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The effect of changes in depressive symptoms on disability status in patients with diabetes

Hsiang Huang¹, Joan Russo¹, Michael Von Korff², Paul Ciechanowski¹, Elizabeth Lin², Evette Ludman², and Wayne Katon¹

¹Department of Psychiatry & Behavioral Sciences, University of Washington Medical School, Seattle, WA

²Group Health Research Institute, 1730 Minor Ave, Suite 1600, Seattle, WA

Abstract

Objective—To examine the association between changes in depressive symptoms and disability status in patients with diabetes.

Methods—This 5-year prospective cohort study included 2,733 patients with diabetes enrolled in the Pathways Epidemiologic Follow-Up Study who had completed depression and activities of daily living questionnaires at baseline and 5 years. Four depression groups were created using changes in depression scores over 5 years: No depression, improved depression, persistent depression, and development of depression. After controlling for sociodemographic and clinical characteristics, we examined the association between changes in depressive symptoms and incident disability at 5 years using Poisson regression.

Results—In patients nondisabled at baseline (n=2,155), the improved depression group had a risk of disability comparable to the no depression reference group (Relative Risk (RR): 0.70, 95% CI (0.44–1.12)). The development of depression and persistent depression groups were significantly more likely to develop disability compared with the no depression group (RR: 2.86, 95% CI (2.12–3.86) and RR: 2.16, 95% CI (1.47–3.18), respectively). Among those who were disabled at baseline, there was no significant change in the disability status of the three depression groups when compared to disabled patients with no depressive symptoms at either time point.

Conclusions—Among initially nondisabled patients with diabetes, those whose depression improved had functional outcomes comparable to those who were non-depressed at baseline and 5 years. Patients who developed depression and had persistent depression were more likely to experience disability at 5 years than those who were non-depressed at baseline and 5 years.

Introduction

Major depressive disorder (MDD) and diabetes mellitus (DM) are each among the leading causes of disability-adjusted life years worldwide(1). There appears to be bidirectional

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Address: 1959 NE Pacific St., Box 356560, Seattle, WA 98195-6560, Phone: 203-507-3188

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interactions between these two illnesses. Those who are depressed are more likely to develop DM, while those who have DM are at risk for developing depression(2). The prevalence rate of MDD in patients with DM has been estimated to be up to 18% and is 2-fold higher than in primary care patients without diabetes (3). Comorbidity of these two illnesses may lead to additive functional impairment (4). Cross-sectional studies have demonstrated that patients with comorbid MDD and DM have a higher prevalence of functional limitations compared to those with DM alone(5).

With the aging of the U.S. population, the number and proportion of patients at risk for comorbid DM and MDD will also grow as DM is more common in the elderly. It will be important to find different approaches to preserving the function of patients with both conditions in order to maximize their overall quality of life. One approach to preventing disability may be the treatment of depression since depression has been identified in previous studies as a potentially modifiable risk factor for disability in patients with DM(6). Longitudinal studies have examined the relationship between chronic medical conditions and disability in the elderly (7). However, prospective studies examining the association between depression status and incident disability status in elderly patients with DM are not available. Establishing the existence of a longitudinal relationship between MDD and incident disability in patients with DM could help reinforce the importance of treating MDD in preventing disability in this population.

The Pathways Follow-up Study is a 5-year prospective study of a large cohort of patients with DM enrolled in a health maintenance organization (8). The purpose of this study is to examine the effect of changes in depression symptoms on disability status in patients with DM. We hypothesized that improvements in depression symptoms would be associated with a preservation of functional status, while the development of depression or persistent depression symptoms would be associated with incident disability in those with no or few physical impairments at baseline. We also hypothesized that in those with significant disability at baseline, changes in depression would have no effect on disability at five year follow up.

Methods

Setting

Group Health (GH) is a mixed-model prepaid health plan with 30 primary care clinics serving approximately 500,000 members in Washington State. Nine GH clinics were selected for this study. All study procedures were approved by institutional review boards at GH and University of Washington, Seattle.

