

Self Management

The influence of diabetes psychosocial attributes and self-management practices on change in diabetes status

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ABSTRACT

Objective: To examine the influence of diabetes psychosocial attributes and self-management on glycemic control and diabetes status change.

Methods: Using data from the Health and Retirement Study, a nationally representative longitudinal study of U.S. adults >51 years, we examined cross-sectional relationships among diabetes psychosocial attributes (self-efficacy, risk awareness, care understanding, prioritization of diabetes, and emotional distress), self-management ratings, and glycemic control. We then explored whether self-management ratings and psychosocial attributes in 2003 predicted change in diabetes status in 2004.

Results: In multivariate analyses ($N = 1834$), all diabetes psychosocial attributes were associated with self-management ratings, with self-efficacy and diabetes distress having the strongest relationships (adj coeff = 8.1, $p < 0.01$ and -4.1 , $p < 0.01$, respectively). Lower self-management ratings in 2003 were associated cross-sectionally with higher hemoglobin A1C (adj coeff = 0.16, $p < 0.01$), and with perceived worsening diabetes status in 2004 (adj OR = 1.36, $p < 0.05$), with much of this latter relationship explained by diabetes distress.

Conclusion: Psychosocial attributes, most notably diabetes-related emotional distress, contribute to difficulty with diabetes self-management, poor glycemic control, and worsening diabetes status over time.

Practice implications: Self-management and adherence interventions should target psychosocial attributes such as disease-related emotional distress.

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1. Introduction

Effective patient self-management is necessary to prevent adverse clinical outcomes in diabetes [1,2]. A number of psychosocial attributes have been associated with diabetes self-management. For example, individuals with higher levels of diabetes self-efficacy [3–8], more knowledge about diabetes [9–11], and better understanding of their diabetes status and risk for complications [12,13] have better diabetes self-management and glycemic control.

Other attributes, such as diabetes-related emotional distress, are associated with poor diabetes self-management and glycemic control [14–16]. Distress about diabetes can encompass a range

of emotions, including feeling discouraged about a treatment plan, worrying about low blood sugar or long-term disease complications, and having difficulty paying for medications or defining concrete goals for diabetes care. Not surprisingly, there is often substantial overlap between levels of distress and depressive symptoms [17], which have also been shown to influence glycemic control [18].

Many of these diabetes-related psychosocial attributes are modifiable through interventions [3,19–23], suggesting a potential opportunity to improve patient outcomes by targeting these attributes. Little is known, however, about the relative contributions of these psychosocial attributes to a person's performance of self-management tasks [24]. In addition, it is unclear whether patients' self-assessment of these attributes and of their self-management can reliably predict changes in their diabetes status over time.

To address these deficiencies, we developed a conceptual model illustrating hypothesized associations among psychosocial attributes, self-reported performance of self-management tasks, and patient-perceived diabetes status change (Fig. 1). Using this model,

