the Pathways Epidemiologic Study, 3 patients died on their first day of eligibility for analysis (Figure 1), and 5 patients did not have measures for baseline depression status, leaving 3,591 participants for the current investigation.

Approximately 19% of patients had baseline probable major (11.2%) or minor (7.9%) depression. Compared to patients with minor depressive symptoms or no depression, patients with probable major depression at baseline were younger and more likely to be female, unmarried, smokers, and physically inactive. They also had higher mean RxRisk scores, greater severity of diabetic complications, higher mean HbA_{1C} levels, higher mean BMI, and were more likely to be treated with insulin (Table 1). Furthermore, patients with probable major depression at baseline had higher mean total inpatient healthcare costs over the 3 year follow-up period ($12,447, 95% CI($9,416–$15,477)) compared to patients without depression ($6,700, 95% CI($6,050–$7,350)) or patients with probable minor depression ($6,845, 95% CI($4,854–$8,837)).

During the 3 year follow-up period, a total of 1,182 patients with diabetes were hospitalized at least once, including 193 patients with at least one ICU admission, 187 patients with at least one CCU admission, 742 patients with at least one general medical-surgical unit admission, and 60 patients with both ICU and CCU admissions. Among the entire cohort and the 1,182 patients who were hospitalized, patients with baseline probable major depression had a greater number of days hospitalized for medical illnesses compared to those without depressive symptoms or those with probable minor depression (Table 2).

Unadjusted analyses found that baseline probable major depression was associated with a 1.94-fold increased risk of ICU admission (95% CI(1.34–2.81)) and a 1.95-fold greater risk for more inpatient days over the 3 year follow-up period (95% CI(1.50–2.54)). Additionally, there were non-significant trends for an association between baseline probable major depression and both CCU admission (Hazard Ratio (HR) 1.36, 95% CI(0.89–2.08)) and general medical-surgical unit admission (HR 1.18, 95% CI(0.94–1.47)). After adjusting for demographics, baseline probable major depression in patients with diabetes was associated with a 2.41-fold greater risk of ICU admission (95% CI(1.65–3.52)), a 1.66-fold greater risk of CCU admission (95% CI(1.08–2.55)), a 1.35-fold greater risk of general medical-surgical unit admission (95% CI(1.08–1.70)), and a 2.28-fold greater likelihood of having more total hospital days (95% CI(1.76–2.96)). When baseline illness severity and other clinical measures were included in the analysis, patients with diabetes and baseline probable major depression had a 1.89-fold greater risk of ICU admission (95% CI(1.28–2.79)), and a 1.71-fold greater likelihood of spending more days hospitalized (95% CI(1.35–2.16)). However, the associations with CCU admission (HR 1.31, 95% CI(0.85–2.04)) and general medical-surgical unit admission (HR 1.21, 95% CI(0.96–1.52)) were no longer statistically significant. After adjusting for demographics, baseline clinical characteristics, health-risk

behaviors, and enrollment status in the Pathways Randomized controlled trial, baseline probable major depression in patients with diabetes was the single strongest factor associated with ICU admission (Figure 2). Non-significant trends for an association between baseline probable major depression and both CCU and general medical-surgical unit admission remained in the final adjusted model (Table 3).

Baseline probable minor depression was not associated with ICU, CCU, or general medical-surgical unit hospitalizations or total number of days hospitalized in any of the models.

DISCUSSION

In this prospective investigation of patients with diabetes, probable major depression at baseline was the single strongest factor associated with ICU hospitalization, as well as more days spent hospitalized, even after adjusting for baseline medical comorbidity and diabetic complication severity. The present study is the first to identify depression as a prospective risk factor for ICU admission. The association between depression and ICU admission in patients with diabetes found in this study builds upon the findings of prior studies[15] that comorbid depression in patients with chronic medical illnesses increases the risk of dire outcomes. While the associations between depression and CCU or general medical-surgical unit admission did not reach statistical significance in the fully adjusted models, there were trends towards greater risk amongst patients with baseline probable major depression, suggesting that the present study may have lacked statistical power to detect these associations. Prior investigations in elderly populations have identified depression as a predictor of hospitalization for medical illnesses.[19–22] However, to our knowledge, the present study is the first to find that depressive symptoms were associated with hospitalizations in a cohort that includes only patients with diabetes and patients of mixed ages.