Study cohort selection

The cohort for this longitudinal study (Pathways Epidemiologic Study) included adults from the GH diabetes registry who received care between 2000 and 2002 at any of nine study clinics. The diabetes registry includes GH members meeting any of the following eligibility criteria in the prior 12 months: filled a prescription for insulin or an oral hypoglycemic agent, two fasting glucose levels $\geq 126\text{mg/dl}$, two random plasma glucose levels $\geq 200\text{mg/dl}$, two outpatient diagnoses of diabetes, or any inpatient diagnosis of diabetes (9). Beginning in March 2001, surveys were mailed to 9,063 potentially eligible patients with 1,222 patients found to be ineligible due to death, disenrollment, cognitive impairment, language/hearing impairment, or erroneous diagnosis of diabetes. Among 7,841 eligible patients, 4,839 subjects (61.7% of eligible patients) returned the baseline questionnaire. At five years after the baseline questionnaire was completed, 662 patients had died and 2 requested no further contact. The telephone survey team approached the remaining 4,175

patients to complete a telephone interview (249 patients were ineligible due to cognitive impairment, hearing impairment, or non-English speaking status). 2,909 surveys were completed (1,017 patients did not complete the survey due to refusal, proxy refusal, or being unreachable). Of the 2,909 patients who had completed the surveys, 139 patients declined use of chart data, 11 patients had a missing depression questionnaire, and 26 patients had a missing Activities of Daily Living questionnaire. A total of 2,733 patients were included for analysis (see Figure 1).

Measurements

The Patient Health Questionnaire (PHQ-9) was used to detect depression at baseline and 5 year follow up. This questionnaire is based on the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) criteria for MDD (10). The PHQ-9 diagnosis of major depressive disorder has been shown to be both valid and reliable compared to structured psychiatric interviews in previous studies(11).

We applied the optimum cut off score of 10 to screen for patients with clinically relevant depressive symptoms (12). We used two measures of depression in this study: 1) Baseline depression scores: those with PHQ-9 <10 were categorized into the non-depressed group, while those with PHQ-9 ≥10 were placed into the depressed group; and 2) 5 year follow up depression change measurement (a clinically relevant change in depression is defined as a change of ≥5 on the PHQ-9)(12). Thus, 4 groups were created: no depression (<10 at baseline and ≤5 point increase); improvement in depression (≥10 at baseline and ≥5 point decrease); development of depression (≤10 at baseline and ≥5 point increase); and persistent depression (≥10 at baseline and ≤5 point decrease). As in previous literature, the groups formed by the combination of the baseline and 5 year depression scores were used as our independent variables in the analyses (see Table 2)(13).

The baseline questionnaire included questions on age, sex, years of education, employment, ethnicity, marital status, height, weight, age of onset/duration of diabetes, type of treatment at onset of diabetes, current smoking status, and body mass index. Baseline HbA1c levels were collected from automated lab data (the HbA1c level closest to the time that the questionnaire was returned was used). Automated pharmacy data regarding oral hypoglycemic drugs and insulin use were used to characterize the intensity of diabetes treatment. Patients were classified as having type I diabetes if the onset was prior to 30 years of age, insulin was the first treatment prescribed, and they were currently taking insulin.

The World Health Organization Disability Assessment Schedule (WHO-DAS-II) asks questions about difficulties performing certain tasks due to either physical or mental health problems (14). Five Activities of Daily Living (ADL) items addressing objective domains pertaining to self care were selected as global perceptions of health may be more negatively influenced by depression. The following questions with regards to difficulties in performing ADLs over the past 30 days were asked at baseline and 5-year follow up:

- Washing your whole body?
- Getting dressed?
- Eating?
- Staying by yourself for a few days?
- Taking care of your household responsibilities?