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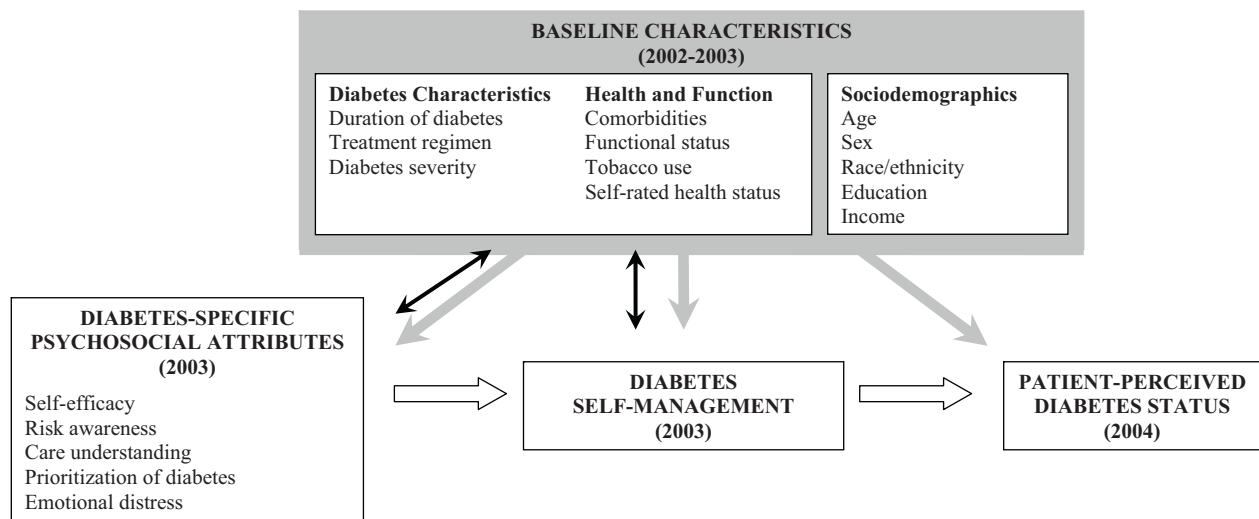


Fig. 1. Hypothesized relationships among psychosocial attributes, self-reported self-management, and perceived diabetes status change over one year.

we sought to answer two related research questions: (1) what is the relative contribution of key diabetes psychosocial attributes, such as disease-specific self-efficacy and distress, to performance of self-management tasks, and (2) to what degree does a person's assessment of their self-management and psychosocial attributes predict patient-perceived diabetes status over time. We examined these relationships using the health and retirement study (HRS), a nationally representative longitudinal study of middle-aged and older adults.

2. Methods

2.1. Study population

The HRS is a nationally representative longitudinal study of adults over the age of 50 [25]. In-depth health and economic information is gathered from more than 22,000 individuals through biennial surveys. In 2003, the HRS conducted a substudy of individuals with diabetes. HRS participants who reported a diagnosis of diabetes in 2002 and were not participating in other concurrent HRS substudies were eligible. Of the 2514 eligible participants, 129 were determined to have died prior to the October 2003 start of the Diabetes Study. Questionnaires were returned by 1901 of the remaining eligible individuals (response rate 79.7%). The survey covered a wide range of topics including diabetes history and status, performance of self-management tasks, and knowledge and feelings about diabetes. A subset of 1233 participants (64.9% of those who returned questionnaires) returned a valid blood specimen using a self-administered hemoglobin A1C fingerstick kit. Individuals with certain characteristics (males, non-blacks, and those with higher levels of education, higher income, fewer limitations in activities of daily living, shorter duration of diabetes, better health status, and lower levels of depression) were significantly more likely to return the hemoglobin A1C assay. Individuals with type 1 diabetes ($n = 50$) and those under the age of 51 at the time of the 2003 survey ($n = 17$) were excluded, resulting in a total sample of 1834, including 1187 individuals with hemoglobin A1C values.

2.2. Study variables

2.2.1. Diabetes status change

The main outcome of interest was perceived diabetes status change. This was assessed in the 2004 core HRS survey by asking,

"Since we interviewed you last, is your diabetes better, worse, or about the same?" Responses were dichotomized as "worse" vs. "better" or "about the same."

2.2.2. Baseline measures of self-management and psychosocial attributes

Self-management was assessed in the 2003 diabetes survey using a well-validated measure in which participants were asked to rate their difficulty with and ability to complete tasks over the past six months in five domains (medication adherence, diet, exercise, blood sugar monitoring, and checking feet for ulcers) (Appendix Table A) [26,27]. Responses on a 5-point scale ranged from "So difficult: I could not do it at all," to "Not difficult: I got it exactly right." The sum of responses to the five self-management questions, which could range from 0 to 25, was converted to a 100-point scale and used as a dependent variable in cross-sectional analyses. For purposes of presentation clarity, this measure was categorized when used as an independent variable in longitudinal analyses. For the categorical variable, an individual's overall self-management rating was considered low, moderate, or high based on whether the individual ranked 0–1, 2–3, or 4–5 self-care tasks as "Not difficulty: I got it exactly right."

