Effect of Comorbid Depression on Outcomes in Diabetes and Its Relationship to Quality of Care and Patient Adherence: A Statewide Primary Care Ambulatory Research and Resources Consortium Study

David Katerndahl, MD, MA; Walter L. Calmbach, MD, MPH; and Johanna Becho, BA

ABSTRACT

Objective: To determine whether current depression was associated with poorer quality of care and poorer patient adherence to treatment regimens and whether current depression was associated with patient diabetes outcomes independent of its relationships to quality of care and patient adherence among patients with diabetes.

Method: This study was conducted in the offices of family physicians who belong to the Statewide Primary Care Ambulatory Research and Resources Consortium from March 2006 to March 2011. Seven primary care physicians enrolled 10 to 20 English- or Spanish-speaking patients with diabetes presenting for routine follow-up visits. Subjects included 106 patients who completed a questionnaire documenting their depressive symptoms, compliance with diabetes therapy, diabetes-related quality of life, and patient satisfaction. The physicians completed a 4-item questionnaire concerning whether the patient had depression and any depression treatments that they ordered. All questions were answered either "yes" or "no." A practice research coordinator evaluated the quality of diabetes care provided and ordered hemoglobin A_{1c} (HbA_{1c}) testing for the patient.

Results: Depression was associated with poorer compliance, quality of care, diabetes-related quality of life, and patient satisfaction; only HbA_{1c} levels did not correlate with depression. When adjusting for compliance and quality of care, depression was still associated with poorer quality of life and satisfaction ($P \leq .001$). While physician recognition and treatment of depression were less than optimal, depression severity was a significant predictor of receiving some form of mental health intervention ($P \leq .05$) except for the provision of mental health counseling. Poor diabetes control was associated with the provision of counseling ($P \leq .10$), while poor quality of life was associated with recognition of depression ($P \leq .10$).

Conclusions: Depression was independently associated with satisfaction and quality of life but not diabetes control. Although depression severity was an important predictor of depression recognition and treatment, poor quality of life was a predictor of recognition, and poor diabetes control was a predictor of receiving mental health counseling.

Prim Care Companion CNS Disord 2012;14(3):doi:10.4088/PCC.11m01269

Submitted: *August 8, 2011; accepted October 6, 2011.*
Published online: *May 3, 2012.*
Corresponding author: *David Katerndahl, MD, MA, Family and Community Medicine, University of Texas Health Science Center at San Antonio, 7703 Floyd Curl Drive, San Antonio, TX 78229-3900 (katerndahl@uthscsa.edu).*

Diabetes is a common disorder among primary care patients in Texas.[1] Diabetes consumes considerable health care resources and is associated with significant morbidity and disability. Tight control of diabetes can avert such consequences as diabetic nephropathy and vascular disease. However, diabetes control is dependent upon the quality of care administered and patient adherence to the treatment regimen.

Both quality of care and patient adherence are potentially affected by depression in the patient. Due to competing demands,[2] the physician may delay quality of care measures in order to address depression.[3] Similarly, patients with depression may be unable or unwilling to commit the time and energy necessary to comply with the treatment regimen. When the Chronic Illness Care Model[4] is utilized, the problem of diabetes control in depressed patients may reflect a nonactivated patient interacting with a reactive medical team, leading to a less-than-productive interaction that then impacts quality of care and clinical outcomes.

This issue may be particularly important for patients with diabetes seen in primary care settings. Many primary care patients have psychosocial problems such as major depression,[3] but studies have shown that the prevalence of depression is also particularly high among diabetic patients,[5] although such an association may be due to the increased number of ambulatory visits and opportunities for recognition.[6] Consequently, depression among diabetic patients may lead to poor patient adherence to the diabetes treatment regimen[7] and to poor quality of care. Ultimately, depression among diabetic patients can lead to poor diabetes control and poor outcomes.[8–10]

However, is depression associated with poorer quality of diabetes care? Is the relationship between depression and diabetes outcomes due to the association of depression with poor compliance and quality of care or is it a direct relationship (Figure 1)?

Recognition and treatment of depression among diabetic patients may improve patient adherence and quality of care, leading to improved patient outcomes. The purpose of this study was to (1) document whether current depression was associated with poorer quality of care, (2) determine whether current depression was associated with poorer patient adherence to treatment regimens, and (3) determine whether current depression was associated with diabetes outcomes independent of its relationships to quality of care and patient adherence among diabetic patients seen in primary care settings.

