THE RELATIVE IMPACT OF DIABETES DISTRESS VS DEPRESSION ON GLYCEMIC CONTROL IN HISPANIC PATIENTS FOLLOWING A DIABETES SELF-MANAGEMENT EDUCATION INTERVENTION

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Objectives: Studies in non-Hispanic populations have shown that depression and diabetes distress are associated with glycemic control. Although rates of depression and diabetes distress are high among Hispanics with diabetes, there is little research investigating the relationship between these factors and glycemic control in this population. The purpose of the current analysis was to examine the relative impact of change in diabetes distress and change in depressive symptoms on change in glycemic control in Hispanic patients following a diabetes self-management education (DSME) intervention.

Design: We conducted a diabetes self-management education intervention in 23 Hispanic (predominantly Puerto Rican) and 168 non-Hispanic type 2 diabetes patients and measured glycemic control (HbA1c), depressive symptoms (CES-D), and diabetes distress (PAID) at baseline and 6 months.

Results: In multiple linear regression, change in diabetes distress from baseline to six-month follow-up was significantly associated with change in HbA1c among Hispanic patients, such that a 10-point reduction on the PAID scale of diabetes distress was associated with a clinically significant reduction in HbA1c of .55 ± .06% (P=.03). Change in depression was not associated with change in HbA1c (P=.59). Findings in non-Hispanic patients were similar.

Conclusions: Change in diabetes distress, but not change in depressive symptoms, was associated with change in HbA1c in both Hispanic and non-Hispanic patients. This analysis supports the utility of DSME in reducing diabetes distress and improving glycemic control among Hispanic patients. (*Ethn Dis.* 2011;21(3):322–327)

Key Words: Diabetes Distress, Depression, Depressive Symptoms, Glycemic Control, Type 2 Diabetes, Intervention, Hispanic, Latino

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INTRODUCTION

The current prevalence of diabetes among Hispanics is approximately 10%,[1] and the Centers for Disease Control and Prevention has estimated that one in two Hispanics born after the year 2000 will be diagnosed with diabetes in their lifetime.[1,2] This alarming increase in diabetes among Hispanics is of great concern in any context, and is especially important given that they are the fastest growing minority group within the United States and are projected to be 25% of the US population by 2050.[3] Hispanic patients with diabetes have higher rates of certain diabetes-related complications, including higher glycemic levels and nephropathy, as well as increased mortality.[4] Moreover, Hispanic patients with diabetes have a high incidence of depression that often goes undiagnosed and untreated, which may be related to difficulties in accessing care or cultural and normative influences that affect recognition and help-seeking behaviors.[5,6]

Clinical depression, depressive symptoms, and diabetes-specific emotional distress are common comorbidities found among patients with diabetes.[7] When compared to the general population, depression is two to three times more common among diabetes patients.[8] Depression in persons with diabetes is associated with worse glycemic control and increased mortality.[9] Because of these implications, early recognition and treatment of depression is a high priority in patients with diabetes. However, successful treatments of clinical depression among patients with diabetes have had little or no effect in reducing HbA1c, improving self-care behaviors, or managing diabetes.[10,11]

Diabetes-specific emotional distress, defined as a patient's concerns about disease management, support, emotional burden, and access to care,[12] is an important condition distinct from clinical depression. Patients who display high levels of depressive symptoms may not necessarily have clinical depression, but may instead be experiencing high levels of emotional distress.[13] Fisher et al assessed 506 patients with type 2 diabetes and showed that diabetes-specific emotional distress, but not clinical depression or depressive symptoms, was significantly associated with HbA1c in both cross-sectional and longitudinal analyses.[14] In another study, van Bastelaar et al examined 627 patients with diabetes and showed that depressed patients without elevated diabetes distress did not show a significantly increased risk of elevated HbA1c.[9] Thus, the association between depression and glycemic control may be mediated by diabetes-specific emotional distress.