Increased medical comorbidity and diabetes complication severity were also associated with hospitalizations and days hospitalized in the fully adjusted model. Evidence suggests that depression and diabetes complications may be bidirectionally related. Depression has been shown to be a risk factor for development of macro- and microvascular complications,[12] and incident diabetes macrovascular complications have been shown to be a risk factor for depression.[32] In our model that controlled for diabetes complications, the effect of depressive symptoms may be diminished by “over-controlling” for diabetes complication severity due to depression. Randomized controlled trials of enhanced depression treatment in patients with diabetes have demonstrated improvements in depressive symptoms,[30,33] including among patients with increased burden of diabetic complications,[34] and new interventions are being designed to translate improved depression treatment in patients with diabetes into improvements in medical outcomes.[35]

In patients with diabetes, depressive symptoms may be associated with increased risk of ICU admissions because of both behavioral and biological factors. Depression in patients with diabetes is known to be associated with poor adherence to self-care behaviors (i.e., exercise, diet, smoking cessation),[11, 12, 36] decreased adherence to disease controlling medications (i.e., oral hypoglycemic, lipid-lowering, and anti-hypertensive agents),[36] and an increased risk of having multiple cardiac risk factors,[24] all factors also associated with increased risk for critical illnesses.[37,38] Depression is also associated with increased inflammation,[39] as well as abnormalities in the hypothalamic-pituitary-adrenal axis which lead to chronic glucocorticoid elevations,[39] increasing the risk of severe infectious processes due to immunosuppression.[40,41] Moreover, chronic glucocorticoid elevation may directly damage brain areas such as the hypothalamus,[42,43] increasing the risk of dementia, a risk factor for medical hospitalization in elderly patients when comorbid with depression.[21]

Improved recognition and treatment of depression in patients with diabetes may produce substantial reductions in healthcare costs through reductions in hospitalizations for medical illnesses. Approximately one in every five healthcare dollars in the U.S. is spent on patients with diabetes, and inpatient medical treatment accounts for 50% of all healthcare costs attributable to diabetes.[5] Furthermore, depression prior to a critical illness may be associated with an increased risk of major depression in the months post-ICU,[44] potentially increasing the risk of ICU recidivism in depressed patients with diabetes. A previous study of an intervention targeted at reducing depressive symptom burden in elderly patients found that improvements in depression status were associated with reduced inpatient medical admissions and overall decreases in healthcare costs,[45] and studies of enhanced depression treatment in patients with diabetes have found reductions in outpatient medical costs,[46] as well as a trend towards decreased healthcare costs overall.[47] Since inpatient medical treatment accounts for as high as 50% of the healthcare costs in patients with diabetes, investigations that examine the impact of effective depression treatment in patients with diabetes on ICU admissions are needed.