METHOD

Sample

This study was conducted in the offices of family physicians who belong to the Statewide Primary Care Ambulatory Research and Resources Consortium of the Texas Academy of Family Physicians

Clinical Points

- Among diabetic patients, current depression may affect diabetes care, as these patients report poorer compliance, lower patient satisfaction, and poorer quality of life and show poor quality of care.
- Depression is not well recognized, especially in mild cases, but is also sometimes overdiagnosed.
- Physicians were more likely to recognize depression in their female patients, in those with moderate-severe depression (per PHQ-9 score), and among patients who reported a poorer quality of life.

from March 2006 to March 2011. Each of 7 primary care physicians enrolled 10 to 20 English- or Spanish-speaking patients with diabetes presenting for routine follow-up visits. Only patients seen by the physician for at least 1 year were eligible for participation. When patients presented for their office visit, the office staff member designated as the study's research coordinator approached the patient, explained the study in English or Spanish at the patient's preference, and elicited consent for participation. This study was reviewed and approved by the Institutional Review Board at the University of Texas Health Science Center at San Antonio.

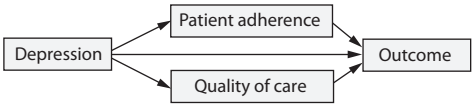
Procedure

Once enrolled in the study, the subject completed the patient questionnaire in English or Spanish prior to seeing the physician. This questionnaire elicited information about the patient's demographics, compliance with the treatment regimen, symptoms of depression, and diabetes-related quality of life. This information was not shared with the physician prior to the doctor-patient encounter. Once the physician had seen the patient, the physician was asked 4 questions about whether he/she felt that the subject was currently depressed and whether any depression treatments were started. The research coordinator then reviewed the chart to assess the quality of care provided in the prior 12 months and ordered hemoglobin A_{1c} (HbA_{1c}) testing for the patient.

In addition to basic demographic information, participants completed a questionnaire documenting their depressive symptoms, compliance with diabetes therapy, diabetes-related quality of life, and patient satisfaction. Depression was assessed via the 9-item Patient Health Questionnaire (PHQ-9) of the Primary Care Evaluation of Mental Disorders,[11] which is scored on a 4-point scale from 0 (not at all) to 3 (nearly every day). The threshold for a label of depression was a score of at least 10 points. The PHQ-9 has good positive (12.2) and negative (0.28) likelihood ratios in primary care settings, and its scoring corresponds to *DSM-IV* criteria and depression severity.[12] In the study sample, the PHQ-9 had a Cronbach α of 0.904.

Patient adherence to the medical regimen was measured using an instrument consisting of 10 items addressing adherence to diet, exercise, glucose monitoring, and medication.[13] While most questions measured compliance as the number of days in the past week in which the patient complied, medication compliance was measured differently. For each medication, participants indicated the number of times that they missed a dose, added an extra dose, or reduced the dose. Medication compliance was then calculated as the proportion of medications to which the patient was fully compliant. Because each area of compliance (diet, exercise, self-testing, and medication) entailed a different number of questions, mean scores from 0 to 7 were computed for each area. Total compliance was then computed as the mean of all of the relevant areas of compliance. In the study sample, the nonmedication self-care questions had a Cronbach α of 0.751.

Figure 1. Theoretical Model



Because quality of care includes patient satisfaction, subjects completed a 6-item patient satisfaction instrument scored from 0 (very unsatisfied) to 3 (very satisfied) on the basis of American Diabetes Association (ADA) recommendations.[14] Total satisfaction can be measured as the sum of the scores. In the study sample, the patient satisfaction instrument had a Cronbach α of 0.880.

A 7-question instrument taken from the Type-2 Diabetes Symptom Checklist[15] scored from 0 (never) to 3 (all the time) and focusing on diabetes-specific symptoms was used to assess diabetes-related quality of life. Total quality of life was computed as the sum of the scores. In the study sample, the quality of life instrument had a Cronbach α of 0.805.

After the doctor-patient encounter was over, the physician documented whether the patient was already receiving antidepressant therapy and answered 4 questions concerning the assessment and management: "Do you believe that this patient is depressed?" "Did you start this patient on an antidepressant?" "Did you provide this patient with mental health counseling?" and "Did you refer this patient to a mental health provider?" All questions were answered either "yes" or "no."