Despite the fact that Hispanic patients have higher rates of diabetes

as well as depression, and so may be expected to have high levels of diabetes-specific emotional distress, we are aware of only one study addressing diabetes distress in this population. This cross-sectional study found greater diabetes emotional distress for Hispanic compared to non-Hispanic patients, and found that diabetes distress was significantly associated with HbA1c.[15] The purpose of our study was to examine the association between change in diabetes distress and change in HbA1c in Hispanic (predominantly Puerto Rican) patients following a behavioral intervention. A secondary aim was to determine whether Hispanic and non-Hispanic patients differed in terms of the relative impact of change in diabetes distress vs change in depressive symptoms on change in HbA1c.

METHODS

Study Design and Participants

Participants were recruited from the adult type 2 diabetes (T2DM) patient population of a large hospital medical center in Springfield, MA following chart review and physician approval for patient participation. The Hispanic population in Springfield is predominantly (89.3%) Puerto Rican.[16] Participants were aged 30–80 years, had poorly controlled blood glucose (HbA1c≥ 7.5%), and were able to speak and write in English. Exclusion criteria included the presence of major diabetes complications (ie, proliferative retinopathy, cardiovascular conditions including stroke or myocardial infarction within the past 12 months, congestive heart failure, renal disease [microalbumin>300ug/mg], severe autonomic neuropathy, lower limb amputations), pregnancy, any severe psychiatric disorders such as schizophrenia or mental retardation, or visual, literacy, or comprehension barriers that would prevent completion of study questionnaires.

The purpose of our study was to examine the association between change in diabetes distress and change in HbA1c in Hispanic (predominantly Puerto Rican) patients following a behavioral intervention.

The six-month intervention involved randomizing patients to one of four diabetes self-management education (DSME) conditions, two of which included motivational interviewing and two of which provided standard education (methods described previously).[17] All DSME sessions were conducted by a certified diabetes educator, and all participants received four DSME sessions within the intervention period. Participants completed a baseline research visit to assess demographic (eg, age, ethnicity, sex, education level), clinical (eg, glycemic control, BMI), and behavioral factors (eg, depression, diabetes distress, self-care behaviors). Participants then completed a second research visit following the final (six month) DSME session during which the baseline assessments were repeated. The hospital's Internal Review Board committee approved the study.

Study Measures

Glycosylated hemoglobin (HbA1c) was measured in random blood samples analyzed at the Baystate Medical Center reference laboratory. The Baystate Medical Center laboratory uses the HPLC ion capture method (Tosh Medics Inc., San Francisco, CA).

Behavioral factors were measured by self-report on validated questionnaires. Diabetes distress was measured using the Problem Areas in Diabetes (PAID) scale,[18] a 20-item scale that provides an overall measure of diabetes-related emotional distress, such that higher scores denote greater distress. The PAID has high internal reliability ($\alpha>.90$), sound concurrent validity as determined by moderate to strong correlations with a range of theoretically-related measures,[18,19] and responsiveness to change with brief psychosocial and educational interventions.[20] Depressive symptoms were measured using the Center for Epidemiologic Studies Depression Scale (CES-D), a reliable, widely used 20-item assessment of depressive feelings and behaviors during the past week.[21] The standard cutoff score of ≥16 on the CES-D has a sensitivity of .95 and a specificity of .70 for predicting major depression.[22] Diabetes self-care behaviors were measured using the Self Care Inventory-Revised (SCI-R),[23] which assess patient perceptions of diet, exercise, medication adherence, and self-management of blood glucose.

Statistical Analyses

Means, standard deviations, and ranges were reported for continuous covariates (ie, age, BMI, diabetes duration, HbA1c, questionnaire scores) and categorical covariates were described as the number and percent of participants in each category (ie, sex, ethnicity, education level, medication use). Associations of baseline independent variables (eg, depressive symptoms and diabetes distress) with baseline HbA1c were assessed using multiple linear regression, such that covariates associated with HbA1c and/or dependent variables at $P<.2$ were tested in regression models, and covariates associated with at least a 10% change in the beta coefficient for HbA1c were retained in final models. Models were run in both Hispanic and non-Hispanic patients. A similar analysis was conducted for variable change scores from baseline to follow-up. All analyses were conducted using SAS software version 9.1 (SAS Institute, Cary, NC).