Difficulty performing each task is scored as “none (1), mild (2), moderate (3), severe (4), extreme/cannot do (5).” A mean ADL score was calculated by dividing the total score (range: 5 to 25) by the number of ADL questions asked (5). Participants reporting a mean

ADL score of <2 across the five ADL items (signifying no disability or mild physical impairment) were categorized as “nondisabled,” whereas those reporting a mean ADL score of ≥ 2 were categorized as “disabled.”

For medical comorbidity, we used computerized pharmacy records to compute a chronic disease score (RxRisk) which has been shown to correlate with subsequent hospitalization and mortality(15). A measure (Diabetes Complication Severity Index) using automated data was used to code for 7 types of diabetes complications present 12 months before study entry (retinopathy, neuropathy, nephropathy, cerebrovascular, cardiovascular, peripheral vascular, and metabolic acidosis). This diabetes complications measure has been shown to predict subsequent mortality and hospitalization rates (16). We used automated medical records to identify microvascular and macrovascular complications (macrovascular events were also verified by chart review) as well as coronary procedures using ICD-9 and CPT codes at baseline and 5-year follow up (17).

Statistical analyses

The analysis sample consisted of 2,733 patients who completed the 5-year assessment and provided permission for their medical records to be abstracted (see Figure 1). Multiple linear regressions were performed for the entire study sample to examine the relationship between PHQ-9 scores and ADL scores: 1) baseline PHQ-9 score and baseline ADL score 2) 5 Year PHQ-9 score and 5 year ADL score 3) baseline to 5 year change in PHQ-9 score and ADL score at 5 years 4) baseline to 5 year change in PHQ-9 score and baseline to 5 year change in ADL score. For each relationship we fit both an unadjusted and adjusted model. In the adjusted models, we controlled for age, gender, ethnicity, employment, education, marital status, baseline number of diabetes complications, RxRisk, HbA1c, insulin use, type I diabetes, years with diabetes, and incident macrovascular/microvascular complications.

In order to further examine the trajectory of depression and its influence on disability, we proceeded to form four longitudinal groups based on the baseline and 5-year PHQ-9 groupings: no depression symptoms, improvement in depression symptoms, development of depression symptoms, and persistent depression symptoms. Chi-square analysis (for categorical measures) and analysis of variance (for continuous measures) were used to detect differences in characteristics among the four groups. *A priori*, we partitioned the 3-degree of freedom group difference variance into 3 single degree of freedom contrasts, testing each of the depression groups against the ‘no depression’ reference group.

Descriptive means and standard deviations were generated for the ADL variables for the four depression groups while individual analyses of covariance (ANCOVAs) were performed on each measure. For baseline measures, the covariates were age, gender, ethnicity, employment, education, marital status, macrovascular/microvascular events, number of diabetes complications, RxRisk, HbA1c, insulin use, type I diabetes, and years with diabetes. For analyses of the 5-year data, we also added the baseline value of ADL as a covariate.

In order to understand the relationship between depression symptoms and ADLs over time, we stratified participants based on their functional status into two groups: ‘nondisabled’ defined as a mean score of <2 at baseline and ‘disabled’ defined as a mean score of ≥ 2 at baseline. These two groups were analyzed separately using Poisson regression analyses, estimating the incremental relative risk (95% confidence interval) of either becoming or remaining disabled at 5 years.

Results

Participants (n=2,733) were compared to nonparticipants (n=1,444). Approximately 70% of eligible participants were included in this study. Participants included in this study did not differ from nonparticipants on age (participants 61.2 ± 12.4 , nonparticipants 62.0 ± 14.1), gender (participants 49.3%, nonparticipants 49.9%), baseline PHQ-9 score (participants 5.57 ± 5.5 , nonparticipants 5.52 ± 5.7), or years with DM (participants 9.0 ± 9.0 , nonparticipants 8.7 ± 8.6), but did significantly differ on ethnicity (participants 81.0% Caucasian, nonparticipant 67.2% Caucasian, $p < 0.001$).