The research coordinator at each practice then completed the quality of care assessment and ordered HbA_{1c} measurement. To assess quality of diabetes care, the research coordinator completed a 13-item medical record data extraction form of yes/no questions based on ADA guidelines.[16] This form enabled the calculation of a quality of care score using the ADA Physician Recognition Scoring algorithm.[16] In the study sample, the quality of care measurement had a Kuder-Richardson Formula 20 of 0.613. To assess the level of current diabetes control, subjects had blood drawn at the end of the patient encounter for measurement of HbA_{1c}. This testing was conducted by an external laboratory (Quest Diagnostics, Teterboro, New Jersey). Diabetes was considered controlled if the HbA_{1c} level was at or below 7.0%.

Analysis

To determine whether differences in compliance, quality of care, and outcomes between depressed and nondepressed patients exist, the Student *t* test was used. A P value $\leq .05$ was considered significant, with $.05 < P$ value $\leq .10$ considered as trending toward significance. To assess whether depression contributed to patient outcomes independent of any relationship with compliance and/or quality of care, multiple linear regression analysis with forward entry was used; hierarchical analysis to adjust for intrapractice variation could not be used due to the small number of providers. Logistic regression with forward entry was used to identify factors associated with recognition and treatment of depression by physicians. Power analysis suggests that the sample size should be sufficient to detect a medium effect size using an $\alpha \leq .05$ with statistical power of 0.80.[17]

RESULTS

The demographic description of the 106 patients enrolled in the study is presented in Table 1. In addition, 18 patients (17%) completed the questionnaire in Spanish. Only 14 subjects (13%) were not taking any medications for their diabetes (mean ± SD = 1.78 ± 1.08 medications). Subjects were most compliant with their medications (5.28 ± 2.83) and least compliant with exercise (2.77 ± 2.36). Of the 91 subjects who obtained a HbA_{1c} level and completed all of the PHQ-9 questions, 48 (53%) had HbA_{1c} levels ≤ 7.0% and 13 (14%) met criteria for mild depression (10–14 points) and 24 (26%) met criteria for moderate-severe depression (≥ 15 points). The level of quality of care was generally good (8.35 ± 2.35). Patient satisfaction (15.29 ± 3.35) and quality of life (15.35 ± 4.34) were generally poor.

As Table 2 shows, the presence of even mild depression was associated with lower levels of compliance (especially in terms of dietary compliance) and quality of care (particularly in the monitoring of laboratory values of HbA_{1c}, serum lipids, and urinary microalbumin). Although depressed patients did not have higher levels of HbA_{1c}, they did report less satisfaction and poorer quality of life. Figure 2 presents the models constructed for each outcome, showing that HbA_{1c} levels were only related to quality of care; depression and compliance were not associated independently with HbA_{1c} levels. However, quality of life was independently related to depression, and satisfaction was only independently associated with depression.

While 9 (9%) of the 98 patients for whom the physicians answered questions were already taking antidepressants, physicians diagnosed 38 patients (39%) with depression. Only 75 patients not already taking antidepressants had complete PHQ-9 assessments and physician questionnaires. Of the 10 patients with mild depression, physicians only recognized 3 (30%) as being depressed but diagnosed depression in 11 (69%) of the 16 patients with moderate-severe depression. Yet, 9 (18%) of the 49 patients without depression were diagnosed as depressed by physicians. This diagnosis of depression equated to physician recognition κ's of 0.365 for any depression and 0.418 for moderate-severe depression.

Of the patients not already taking antidepressants, 21 (26%) of 81 patients received a new depression intervention. Of these patients, 12 (15%) were prescribed an antidepressant, 15 (18%) received mental health counseling during the visit, and 5 (6%) were referred to mental health providers. Overall, by the end of the visit, 4 (36%) of the 11 patients with mild depression per the PHQ-9 and 16 (70%) of the 23 patients with moderate-severe depression per the PHQ-9 had received some form of mental health intervention. Table 3 presents the results of the logistic regressions. Not surprisingly, the PHQ-9 score significantly predicted recognition, any new treatment, new antidepressant prescription, and mental health referral. However, depression recognition was found to be dependent upon female gender and poor quality of life. Provision of mental health counseling was unrelated to PHQ-9 score, depending instead on lower level of education and well-controlled diabetes.