Table 1. Selected baseline characteristics of study participants*

	Hispanic (*n*=23) Mean (SD)	Non-Hispanic (*n*=168) Mean (SD)	*P*
Age (years)	46.3 (9.0)	56.7 (10.2)	<.01
Diabetes duration (years)	9.5 (8.7)	8.0 (6.7)	.31
Female: *n* (%)	16 (69.6%)	97 (57.7%)	.28
Education level: *n* (%)			
≤HS graduate	11 (47.8%)	60 (36.4%)	
Some college	9 (39.1%)	48 (29.1%)	
≥Bachelor's degree	3 (13.0%)	48 (29.1%)	.25
Married: *n* (%)	13 (65.0%)	94 (68.1%)	.78
Body mass index (kg/m^2)	35.3 (4.3)	34.3 (6.6)	.50
HbA1c	9.1 (1.4)	8.8 (1.2)	.44
SCI-R score	51.2 (20.6)	57.2 (15.3)	.09
PAID score	59.6 (24.4)	39.8 (22.1)	<.01
CES-D score	22.7 (14.6)	15.5 (11.0)	<.01

* SCI-R = Self-Care Inventory – Revised, range: 0 (low self-care behaviors) – 100 (high self-care behaviors); PAID = Problem Areas in Diabetes, range: 0 (low distress) – 100 (high distress); CES-D = Center for Epidemiologic Studies – Depression scale, range: 0 (no depression) – 60 (high depression), with ≥16 classified as major depression.

RESULTS

Of 545 patients who contacted study personnel and were screened for eligibility, 234 patients were eligible and enrolled in the study.[17] Of those enrolled, 23 described themselves as Hispanic and 168 described themselves as non-Hispanic, while the remaining 44 participants did not report data on ethnicity. Among the 168 non-Hispanic patients, 87% described themselves as White, 11% as Black, and 2% as another ethnicity. Of those with complete ethnicity data who completed the baseline study visit, 14 Hispanic and 134 non-Hispanic patients completed the six-month follow-up HbA1c assessment, and 11 Hispanic patients and 113 non-Hispanic patients completed the entire follow-up visit (ie, completed questionnaires and clinical assessments).

Hispanic and non-Hispanic patients differed at baseline in terms of age, PAID score, and CES-D score ($P<.01$ for all), such that Hispanic patients were younger, had more diabetes-specific emotional distress, and higher levels of depression. Hispanic patients also tended to score lower for diabetes self-care behaviors ($P=.09$) (Table 1).

In Hispanic patients, self-care behaviors were associated with HbA1c at baseline in linear regression analysis, such that a 10-point reduction in self-care behaviors was associated with a reduction in HbA1c of .33 ± .13% ($P=.02$; Table 2, Model 1). Depressive symptoms were not associated with HbA1c at baseline in Hispanic patients, while diabetes distress tended to be associated with HbA1c (Table 2). Adjustment for appropriate covariates did not affect these associations (data not shown).

The level of HbA1c tended to improve from baseline to six-month follow-up in Hispanic patients (mean change: −.63 ± 1.44; $P=.13$) (Table 3). Diabetes distress was reduced (ie, improved) among Hispanic patients, as shown by a clinically significant mean change in PAID score of −12.3±17.9 ($P=.046$; Table 3). Self-care behaviors (SCI-R) among Hispanic patients were also improved ($P<.01$). Depressive symptoms decreased among Hispanic patients over the course of follow-up ($P<.04$), although the magnitude of the decrease was not clinically significant. Changes in non-Hispanic patients for these variables were similar, with the exception of change in depressive symptoms; change in depressive symptoms was greater in Hispanic patients as compared to non-Hispanic patients (mean change = −6.9 ± 9.7 vs −1.2 ± 8.7; respectively; $P=.04$).