Table 1 shows both the unadjusted and adjusted relationships between PHQ-9 scores and ADL scores. Statistically significant associations ($p < 0.001$) were found for the following: 1) baseline PHQ-9 score and baseline ADL score 2) 5 Year PHQ-9 score and 5 year ADL score 3) baseline to 5 year change in PHQ-9 score and ADL score at 5 years 4) baseline to 5 year change in PHQ-9 score and baseline to 5 year change in ADL score. Adjusting the models for the covariates resulted in minimal change to the regression coefficients.

Table 2 shows the baseline PHQ-9 scores and 5-year follow up PHQ-9 scores for the four depression groups. Table 3 shows that the four depression groups differed on all measures except for ethnicity, RxRisk, microvascular events/procedures post-baseline, and macrovascular events pre-baseline. In general, the no depression group differed from the improved depression and persistent depression group. Compared with the non-depressed group, those with either improved depression or persistent depression were more likely to be women, married, younger, and had higher HbA1c levels, more diabetic complications, a higher likelihood of being treated with insulin, more microvascular events/procedures before baseline, and higher BMIs. The no depression group and the development of depression group were mostly similar on baseline characteristics.

Based on the ANCOVAs, Table 4 shows that the four depression groups had significant differences in ADL scores at both baseline and at the 5 year follow up after adjusting for the covariates. For the nondisabled groups at baseline, compared with the no depression group, the improved depression group and persistent depression group had significantly more disability. For the nondisabled groups at 5 year assessment, when compared with the no depression group, there was lower disability in the improved depression group and significantly higher disability in the development of depression and persistent depression groups. For the disabled groups at baseline, when compared with the no depression group, the improved depression group and persistent depression group had significantly more disability. For the disabled groups at 5 years, when compared with the no depression group, there was significantly higher disability in the development of depression and persistent depression group.

Table 5 demonstrates that after adjustment for covariates, in patients nondisabled at baseline, those with improved depression did not have an increased risk of becoming disabled at 5 years compared with the no depression reference group (Relative Risk (RR) 0.70, 95% confidence interval (CI) (0.44–1.12)). However, those nondisabled at baseline who developed depression or had persistent depressive symptoms were significantly more likely to develop disability at 5 years (RR=2.86, 95% CI (2.12–3.86) and RR=2.16, 95% CI (1.47–3.18), respectively).

For those disabled at baseline, there was no difference in the relative risk ratios for persistent disability at 5 years among the 3 depression groups (improved depression, development of depression, persistent depression) when compared to the non-depressed reference group.

Discussion

Our study examined the longitudinal relationship between changes in depression symptoms and disability in patients with DM, adding to the literature of prospective studies of aging populations examining how changes in depression influence disability status(18, 19). PHQ-9 scores at baseline and 5 years were found to be significantly associated with ADL scores at their respective time points (i.e. increased PHQ-9 scores were associated with increased ADL scores). In addition, increases in PHQ-9 scores over 5 years are significantly associated with increases in ADL scores at 5 years as well as 5 year worsening in ADL scores.

In those who were nondisabled at baseline, improvement in depression symptoms from baseline to 5 year follow up was not associated with disability status at 5 years compared to those who have no or few depression symptoms at baseline and at 5 years. In those who were nondisabled at baseline and had either persistent depression symptoms or development of depression symptoms, there was a greater than 2-fold statistically significant chance of becoming disabled at 5 years when compared to those who have no depression symptoms over 5 years. For patients who were disabled at baseline, there was no significant change in disability status in any of the three depression groups (improved depression symptoms, development of depression symptoms, and persistent depression symptoms) when compared to the reference group of disabled patients with no depression symptoms at either time point.

The effect of MDD on energy, motivation, and cognition may lead to poor health behaviors in patients (20). Patients with DM who have MDD are less likely to adhere to self-care regimens such as diet, exercise, smoking cessation, and taking prescribed medications which may lead to worse medical outcomes, increased health care utilization, and higher medical costs(5)(21, 22)(23). Other studies have shown that the combination of MDD and DM is associated with higher symptom burden and risk of morbidity and mortality(24)(25). In addition, the impact of MDD on self-care in patients with DM may contribute to increased microvascular and macrovascular complications leading to increased risk of disability.