Several important limitations of the present study are noted. First, because a substantial number of patients eligible for the Pathways Epidemiologic Study were either lost to follow-up or did not grant permission for medical record review, there is the potential that non-response bias may affect our results. Second, although our models controlled for clinical severity of diabetes and medical comorbidity, we cannot exclude the possibility that depression in our sample was secondary to impending failing health, and was therefore a proxy for severe medical illness. Third, since baseline depressive symptoms were assessed using a questionnaire (i.e., PHQ-9), and not a structured or semistructured diagnostic interview, a diagnosis of major depression could not be made, hence the use of the phrases “probable major depression” or “symptoms suggestive of major depression” throughout. An additional limitation is that self-report of baseline factors such as physical inactivity, smoking, and BMI may not accurately reflect subsequent health behaviors over the follow-up period. Also, we only measured depression at baseline and depression status may have changed over the follow-up period. However, the Pathways randomized controlled trial found that over 70% of patients with a PHQ-9 score ≥ 10 reported that they had been depressed for more than 2 years.[30] In addition, our investigation may have lacked statistical power to detect significant associations between baseline probable major or minor depression and CCU or general medical-surgical unit admissions. Moreover, this study was completed in only one geographic region of the U.S., potentially limiting generalizability. Also, because over 20% of our sample did not fill out the question on income, we did not include this variable in our analyses; however, educational level is an acceptable proxy for socioeconomic status. Finally, due to the observational nature of the present investigation, the possibility of residual confounding does exist.

In conclusion, comorbid depression in patients with diabetes is associated with increased risk of ICU admissions. Furthermore, patients with diabetes and comorbid depression are at increased risk of spending more days hospitalized. In the absence of additional studies, clinicians should include assessment and treatment of depression to other preventive measures such as treating comorbid medical conditions and reducing diabetic complications to reduce critical illness-related admissions among patients with diabetes.

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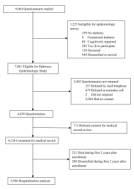
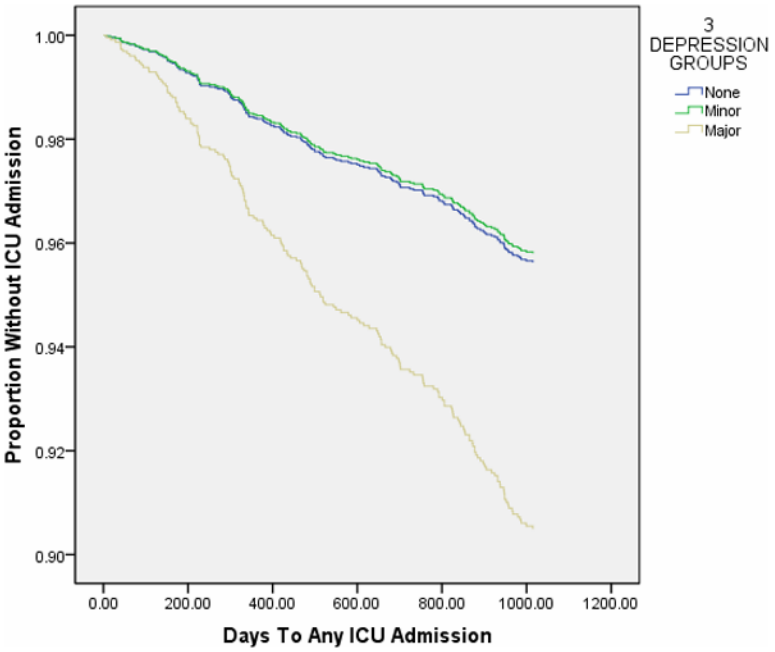


Figure 1.
Recruitment of epidemiologic cohort study to assess hospitalizations



Abbreviations: ICU = intensive care unit.

Figure 2.

Time to first intensive care unit admission for Pathways epidemiologic cohort by depression group

Abbreviations: ICU = intensive care unit.