Five diabetes-specific psychosocial attributes were assessed in the 2003 diabetes survey (Appendix Table A). Diabetes self-efficacy, risk awareness, and care understanding were evaluated using validated measures adapted from the diabetes care profile [28]. Diabetes self-efficacy was measured based on participants' reported confidence in their ability to perform six key diabetes care activities. Diabetes risk awareness, a measure of a person's perception of potential adverse consequences of diabetes and their ability to modify these outcomes, was assessed by asking participants whether they agreed that following their prescribed diabetes treatment plan closely would help prevent six potential adverse consequences of diabetes. Diabetes care understanding was assessed by asking participants to rate how well they understood ten different aspects of their diabetes care [26]. Prioritization of diabetes was assessed by asking participants whether they agreed with the statement, "Taking care of my diabetes is my top priority right now" [29]. Diabetes-specific emotional distress was assessed through questions adapted from the problem areas in diabetes scale, in which participants were asked to rate whether ten potential diabetes-related psychosocial stressors were a problem for them [15]. For purposes of presentation clarity, psychosocial attributes were analyzed as

categorical variables that were constructed a priori by dichotomizing item responses, summing the items into a single score, and then dividing the scores into three categories that ensured a reasonable sample size in each group (Appendix Table A).

2.2.3. Covariates

Measures of baseline diabetes status included duration of diabetes, treatment regimen, and diabetes severity. Duration of diabetes was ascertained by subtracting age at diabetes diagnosis from age at the time of the 2003 diabetes survey. Missing values were replaced using the diabetes diagnosis year from the HRS 2006 or 2008 core surveys, or by identifying the last HRS core survey in which the participant reported not having diabetes. Antihyperglycemic treatment regimen was obtained from the 2003 diabetes survey and was categorized as no medications, oral medications with no insulin treatment, and insulin treatment with or without oral medications. Diabetes severity was evaluated using diabetes-related components of the total illness burden index (TIBI) score; a composite measure that was developed to assess comorbid illness in older adults using self-reported symptoms and medical event history [30].

Baseline self-rated health status was assessed using a single-item validated measure taken from the 2002 HRS core survey [31]. Baseline functional status was assessed through a count of activities of daily living limitations as reported in the 2002 HRS core survey. Non-diabetes comorbidities were assessed through reports of hypertension, cancer, non-asthma chronic lung disease, coronary heart disease or heart failure, stroke or TIA, or arthritis in the 2002 HRS core survey. Tobacco use over the past ten years was determined using data from HRS core surveys between 1992 and 2002. Depression was assessed in the 2003 HRS core survey through a modified version of the Center for Epidemiologic Studies Depression Scale (CES-D) that incorporates 8 of the original 20 items [32,33].

Sociodemographics obtained from the 2002 HRS core survey were race (white, black, other), sex, years of formal education (<12, 12, >12), and income (analyzed in quartiles of ratio of family income to the poverty threshold). Age was assessed at the time of the 2003 diabetes survey and was analyzed as a continuous variable.

2.3. Hemoglobin A1C

A hemoglobin A1C value was obtained via a 2003 mail-in assay (At-Home; FlexSite Diagnostics Inc, Palm City, FL) that uses the Roche Unimate immunoassay and the Cobas Integra analyzer (F. Hoffmann-La Roche Ltd., Basel, Switzerland) calibrated to a synthetic hemoglobin A1C standard.

2.4. Statistical analysis

Cross-sectional relationships between each psychosocial attribute and individuals' overall self-management ratings were examined with multivariate regression analyses adjusting for baseline sociodemographics, health, and diabetes covariates. For the subset of participants with a 2003 measure of glycemic control, bivariate and multivariate cross-sectional relationships were examined between individuals' psychosocial attributes and self-management ratings, and their hemoglobin A1C values. In addition, ANOVA analyses were used to explore the relationship between participants' age and their levels of self-management, psychosocial attributes, and glycemic control.