In aging populations, a bidirectional relationship has been shown between MDD and disability. Late-life depression has been associated with the subsequent development of impairments in functioning (18–20, 26). Conversely, disability has also been associated with an increased risk of depressive episodes (27). Disability may contribute to patients being homebound, which in turn isolates patients from social contacts. It has been suggested that social isolation may mediate the relationship between disability and depressive disorders (27). Thus, depression symptoms may be perpetuated once a depressed individual becomes disabled.

Considering the enormous level of additional burden of illness created by depression in those with DM, it should be noted that effective psychotherapy and psychopharmacologic treatments for depression exist (28). In addition, it has been shown that the treatment of late-life depression is associated with improvements in functioning (29). Recent research has demonstrated the effectiveness of collaborative care treatment in improving depression and medical outcome measures in a large population of patients with comorbid depression and medical illness (30). It may be a reasonable strategy to aggressively treat both disorders concurrently in an effort to prevent functional disability in this patient population.

Limitations of this study include patients being drawn from one large HMO in the Pacific Northwest. Thus our findings may not be generalizable to other practice settings and U.S. regions. In addition, only 70% of eligible patients participated in the study. Another limitation is that depression and disability were only measured at baseline and 5 year follow up. This long lag in measuring depression status and functional impairment may have

explained our findings that patients disabled at baseline did not have significant improvement in their functioning despite improvements in depression symptoms, whereas previous studies have found that late-life depression treatment resulted in improvement in functional status(29).

A primary strength of this study lies in the prospective design. Additional strengths of this study include the formulation of our hypothesis *a priori*, large sample size, the diversity of the patient population, the use of well validated questionnaires, controlling for sociodemographic variables, and the use of automated data to control for the severity of diabetes as well as comorbid medical illnesses. Another strength is the use of specific objective domains (ability for self-care) to measure disability rather than global measures such as perception of health which may be more influenced by negative perceptions associated with depression.

Conclusion

Our longitudinal study shows that in nondisabled depressed patients with DM, those with improved depression at 5 year follow up had functional outcomes comparable to those who were non-depressed at baseline or follow up. Future randomized trials are needed to examine the effects of depression treatment in improving the functional status of elderly patients with comorbid depression and diabetes.

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Figure 1.
Description of Patient Recruitment

Table 1

Coefficients for the Association between PHQ-9 Score and ADL Disability Score

Measure of Association		Beta Coefficient [*]	95% Confidence Interval
Independent Variable	Dependent Variable		
Baseline PHQ-9 Score	Baseline ADL Score		
	Unadjusted	0.056	0.053, 0.060
	Adjusted [§]	0.050	0.046, 0.053
5 Year PHQ-9 Score	5 Year ADL Score		
	Unadjusted	0.065	0.060, 0.069
	Adjusted [§]	0.057	0.052, 0.061
Baseline to 5 year Change in PHQ-9 Score	5 Year ADL Score		
	Unadjusted	-0.012	-0.016, -0.007
	Adjusted [§]	-0.016	-0.021, -0.012
Baseline to 5 Year Change in PHQ-9 Score	Baseline to 5 Year Change in ADL Score		
	Unadjusted	0.039	0.035, 0.043
	Adjusted [§]	0.039	0.034, 0.043

[§] Covariates used: baseline ADL, age, gender, race, education, marital status, macro/micro events before and after Cohort Entry Date, #diabetes complications, Rx risk, HbA_{1c}, insulin use, type 1 diabetes, years with diabetes, hypertension, smoking status and baseline BMI.