Table 1

Baseline characteristics by depression grouping

Variables	Total (n = 3,591)[a]	No Depression (n = 2,904)	Minor Depression (n = 284)	Major Depression (n = 403)	Test Statistics[b]
Age	63.5 (13.1)	64.1 (13.0)	63.9 (13.3)	58.9 (13.4)	$F = 28.38^{\ddagger}$
Female	1,740 (48.5%)	1,355 (46.7%)	144 (50.7%)	241 (59.8%)	$\chi^2 = 25.10^{\ddagger}$
Married	2,328 (64.8%)	1,920 (66.1%)	184 (64.8%)	224 (55.6%)	$\chi^2 = 17.22^{\ddagger}$
Non-white	675 (18.8%)	522 (18.0%)	74 (26.1%)	79 (19.6%)	$\chi^2 = 11.26^{\dagger}$
Education beyond high school	2,741 (76.3%)	2,252 (77.5%)	191 (67.3%)	298 (73.9%)	$\chi^2 = 16.60^{\ddagger}$
RxRisk score	3,063.1 (2,355.0)	3,028.2 (2,313.2)	3,227.7 (2,357.8)	3,198.8 (2,631.7)	$F = 1.68^{*}$
DCSI	1.7 (1.8)	1.6 (1.8)	1.9 (2.0)	2.0 (2.1)	$F = 11.05^{\ddagger}$
Years since diabetes diagnosis	9.5 (9.4)	9.4 (9.5)	10.6 (10.0)	9.4 (8.2)	$F = 2.04^{*}$
HbA_{1C}	7.8 (1.5)	7.7 (1.5)	7.9 (1.6)	8.1 (1.6)	$F = 13.03^{\ddagger}$
Currently requiring insulin	1,051 (29.3%)	800 (27.5%)	89 (31.3%)	162 (40.2%)	$\chi^2 = 27.99^{\ddagger}$
Type 1 Diabetes	152 (4.2%)	132 (4.5%)	6 (2.1%)	14 (3.5%)	$\chi^2 = 4.43^{*}$
BMI	31.6 (7.1)	31.0 (6.7)	32.2 (7.2)	35.1 (9.1)	$F = 62.96^{\ddagger}$
Current smoking	294 (8.2%)	202 (7.0%)	29 (10.2%)	63 (15.6%)	$\chi^2 = 37.13^{\ddagger}$
Exercise					
≤1 day per week	1,138 (31.7%)	832 (28.7%)	123 (43.3%)	183 (45.4%)	$\chi^2 = 65.15^{\ddagger}$
2–7 days per week	2,453 (68.3%)	2,072 (71.3%)	161 (56.7%)	220 (54.6%)	
PHQ-9 Score	5.6 (5.5)	3.6 (3.3)	9.7 (2.2)	16.7 (3.8)	$F = 3{,}151.24^{\ddagger}$

All values are mean ± SD or *n* (%) unless otherwise indicated.

Abbreviations (in alphabetic order): BMI = body mass index; DCSI = Diabetes Complications Severity Index; HbA_{1C} = glycosylated hemoglobin; PHQ-9 = Patient Health Questionnaire-9; RxRisk = Non-diabetic medical comorbidity measure.

[a] Five subjects did not have measures for depression status.

[b] F-statistic with 2,3588 degrees of freedom or Pearson χ^2 with 2 degrees of freedom.

* $P < 0.05$

† $P < 0.01$

$^{\ddagger}P < 0.001$

Table 2

Total hospital days for medical illness over the 3 year period by depression grouping

Variables	Total (n = 3,591)[a]	No Depression (n = 2,904)	Minor Depression (n = 284)	Major Depression (n = 403)	Test Statistics
n (%) with any hospitalization	1,182 (33)	926 (32)	94 (33)	162 (40)	$\chi^2 = 11.2$[b†]
Total hospital days over 3 year period (n=3,591)[a]	2.8 (7.6)	2.5 (6.7)	2.9 (7.0)	4.9 (12.2)	F = 17.9[c‡]
Total hospital days over 3 year period among hospitalized (n=1,182)	8.6 (11.2)	7.9 (9.9)	8.9 (9.7)	12.2 (16.8)	F = 10.4[d‡]

All values are mean ± SD unless otherwise indicated.

[a] Five subjects did not have measures for depression status.

[b] Pearson χ^2 with 2 degrees of freedom.