In linear regression analysis, change in diabetes distress from baseline to six-month follow-up was associated with change in HbA1c among Hispanic patients, such that a 10-point reduction on the PAID scale of diabetes distress was associated with a clinically significant[24] reduction in HbA1c of .55 ± .06% ($P=.03$; Table 4, Model 1). Change in depression and change in self-care behaviors were not associated with change in HbA1c among Hispanic patients ($P=.59$ and $P=.13$, respectively). Adjustment for appropriate covariates did not affect these associations (data not shown).

Table 2. Baseline association of psychosocial characteristics with HbA1c among Hispanic patients and non-Hispanic patients estimated using linear regression

	β (SE)	P*	Model R^2
Self-care behaviors (SCI)			
Model 1: Hispanic	−.033 (.013)	.02	.23
Model 2: Non-Hispanic	−.015 (.006)	.01	.03
Diabetes distress (PAID)			
Model 1: Hispanic	.017 (.012)	.16	.09
Model 2: Non-Hispanic	.010 (.004)	.02	.03
Depressive symptoms (CES-D)			
Model 1: Hispanic	.013 (.021)	.52	.02
Model 2: Non-Hispanic	.015 (.009)	.08	.01

* *P* for independent variable.

Table 3. Change in covariates among Hispanic (*n*=14) and non-Hispanic (*n*=134) patients from baseline to six months

	Mean Difference (SD) in Hispanic Patients	Mean Difference (SD) in Non-Hispanic Patients	*P*
BMI (kg/m^2)	.02 (1.60)	−.40 (2.54)	.61
HbA1c (%)	−.63 (1.44)	−.59 (1.38)†	.93
Diabetes distress (PAID)	−12.3 (17.9)*	−10.2 (16.44)†	.69
Depression (CES-D)	−6.9 (9.7)*	−1.2 (8.7)	.04
Self-care behaviors (SCI-R)	11.9 (11.5)†	8.7 (13.8)†	.46

* $P<.05$ for mean difference.
† $P<.01$ for mean difference.

DISCUSSION

This study examined the relative effects of change in diabetes-specific emotional distress and change in depressive symptoms on change in HbA1c in Hispanics with type 2 diabetes before and after a 6-month DSME intervention, and confirmed earlier cross-sectional findings that diabetes distress is higher among Hispanic patients relative to non-Hispanic patients.[15] While change in HbA1c was significantly associated with change in diabetes distress among Hispanic patients, change in depressive symptoms was not associated with change in HbA1c. This finding was consistent with that found in non-Hispanic patients, in that change in diabetes distress, and not change in depressive symptoms, was associated with change in HbA1c in both groups. Although previous studies have reported on the associations between glycemic control and depression,[8,25,26] as well as distress,[7,13,27,28] rates of depression and diabetes distress are high among Hispanics with diabetes[15], and no studies have examined the association between change in diabetes distress and change in HbA1c in a Hispanic population.

While change in HbA1c was significantly associated with change in diabetes distress among Hispanic patients, change in depressive symptoms was not associated with change in HbA1c.

Table 4. Association of change in psychosocial factors with change in HbA1c among Hispanic patients and non-Hispanic patients estimated using linear regression

	β (SE)	P*	Model R^2
Change in self-care behaviors (SCI)			
Model 1: Hispanic	−.063 (.039)	.13	.23
Model 2: non-Hispanic	−.022 (.009)	.02	.04
Change in diabetes distress (PAID)			
Model 1: Hispanic	.055 (.006)	.03	.42
Model 2: non-Hispanic	.030 (.007)	<.01	.13
Change in depressive symptoms (CES-D)			
Model 1: Hispanic	.028 (.051)	.59	.03
Model 2: non-Hispanic	.024 (.015)	.12	.01

* *P* for independent variable.