Multivariate logistic regression models were utilized to assess predictors of worsening perceived diabetes status in 2004. First, a model was constructed to examine the relationship between poor self-reported self-management and worsening diabetes status,

adjusting for sociodemographics (age, race, sex, education, income) and baseline health, function, and diabetes characteristics. Next, the five diabetes-specific psychosocial attributes (self-efficacy, care understanding, prioritization of diabetes, risk awareness, and emotional distress) were added to the model to determine how these attributes influenced the relationship between self-management and diabetes status change. Secondary analyses were subsequently conducted to examine the predicted probability of diabetes status change in the presence or absence of key explanatory variables, with all covariates set at the population means. Additional post hoc analyses were conducted to determine whether significant findings in patients with high levels of diabetes distress were sensitive to the presence of depression symptoms.

Missing items from multiple-item scales were imputed using person mean imputation, where an individual's mean score over observed scale items replaces a missing scale item. Rates of item-level missing data were less than 10% for all covariates used in analyses except for depression, which was included only in secondary analyses and had a missing rate of 10.5%. Regression diagnostic procedures yielded no evidence of multicollinearity in any of the regression models. Diabetes survey weights were utilized in analyses with diabetes status change to adjust for the oversampling design of HRS. Cross-sectional analyses did not utilize survey weights, thus these results are not nationally representative. All analyses were performed using Stata 11.0 (StataCorp 2009, College Station, TX). All data were deidentified and publicly available (<http://hrsonline.isr.umich.edu/>), and the surveys were approved by an institutional review board at the University of Michigan.

3. Results

Table 1 summarizes the baseline characteristics of the 1834 participants who completed the 2003 diabetes survey. Self-reported self-management ratings and psychosocial attributes of these respondents are provided in Appendix Table A.

3.1. Self-reported self-management

There were 448 (26%) individuals who reported performing four or five of the five self-management tasks exactly right over the past six months and were categorized as having high levels of self-management, and 545 (31%) who reported performing none or only one of these tasks exactly right over this time period and were categorized as having low levels of self-management (Appendix Table A). Exercise and diet were the two most challenging self-management activities, with 54% and 35% of individuals reporting difficulty executing these tasks as recommended, respectively (Appendix Table B). Self-reported self-management increased steadily, and significantly, with age (F -statistic 8.56, $p < 0.001$) (Appendix Table C).

3.2. Diabetes-specific psychosocial attributes

Prioritization of diabetes was high, with 1173 (67%) respondents reporting that taking care of their diabetes was one of their top priorities (Appendix Table A). A similar proportion of respondents had high levels of diabetes care understanding in at least 9 of 10 domains (1163, 66%), and high levels of risk awareness regarding the long-term complications associated with uncontrolled diabetes (1262, 72%). Levels of diabetes self-efficacy were also high, with 1092 respondents (61%) indicating that they were confident in their ability to perform at least seven of eight diabetes tasks. Diabetes-specific emotional distress, however, was present to some degree in 62% of individuals, with 657 (38%) participants stating that 1–3 diabetes issues were currently a moderate

Table 1
Participant characteristics.

	Value	Sample, n
Sociodemographics		
Age, mean (SD)	70 (9)	1834
Education (%)		
<12 years	35	640
12 years	33	609
>12 years	32	581
Income, mean (SD) ^a		
1st quartile	1.0 (0.4)	452
2nd quartile	2.2 (0.3)	452
3rd quartile	3.6 (0.5)	452
4th quartile	8.6 (7.8)	453
Race (%)		
Caucasian	76	1402
Black	19	350
Other	5	82
Gender (%)		
Female	52	960
Male	48	874
Baseline Health and Function		
ADL Limitations (%)		
0	76	1400
1–2	17	310
3–5	7	122
Comorbidities, mean (SD) ^b	2 (1)	1746
Tobacco use in past 10 years		
No	82	1508
Yes	18	326
Diabetes duration, mean years (SD)	12 (11)	1732
Diabetes Treatment Regimen (%)		
No insulin or oral medication	15	265
Oral medication only	61	1101
Insulin ± oral medication	24	426
Diabetes severity, mean (SD) ^c	2.5 (1.1)	1834
Self-rated health status (%)		
Good/very good/excellent	55	990
Fair/poor	45	802
Depression (%)		
Absent	39	643
Mild (modified CESD of 1–3)	42	690
Moderate/severe (modified CESD of 4–8)	19	308