Table 1. Demographics of 106 Patients With Diabetes[a]

Demographic	Frequency
Gender (female)	71/102 (70)
Age, mean ± SD, y[b]	56.8 ± 10.6
Race/ethnicity	
Non-Hispanic white	53/99 (54)
Hispanic	28/99 (28)
Black	14/99 (14)
Marital status (married)	63/100 (63)
Education (≥ high school)	67/97 (69)
Income (< $20,000)	47/86 (55)

[a]All data are presented as n (%) unless otherwise specified.
[b]n = 102.

Table 2. Depression Versus Outcomes in Patients With Diabetes

Outcome	Any Depression (n = 37)	No Depression (n = 54)	Significance
Compliance, mean			
Diet	3.56	4.40	$t = 2.73$, $P = .008$
Exercise	2.33	2.91	$t = 1.13$, $P = .264$
Medications	4.89	5.83	$t = 1.46$, $P = .150$
Testing	5.00	6.57	$t = 1.67$, $P = .125$
Total	3.51	4.49	$t = 3.10$, $P = .003$
Quality of care, n (%)			
Hemoglobin A_{1c} assessed?	19/27 (70)	43/50 (86)	Fisher exact test = 0.090
Eye examination?	11/26 (42)	27/49 (55)	Fisher exact test = 0.209
Foot examination?	23/27 (85)	45/50 (90)	Fisher exact test = 0.389
Blood pressure twice?	25/26 (96)	46/49 (94)	Fisher exact test = 0.568
Urinary microalbumin assessed?	14/27 (52)	35/50 (70)	Fisher exact test = 0.092
Serum lipids assessed?	15/27 (56)	40/50 (80)	Fisher exact test = 0.024
Self-management education?	25/27 (93)	48/50 (96)	Fisher exact test = 0.439
Nutrition counseling?	21/27 (78)	43/49 (88)	Fisher exact test = 0.206
Self-monitor blood sugar?	21/27 (78)	41/49 (84)	Fisher exact test = 0.366
Insulin prescribed?	4/27 (15)	9/50 (18)	Fisher exact test = 0.494
Smoking status?	25/26 (96)	47/49 (96)	Fisher exact test = 0.726
Total	7.74	8.62	$t = 1.68$, $P = .098$
Hemoglobin A_{1c}, mean %	7.96	8.09	$t = 0.26$, $P = .792$
Quality of life, mean	12.75	16.92	$t = 4.21$, $P = .000$
Satisfaction, mean	1.74	4.00	$t = 3.06$, $P = .004$

DISCUSSION

The presence of depression in this study was indeed associated with poorer compliance, quality of care, diabetes-related quality of life, and patient satisfaction; HbA_{1c} levels were not correlated with depression. However, when adjusting for the relationship between depression and both compliance and quality of care, depression was still associated with poorer quality of life and satisfaction. While physician recognition and treatment of depression were less than optimal, depression severity was a significant predictor for recognition and most treatments; good diabetes control was associated with the provision of mental health counseling, while poor quality of life was associated with recognition of depression. When the Chronic Care Model is used, this study could potentially lead to decision support by improving the knowledge of providers on the impact of depression in diabetes and to self-management support by helping patients to adhere to the treatment regimens.

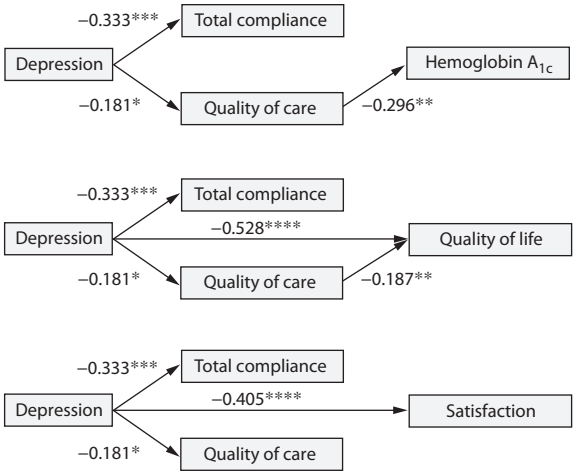
In this study, the association between depression and poor compliance was primarily due to dietary compliance. Although this finding agrees with some previous studies,[7,18] other research found associations with poor exercise[18] and medication[6] adherence. Similarly, this study found that the association between depression and poorer quality of care was primarily due to a lack of serum lipid and HbA_{1c} assessment. Although previous studies have generally not looked at depression and quality of care, Rush et al[19] found that depression was associated with decreased lipid testing among diabetic patients.