Adults with diabetes are twice as likely to experience psychological distress as the general population.[29] This distress may arise from the often constant self-care demands that come with diabetes, such as monitoring blood glucose levels, taking medication, following a healthy diet, and engaging in regular physical activity, or from coping with the threat of serious diabetes-related complications, including increased incidence of kidney disease, amputation, blindness, and the potential for reduced life expectancy.[29] In addition to distress related to diabetes, social and environmental factors may contribute to overall psychological distress. This is particularly true among Hispanics, who have higher rates of certain diabetes complications, and are usually of lower socioeconomic status, lack access to health insurance and a regular source of care, and are often faced with financial, structural, legal, cultural, and linguistic barriers that may limit their access to quality health care.[29] The impact of social factors and diabetes-related distress on overall psychological distress is especially important among Hispanics, since they are more likely to use fewer mental health services and receive poorer mental health care as compared to non-Hispanic Whites.[29]

It has been shown that high psychological distress, caused by diabetes and current life stressors, impacts diabetes behavioral and biological indicators (eg, HbA1c, blood pressure).[13] Albright et al showed that personal stress and family context are significantly associated with poor adherence to diabetes self-care activities.[25] A more recent study by Fisher et al supported that diabetes distress is indeed related to self-care activities, and showed that diabetes distress is significantly associated with HbA1c and physical activity as well as significantly and independently associated with diet and medical adherence.[26] Moreover, studies that examined daily effects of stress and mood on blood

glucose have indicated that patient reports of stressful days, unrelated to diabetes management, are linked to subsequent negative effects on average glycemic levels.[13,28,30]

While early studies of behavioral factors and diabetes outcomes focused on depression,[8,25,26] more recent studies have found that diabetes distress may be a more important predictor of glycemic control.[9,27] A recent prospective observational study of patients with diabetes found that diabetes distress, and not depression, displayed a concurrent association with HbA1c.[14] Our findings are similar to those presented in that study, suggesting that change in diabetes distress is significantly associated with change in HbA1c.

The findings of this study suggest that self-management education interventions in Hispanic patients can affect diabetes distress and glycemic outcomes. Diabetes self-management education interventions address many issues that may be causing diabetes distress such as a lack of knowledge about how to appropriately manage diet and incorporate physical activity into one's lifestyle, how to utilize medications, how to monitor blood glucose, and how to prevent and detect acute and chronic complications. More importantly, DSME may facilitate the improvement of skills that directly influence daily living such as setting goals, problem solving, controlling stress, learning relaxation techniques, and integrating psychosocial coping activities into daily life. Lacking these skills and knowledge about diabetes can negatively effect blood glucose levels, and has been associated with diabetes-specific emotional distress.[27] Our results indicate that diabetes distress may be more responsive to DSME than is depression, and further research into culturally sensitive DSME interventions designed to reduce diabetes distress in Hispanics is needed.

There are several limitations to our study. The ability to detect an effect for change in depressive symptoms may have been limited by our relatively small sample size. However, the fact that we did have sufficient power to detect a significant association for change in diabetes distress suggests that this is an important factor affecting glycemic control in Hispanic patients. The lack of association with depressive symptoms may also be related to the fact that this intervention was not specifically targeting depression; due to the complex nature of depression, depression-specific interventions may be needed to affect change in depressive symptoms.

Our study did not address the effect of acculturation on distress levels in our population of Hispanic (predominantly Puerto Rican) patients with diabetes. Previous studies have shown that higher levels of acculturation have adverse health effects among Hispanics.[31] Our patients self-identified as Hispanic and spoke English, but we did not have other data on acculturation level (eg, duration in the US, language spoken at home). Future studies should focus on the impact of acculturation on diabetes distress in the Hispanic population, as the association between diabetes distress and glycemic control may vary with degree of acculturation.