* Test for significance: p<0.001

Table 2

Mean and Standard Deviation of PHQ-9 Scores at Baseline and 5-Year Assessments

Depression Category	Baseline Mean PHQ-9 Score (SD)	5-Year Mean PHQ-9 Score (SD)	Statistical Significance
Total Sample (n=2,733)	5.6 (5.5)	4.3 (4.7)	p<0.001
No Depression Symptoms (n=1,969)	3.3 (2.8)	2.5 (2.6)	p<0.001
Improved Depression Symptoms (n=377)	15.1 (4.3)	5.3 (4.0)	p<0.001
Development of Depression Symptoms (n=214)	3.2 (2.5)	11.1 (4.0)	p<0.001
Persistent Depression Symptoms (n=173)	13.6 (3.7)	14.0 (4.7)	p=0.143

Table 3

Baseline or Pre-Baseline Characteristics of the Depression Groups

Study Variable	Depression Groups				Test F (3, 2729) or X ² (3)	No Depression vs. Improved Depression	No Depression vs. Develop. of Depression	No Depression vs. Persistent Depression
	No Depression Symptoms N = 1969 (72%)	Improved Depression Symptoms N = 377 (14%)	Develop. of Depression Symptoms N = 214 (8%)	Persistent Depression Symptoms N = 173 (6%)				
% Men (N)	54.1 (1066)	38.2 (144)	47.7 (102)	42.2 (73)	38.69 [‡]	31.57 [‡]	3.00	8.64 [‡]
% Non-White	17.9 (352)	21.5 (81)	20.1 (43)	22.0 (38)	4.11	N/A	N/A	N/A
% Unemployed	50.9 (972)	48.6 (178)	60.5 (127)	51.8 (87)	8.28 [*]	0.52	6.62 [*]	0.02
% High school grad or less	18.4 (359)	19.7 (74)	24.9 (53)	25.1 (43)	9.00 [*]	0.28	4.87 [*]	4.27 [*]
% Unmarried	29.0 (567)	36.3 (136)	32.7 (70)	37.2 (64)	11.85 [‡]	7.51 [‡]	1.10	4.70 [*]
Age – mean (SD)	62.0 (12.2)	57.4 (11.4)	63.4 (13.8)	58.3 (11.7)	19.73 [‡]	6.61 [‡]	1.45	3.72 [‡]
% Type I	5.4 (107)	2.4 (9)	2.8 (6)	6.9 (12)	9.87 [*]	5.62 [*]	2.21	0.43
Years with diabetes	9.0 (9.2)	8.3 (7.3)	9.0 (8.6)	10.7 (10.3)	2.90 [*]	1.78	0.11	2.05 [*]
HbA _{1c}	7.7 (1.5)	8.0 (1.7)	7.7 (1.6)	8.1 (1.6)	7.97 [‡]	3.52 [‡]	0.20	3.25 [‡]
Number of complications (0 – 7)	1.1 (1.1)	1.4 (1.3)	1.3 (1.2)	1.3 (1.2)	5.31 [‡]	3.14 [‡]	1.59	2.32 [*]
RxRisk	2698.4 (2164.8)	2621.6 (2123.6)	3073.9 (2141.4)	2705.8 (2007.0)	2.27	N/A	N/A	N/A
% Insulin use	26.2 (515)	35.0 (132)	32.2 (69)	38.2 (66)	22.47 [‡]	11.99 [‡]	3.35	10.98 [‡]
Hypertension from Automated Data	40.1 (789)	45.1 (170)	40.2 (86)	45.1 (78)	4.55	N/A	N/A	N/A
% Smoking	6.4 (127)	12.5 (47)	9.3 (20)	10.4 (18)	18.84 [‡]	15.82 [‡]	2.13	3.34
BMI at baseline – Mean (SD)	31.4 (6.8)	35.4 (8.8)	31.7 (7.2)	34.3 (7.8)	37.05 [‡]	8.23 [‡]	0.58	4.67 [‡]
% At least 1 microvascular event/procedure pre-baseline	60.5 (1192)	66.8 (252)	66.4 (142)	69.9 (121)	11.71 [*]	5.05 [*]	2.51	5.54 [*]
% At least 1 microvascular event/procedure post-baseline	34.0 (670)	36.9 (139)	31.3 (67)	36.4 (63)	2.36	N/A	N/A	N/A
% At least 1 macrovascular event/procedure pre baseline	16.7 (328)	19.6 (74)	20.3 (43)	16.9 (29)	3.23	N/A	N/A	N/A
% At least 1 macrovascular event/procedure post baseline	11.8 (231)	13.3 (50)	19.3 (41)	11.6 (20)	10.32 [*]	0.54	9.36 [*]	0.00