Although this study found no relationship between depression and either HbA_{1c} level or diabetes control, other studies have noted such an association.[18–20] In fact, the association between depression and insulin use[21] may further support this relationship. In addition, although this study found a direct relationship between depression and satisfaction, independent of compliance and quality of care, no previous work has looked at this issue. However, the relationship between quality of life and depression found in this study, also independent of compliance and quality of care, does agree with numerous previous studies that documented an association between depression and diabetes complications and functional status.[1,7,8,22]

Recognition of depression in this study depended upon depression severity, female gender, and poor quality of life. O'Connor et al[6] also found that depression was more likely to be diagnosed in female diabetic patients. While depression treatment was generally associated with depression severity, poor diabetes control was a predictor of mental health counseling. Previous studies have found that treatment of depression in diabetic patients was associated with improved blood pressure control and testing,[19] as well as improved quality of life and exercise compliance. However, treatment of depression was not closely associated with HbA_{1c} levels or self-care.[23]

This study has several limitations. First, it was conducted among diabetic patients in Texas, a state with a particularly high rate of diabetes, and may not be representative of other populations. Second, due to the relatively small sample size and limited numbers of providers, we could not perform hierarchical regression even though interpractice variation may be relevant. Third, the fact that physicians knew that they were participating in a study about depression in diabetes may have

Figure 2. Significant Relationships Between Depression: Intermediates and Outcomes (β coefficient)



*$P \leq .10$.
**$P \leq .01$.
***$P \leq .005$.
****$P \leq .001$.

Table 3. Predictors of Depression Recognition and Treatment (B [SE])

Predictors	Depression Recognized	New Treatment Given	New Antidepressant Prescribed	Mental Health Counseling Given	Mental Health Referral
Demographic					
Non-Hispanic white[a]	…	…	…	…	…
Married[a]	…	…	…	…	…
Age[a]	…	…	…	…	…
Level of education	…	…	…	−1.08 (0.61)*	…
Gender (female)	3.75 (2.03)*	…	…	…	…
Clinical feature					
Depression severity (PHQ-9)	0.21 (0.11)*	0.10 (0.05)**	0.09 (0.05)*	…	0.13 (0.07)*
Total compliance[a]	…	…	…	…	…
Quality of life	−0.33 (0.19)*	…	…	…	…
Hemoglobin A_{1c} ≤7.0 %	…	…	…	3.20 (1.69)*	…
F (*P*)	20.81 (.000)	4.23 (.040)	2.69 (.101)	7.35 (.025)	3.15 (.076)
Nagelkerke R^2	0.575	0.149	0.108	0.317	0.162

[a]Not a predictor for any of the dependent variables.
*$P \leq .10$.
**$P \leq .05$.
Abbreviation: PHQ-9 = 9-item Patient Health Questionnaire.
Symbol: … = not a significant predictor.

affected their recognition and management of depression among these patients.

These findings suggest that primary care physicians often fail to recognize depression among their diabetic patients despite the observation that depression is directly related to poor patient satisfaction and quality of life as well as the provision of poorer quality of care. Consequently, physicians must work to improve their recognition of depression among diabetic patients, perhaps through the routine use of a depression screening instrument such as the PHQ-9. In addition, physicians must be alert to the potential for depression to compromise the provision of quality diabetes care and its resultant poor diabetes control. Finally, unless depression is recognized and treated, patient satisfaction is likely to remain poor, even with excellent quality of care.

Author affiliations: Family and Community Medicine, University of Texas Health Science Center at San Antonio, San Antonio, Texas.
Potential conflicts of interest: **Dr Katerndahl** has served as a consultant to the Vilazodone Working Group and PGx Health Marketing, has received grant/research support from National Science Foundation, and is a stock shareholder in Abbott. **Dr Calmbach** and **Ms Becho** report no conflicts of interest related to the subject of this article.
Funding/support: This study was funded by the Texas Academy of Family Physicians.
Acknowledgments: The authors wish to acknowledge the physicians who participated in this study: Crawford Allison, MD (Waco, Texas); Andrew Eisenberg, MD (Sarasota, Florida [formerly of Madisonville, Texas]); Carlos Guerra, MD (Waco, Texas); Linda Siy, MD (Fort Worth, Texas); Steven Stoltz, MD (McAllen, Texas); Jasmine Sulaiman, MD (Cleveland, Texas); and Elizabeth Turnage, MD (Waco, Texas). The acknowledged individuals report no conflicts of interest related to the subject of this article.