[c] F-statistic with 2, 3588 degrees of freedom

[d] F-statistic with 2, 1178 degrees of freedom

* P < 0.05

† P < 0.01

‡ P < 0.001

Table 3

Fully adjusted associations of baseline depression and hospital admission groups

Baseline Variables	ICU Admission, Hazard Ratio (95% CI)	CCU Admission, Hazard Ratio (95% CI)	General Medical-Surgical Unit Admission, Hazard Ratio (95% CI)	Total Hospital Days, Incremental Relative Risk (95% CI)
Major depression	2.23 (1.45 – 3.45) ‡	1.21 (0.73 – 2.01)	1.19 (0.91 – 1.55)	1.64 (1.26 – 2.12) ‡
Minor depression	0.96 (0.55 – 1.67)	0.82 (0.47 – 1.44)	1.05 (0.80 – 1.36)	1.01 (0.76 – 1.33)
Age	1.01 (1.00 – 1.03)	1.03 (1.02 – 1.05) ‡	1.02 (1.01 – 1.03) ‡	1.02 (1.02 – 1.03) ‡
Male	1.22 (0.89 – 1.66)	1.22 (0.89 – 1.68)	0.80 (0.68 – 0.93) †	0.96 (0.81 – 1.15)
Non-white	0.65 (0.41 – 1.02)	1.32 (0.90 – 1.92)	0.74 (0.59 – 0.92) †	0.99 (0.77 – 1.27)
Single	0.96 (0.70 – 1.32)	1.27 (0.93 – 1.75)	1.06 (0.91 – 1.25)	1.08 (0.90 – 1.28)
< HS education	1.09 (0.78 – 1.50)	1.25 (0.90 – 1.72)	1.02 (0.86 – 1.21)	1.08 (0.91 – 1.29)
RxRisk score	1.36 (1.14 – 1.62) †	1.22 (1.01 – 1.46)*	1.22 (1.12 – 1.33) ‡	1.31 (1.18 – 1.45) ‡
DCSI	1.15 (1.06 – 1.24) ‡	1.16 (1.07 – 1.25) ‡	1.11 (1.07 – 1.16) ‡	1.16 (1.11 – 1.21) ‡
Years since diabetes diagnosis	1.00 (0.99 – 1.02)	1.02 (1.00 – 1.03)	1.00 (1.00 – 1.01)	1.00 (0.99 – 1.01)
HbA_{1c}	1.02 (0.92 – 1.13)	1.04 (0.94 – 1.16)	1.02 (0.97 – 1.08)	1.07 (0.99 – 1.15)
Currently requiring insulin	1.26 (0.89 – 1.79)	1.09 (0.76 – 1.57)	0.95 (0.79 – 1.15)	1.01 (0.84 – 1.22)
Type 1 diabetes	0.78 (0.30 – 2.07)	1.40 (0.58 – 3.37)	0.78 (0.46 – 1.32)	1.16 (0.60 – 2.27)
BMI	1.00 (0.98 – 1.03)	1.02 (1.00 – 1.04)	0.99 (0.98 – 1.00)	1.01 (0.99 – 1.02)
Current smoking	0.94 (0.50 – 1.75)	0.95 (0.49 – 1.83)	1.41 (1.07 – 1.85)*	1.33 (0.97 – 1.81)
Sedentary lifestyle	0.99 (0.72 – 1.36)	1.39 (1.02 – 1.88)*	1.11 (0.95 – 1.30)	1.19 (1.00 – 1.42)
Enrolled in RCT	0.63 (0.34 – 1.18)	0.94 (0.49 – 1.79)	1.02 (0.74 – 1.41)	0.97 (0.69 – 1.35)

*P < 0.05

†P < 0.01

‡P < 0.001

Abbreviations (in alphabetic order): CI = confidence interval; BMI = body mass index; CCU = coronary care unit; DCSI = Diabetes Complications Severity Index; HbA_{1c} = glycosylated hemoglobin; HS = high school; ICU = intensive care unit; RCT = randomized controlled trial; RxRisk = Non-diabetic medical comorbidity measure.