^a Ratio of family income to poverty threshold in 2002 HRS core survey.^b Presence of hypertension, cancer, lung disease, heart disease, stroke, or arthritis in 2002 HRS core survey.^c Diabetes severity is measured using the diabetes-related components of the Total Illness Burden Index score (range = 1–4).

problem for them, and 423 (24%) participants stating that 4–10 diabetes issues were currently a serious problem for them. The most common issues causing distress were finding money to pay for medications and supplies (25%), feelings of food deprivation (32%), and worrying about the future and the possibility of serious complications (38%) (Appendix Table D).

Several attributes had significant relationships with age. Emotional distress decreased significantly as age increased (F -statistic 7.37, $p < 0.001$). Risk awareness and care understanding also decreased significantly with age, while self-efficacy and prioritization of diabetes did not change substantially (Appendix Table C).

3.3. Associations among psychosocial attributes, self-management, and glycemic control

In multivariate cross-sectional analyses that adjusted for baseline sociodemographics and health covariates, all diabetes-specific attributes were independently associated with self-reported self-management, with diabetes self-efficacy having the strongest positive relationship (adjusted coefficient = 8.1, $p < 0.01$) and diabetes distress having the strongest negative relationship (adjusted coefficient = -4.1 , $p < 0.01$) (Table 2). Among the subset of individuals with cross-sectional hemoglobin A1C levels, lower self-management ratings and higher levels of diabetes distress were associated with worse glycemic control (adj coeff for hemoglobin A1C = 0.16, $p < 0.01$ and 0.21, $p < 0.01$, respectively). Higher levels of diabetes care understanding were associated with better glycemic control (adjusted coefficient -0.14 , $p < 0.05$), and there was a non-significant trend suggesting a correlation between self-efficacy and risk awareness with lower hemoglobin A1C as well (adjusted coefficients -0.07 , $p = 0.22$ and -0.09 , $p = 0.14$, respectively).

3.4. Predictors of worsening diabetes status over time

Low self-reported ratings of self-management in 2003 were associated with a greater likelihood of perceived worsening diabetes status the following year (adjusted OR 1.36, $p < 0.05$) (Table 3). When the model was adjusted for psychosocial attributes, however, this association was no longer significant (adjusted OR 1.17, $p = 0.34$), suggesting that the attributes account for some of the observed relationship between self-management and diabetes status change. Of the psychosocial attributes that were evaluated, only diabetes distress independently influenced

Table 2
Cross-sectional relationships between diabetes-specific psychosocial attributes, self-reported self-management rating, and glycemic control (2003).

	Self-management ^a	Self-management rating corresponding to low, medium, or high intensity of psychosocial attribute ^c			Hemoglobin A1C
	Adjusted coefficient ^b	Low	Medium	High	Adjusted coefficient ^b
Low self-management ratings ^c	–	–	–	–	0.16 ^e
Psychosocial attributes					
Diabetes self-efficacy	8.1 ^e	67.1	75.1	83.2	-0.07
Diabetes risk awareness	1.9 ^e	75.8	77.8	79.7	-0.09
Diabetes care understanding	4.5 ^e	72.1	76.6	81.0	-0.14^d
Prioritization of diabetes	3.1 ^e	74.0	77.1	80.2	0
Diabetes-specific emotional distress	-4.1^e	82.3	78.2	74.1	0.21 ^e