REFERENCES

1. Mier N, Bocanegra-Alonso A, Zhan D, et al. Clinical depressive symptoms and diabetes in a binational border population. *J Am Board Fam Med*. 2008;21(3):223–233.
2. Jaén CR, Stange KC, Nutting PA. Competing demands of primary care: a model for the delivery of clinical preventive services. *J Fam Pract*. 1994;38(2):166–171.
3. Callahan EJ, Jaén CR, Crabtree BF, et al. The impact of recent emotional distress and diagnosis of depression or anxiety on the physician-patient encounter in family practice. *J Fam Pract*. 1998;46(5):410–418.
4. Wagner EH, Austin BT, Davis C, et al. Improving chronic illness care: translating evidence into action. *Health Aff (Millwood)*. 2001;20(6):64–78.
5. Peyrot M, Rubin RR. Levels and risks of depression and anxiety symptomatology among diabetic adults. *Diabetes Care*. 1997;20(4):585–590.
6. O'Connor PJ, Crain AL, Rush WA, et al. Does diabetes double the risk of depression? *Ann Fam Med*. 2009;7(4):328–335.
7. Ciechanowski PS, Katon WJ, Russo JE. Depression and diabetes: impact of depressive symptoms on adherence, function, and costs. *Arch Intern Med*. 2000;160(21):3278–3285.
8. de Groot M, Anderson R, Freedland KE, et al. Association of depression and diabetes complications: a meta-analysis. *Psychosom Med*. 2001;63(4):619–630.
9. Hänninen JA, Takala JK, Keinänen-Kiukaanniemi SM. Depression in subjects with type 2 diabetes: predictive factors and relation to quality of life. *Diabetes Care*. 1999;22(6):997–998.
10. Gary TL, Crum RM, Cooper-Patrick L, et al. Depressive symptoms and metabolic control in African-Americans with type 2 diabetes. *Diabetes Care*. 2000;23(1):23–29.
11. The MacArthur Initiative on Depression and Primary Care. Patient Health Questionnaire. http://www.depression-primarycare.org/clinicians/toolkits/materials/forms/phq9/. Accessed February 13, 2012.
12. Nease DE Jr, Maloin JM. Depression screening: a practical strategy. *J Fam Pract*. 2003;52(2):118–124.
13. Toobert DJ, Hampson SE, Glasgow RE. The summary of diabetes self-care activities measure: results from 7 studies and a revised scale. *Diabetes Care*. 2000;23(7):943–950.
14. California Collaborative To Improve Diabetes Management. *Diabetic Patient Survey*. Ann Arbor, MI: MEDSTAT Group; 1998.
15. Grootenhuis PA, Snoek FJ, Heine RJ, et al. Development of a type 2 diabetes symptom checklist: a measure of symptom severity. *Diabet Med*. 1994;11(3):253–261.
16. National Committee for Quality Assurance (NCQA). Measuring quality. Improving health care. Diabetes Recognition Program. http://www.ncqa.org/dprp. Accessed February 13, 2012.
17. Cohen J. *Statistical Power Analysis for the Behavioral Sciences*. Hillsdale, NJ: Lawrence Erlbaum Assocoates, Inc; 1998.
18. Naranjo DM, Fisher L, Areán PA, et al. Patients with type 2 diabetes at risk for major depressive disorder over time. *Ann Fam Med*. 2011;9(2):115–120.
19. Rush WA, Whitebird RR, Rush MR, et al. Depression in patients with diabetes: does it impact clinical goals? *J Am Board Fam Med*. 2008;21(5):392–397.
20. Van der Does FEE, De Neeling JN, Snoek FJ, et al. Symptoms and well-being in relation to glycemic control in type II diabetes. *Diabetes Care*. 1996;19(3):204–210.
21. Yamaga K, Okajima Y, Kato S, et al. [Clinical study of depression accompanying diabetes mellitus]. *Seishin Shinkeigaku Zasshi*. 2002;104(5):417–426.
22. Brown GC, Brown MM, Sharma S, et al. Quality of life associated with diabetes mellitus in an adult population. *J Diabetes Complications*. 2000;14(1):18–24.
23. Williams JW Jr, Katon W, Lin EHB, et al; IMPACT Investigators. The effectiveness of depression care management on diabetes-related outcomes in older patients. *Ann Intern Med*. 2004;140(12):1015–1024.