Finally, the small sample of Hispanic patients included in this analysis may not be representative of the Puerto Rican-American population as a whole. Further study in diverse Hispanic populations is needed to determine the extent to which the findings of this analysis may be generalized to the general Puerto Rican and Hispanic populations living in the United States.

Greater focus has been placed on depression in diabetes care rather than diabetes distress, as depression has been associated with non-adherence to diabetes self-care and worse overall clinical outcomes.[8] Moreover, clinicians are more likely to detect and treat depression or depressive symptoms than to diagnose and treat patients with high levels of diabetes distress.[8] In addition, there is evidence to suggest that health professionals often underestimate the adverse health effects of diabetes distress because it is expected among those with chronic conditions.[7,32] Although depressive symptoms are serious and treatable among patients with diabetes, a growing body of evidence suggests that high HbA1c levels are more strongly related to diabetes distress than to depressive symptoms.[9,14,33] The data presented here suggests the utility of assessing both current life and disease-related stressors in clinical care.

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REFERENCES

1. Centers for Disease Control and Prevention. National diabetes fact sheet: general information and national estimates on diabetes in the United States, 2007.
2. Narayan KM, Boyle JP, Thompson TJ, Sorensen SW, Williamson DF. Lifetime risk for diabetes mellitus in the United States. *JAMA*. 2003;290:1884–1890.
3. Centers for Disease Control and Prevention (CDC). Prevalence of diabetes among Hispanics–selected areas, 1998–2002. *MMWR Morb Mortal Wkly Rep*. 2004;53:941–944.
4. Carter JS, Pugh JA, Monterrosa A. Non-insulin-dependent diabetes mellitus in minorities in the United States. *Ann Intern Med*. 1996;125:221–232.
5. Glassy CM, Lemus H, Cronan T, Glassy MS, Talavera GA. Relationship between depressive symptoms and cardiovascular risk factors among selected Latino patients at a community clinic. *Psychol Health Med*. 2010;15: 117–126.
6. Lewis-Fernandez R, Das AK, Alfonso C, Weissman MM, Olfson M. Depression in US Hispanics: diagnostic and management considerations in family practice. *J Am Board Fam Pract*. 2005;18:282–296.
7. Fisher L, Skaff MM, Mullan JT, Arean P, Glasgow R, Masharani U. A longitudinal study of affective and anxiety disorders, depressive affect and diabetes distress in adults with Type 2 diabetes. *Diabet Med*. 2008;25: 1096–1101.
8. Ali S, Stone MA, Peters JL, Davies MJ, Khunti K. The prevalence of co-morbid depression in adults with Type 2 diabetes: a systematic