*
p < .01,
p < .001,
p < .0001; N/A = nonapplicable

Table 4

Unadjusted ADL Means and Standard Deviations at Each Assessment and Tests of Difference in Adjusted Means.

Depression Category	ADL Score at baseline [§] Mean (SD)	Statistical Significance (Compared with No Depression Symptoms group)	ADL Score at 5-year follow up [¶] Mean (SD)	Statistical Significance (Compared with No Depression Symptoms group)
Non-Disabled at Baseline Total (n=2,155)	1.3 (0.3)	-	1.4 (0.5)	-
No Depression Symptoms (n=1,712)	1.2 (0.3)	-	1.4 (0.5)	-
Improved Depression Symptoms (n=187)	1.4 (0.3)	p<0.0001	1.3 (0.4)	p<0.01
Development of Depression Symptoms (n=164)	1.3 (0.3)	NS	1.8 (0.7)	p<0.0001
Persistent Depression Symptoms (n=92)	1.5 (0.3)	p<0.0001	1.7 (0.6)	p<0.0001
Disabled at Baseline Total (n=578)	2.5 (0.5)	-	2.2 (0.7)	-
No Depression Symptoms (n=257)	2.4 (0.4)	-	2.1 (0.7)	-
Improved Depression Symptoms (n=190)	2.6 (0.5)	p<0.0001	2.1 (0.8)	NS
Development of Depression Symptoms (n=50)	2.4 (0.4)	NS	2.6 (0.7)	p<0.0001
Persistent Depression Symptoms (n=81)	2.6 (0.5)	p<0.0001	2.5 (0.7)	p<0.0001

[§] Covariates used: age, gender, race, education, marital status, macro/micro events before and after Cohort Entry Date, # diabetes complications, Rx risk, HbA_{1c}, insulin use, type 1 diabetes, years with diabetes, hypertension, smoking status and baseline BMI

[¶] Covariates same as [§](baseline) + baseline ADL score

Table 5

Prevalence and Adjusted[§] Relative Risk (RR) of becoming disabled and being persistently disabled at 5-year follow up by changes in depression symptoms and baseline disability using Poisson Regression.

Depression Category	Among Nondisabled at Baseline (n=2155)			Among Disabled at Baseline (n=578)		
	Prevalence of becoming disabled at 5-year follow up %	Relative risk of becoming disabled at 5-year follow up RR (95% CI)	p-value	Prevalence of being persistently disabled at 5-year follow up %	Relative risk of being persistently disabled at 5-year follow up RR (95% CI)	p-value
Total	14.3%	-	-	62.5%	-	-
No Depression Symptoms	11.1%	Reference Group	-	58.0%	Reference Group	-
Improved Depression Symptoms	10.7%	0.70 (0.44–1.12)	NS	59.5%	1.05 (0.80–1.37)	NS
Development of Depression Symptoms	39.0%	2.86 (2.12–3.86)	p<0.0001	80.0%	1.42 (0.99–2.04)	NS
Persistent Depression Symptoms	38.0%	2.16 (1.47–3.18)	p<0.0001	72.8%	1.25 (0.90–1.73)	NS

[§] Covariates used: baseline ADL, age, gender, race, education, marital status, macro/micro events before and after Cohort Entry Date, # diabetes complications, Rx risk, HbA_{1c}, insulin use, type 1 diabetes, years with diabetes, hypertension, smoking status and baseline BMI.