review and meta-analysis. *Diabet Med*. 2006;23:1165–1173.
9. van Bastelaar KM, Pouwer F, Geelhoed-Duijvestijn PH, et al. Diabetes-specific emotional distress mediates the association between depressive symptoms and glycaemic control in Type 1 and Type 2 diabetes. *Diabet Med*. 2010;27:798–803.
10. Katon WJ, Von Korff M, Lin EH, et al. The Pathways Study: a randomized trial of collaborative care in patients with diabetes and depression. *Arch Gen Psychiatry*. 2004;61:1042–1049.
11. Lin EH, Katon W, Rutter C, et al. Effects of enhanced depression treatment on diabetes self-care. *Ann Fam Med*. 2006;4:46–53.
12. Fisher L, Glasgow RE, Mullan JT, Skaff MM, Polonsky WH. Development of a brief diabetes distress screening instrument. *Ann Fam Med*. 2008;6:246–252.
13. Fisher L, Mullan JT, Skaff MM, Glasgow RE, Arean P, Hessler D. Predicting diabetes distress in patients with Type 2 diabetes: a longitudinal study. *Diabet Med*. 2009;26:622–627.
14. Fisher L, Mullan JT, Arean P, Glasgow RE, Hessler D, Masharani U. Diabetes distress but not clinical depression or depressive symptoms is associated with glycemic control in both cross-sectional and longitudinal analyses. *Diabetes Care*. 2010;33:23–28.
15. Welch G, Schwartz CE, Santiago-Kelly P, Garb J, Shayne R, Bode R. Disease-related emotional distress of Hispanic and non-Hispanic type 2 diabetes patients. *Ethn Dis*. 2007;17:541–547.
16. Kala M, Jones C. Springfield. 2006.
17. Welch G, Zagarins SE, Feinberg RG, Garb JL. Motivational interviewing delivered by diabetes educators: Does it improve blood glucose control among poorly controlled type 2 diabetes patients? *Diab Res Clin Prac*. 2011;91:54–60.
18. Polonsky WH, Anderson BJ, Lohrer PA, et al. Assessment of diabetes-related distress. *Diabetes Care*. 1995;18:754–760.
19. Welch GW, Jacobson AM, Polonsky WH. The Problem Areas in Diabetes Scale. An evaluation of its clinical utility. *Diabetes Care*. 1997;20:760–766.
20. Welch G, Weinger K, Anderson B, Polonsky WH. Responsiveness of the Problem Areas In Diabetes (PAID) questionnaire. *Diabet Med*. 2003;20:69–72.
21. Radloff LS. The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*. 1977;1:385–401.
22. Thomas JL, Jones GN, Scarinci IC, Mehan DJ, Brantley PJ. The utility of the CES-D as a depression screening measure among low-income women attending primary care clinics. The Center for Epidemiologic Studies-Depression. *Int J Psychiatry Med*. 2001;31:25–40.
23. Weinger K, Butler HA, Welch GW, La Greca AM. Measuring diabetes self-care: a psychometric analysis of the Self-Care Inventory-Revised with adults. *Diabetes Care*. 2005;28:1346–1352.
24. Waugh N, Cummins E, Royle P, et al. Newer agents for blood glucose control in type 2 diabetes: systematic review and economic evaluation. *Health Technol Assess*. 2010;14:1–248.
25. Albright TL, Parchman M, Burge SK, RRNeST Investigators. Predictors of self-care behavior in adults with type 2 diabetes: an RRNeST study. *Fam Med*. 2001;33:354–360.
26. Fisher L, Glasgow RE, Strycker LA. The relationship between diabetes distress and clinical depression with glycemic control among patients with type 2 diabetes. *Diabetes Care*. 2010;33:1034–1036.
27. Adriaanse MC, Pouwer F, Dekker JM, et al. Diabetes-related symptom distress in association with glucose metabolism and comorbidity: the Hoorn Study. *Diabetes Care*. 2008;31:2268–2270.
28. Aikens JE, Wallander JL, Bell DS, McNorton A. A nomothetic-idiographic study of daily psychological stress and blood glucose in women with type I diabetes mellitus. *J Behav Med*. 1994;17:535–548.
29. Spencer MS, Kieffer EC, Sinco BR, et al. Diabetes-specific emotional distress among African Americans and Hispanics with type 2 diabetes. *J Health Care Poor Underserved*. 2006;17:88–105.
30. Skaff MM, Mullan JT, Almeida DM, et al. Daily negative mood affects fasting glucose in type 2 diabetes. *Health Psychol*. 2009;28:265–272.
31. Kaplan MS, Marks G. Adverse effects of acculturation: psychological distress among Mexican American young adults. *Soc Sci Med*. 1990;31:1313–1319.
32. Shao WA, Williams JW Jr, Lee S, Badgett RG, Aaronson B, Cornell JE. Knowledge and attitudes about depression among non-generalists and generalists. *J Fam Pract*. 1997;44:161–168.
33. Welch GW, Weinger K, Jacobson AM. Psychosocial aspects of type 2 diabetes. In: Goldstein B, Muller-Wieland D, eds. *Textbook of Type 2 Diabetes*, 2nd ed. Martin Dunitz Publishers: London. 2007.

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