^a Self-management rating is a 100-point score that represent participants' self-reported difficulty with and ability to complete tasks over the past six months in five domains (medication adherence, diet, exercise, blood sugar monitoring, and checking feet for ulcers). Higher scores indicate higher self-management ratings.^b Results are from separate multivariate regression analyses for each attribute, with the 100-point self-management rating or hemoglobin A1C serving as the dependent variable. Models are adjusted for sociodemographics, baseline functional status, health status, and comorbidities, tobacco use, diabetes duration, treatment regimen, and severity. Models did not adjust for health status, but in sensitivity analyses that included health status, results were unchanged.^c Self-management and psychosocial attribute categories are described in Appendix Table A.^d $p < 0.05$.^e $p < 0.01$.

Table 3

Association between patient self-management ratings and psychosocial attributes (2003), and perceived worsening diabetes status (2004).

	Unadjusted OR	Adjusted OR ^a	
		N = 1403	N = 1312
Poor self-rated self-management ^d	1.45 ^c	1.36 ^b	1.17
Psychosocial attributes			
Diabetes self-efficacy ^d	0.77 ^b	–	0.93
Diabetes risk awareness ^d	1.05	–	1.01
Diabetes care understanding ^d	0.85	–	0.92
Prioritization of diabetes ^d	1.02	–	0.92
Diabetes-specific emotional distress ^d	2.15 ^c	–	1.81 ^c

^a Both models adjust for 2002 or 2003 measures of age, race, sex, education, income, health status, functional limitations, comorbidities, tobacco use, diabetes duration, diabetes medication regimen, and diabetes severity (TIBI score).

^b $p < 0.05$.

^c $p < 0.01$.

^d Self-management and psychosocial attributes are categorized as high, moderate, and low, as described in [Appendix Table A](#).

diabetes status change in the full multivariable model, with higher levels of distress resulting in greater likelihood of perceived worsening diabetes status in 2004 (adjusted OR 1.81, $p < 0.01$).

Several post hoc analyses were conducted to further explore the relationship between diabetes distress and worsening diabetes status. [Fig. 2](#) illustrates how this relationship remains fairly consistent across all self-reported ratings of self-management. For example, the predicted probability of worsening diabetes status ranges from 3.9% with no diabetes distress to 11.7% with severe diabetes distress among individuals with high self-management ratings, and ranges from 5.2% to 15.4% among individuals with low self-management ratings. Given the known clinical association between depression and diabetes distress [\[14\]](#), the relationship between these constructs was also evaluated. There was a moderate correlation between continuous measures of these variables ($r = 0.32$). When depression was included in the full model, however, a significant association between diabetes distress and worsening diabetes status persisted (OR 1.70, $p < 0.01$).

4. Discussion and conclusion

4.1. Discussion

In this study of middle-aged and older individuals with type 2 diabetes, we identified a strong cross-sectional relationship between multiple diabetes-specific psychosocial attributes (including self-efficacy, care understanding, and disease-related distress) and self-management. We also confirmed that poor

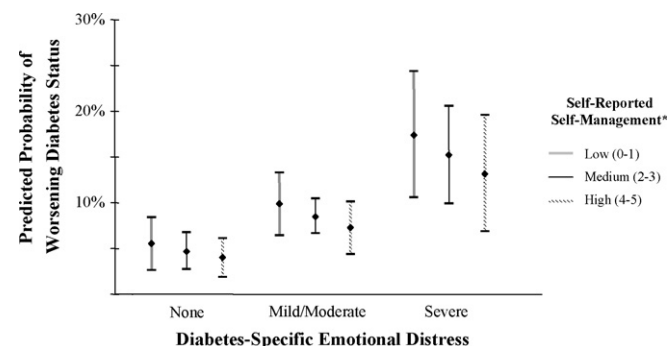


Fig. 2. Predicted probability of worsening diabetes status (2004) with varying levels of diabetes-specific emotional distress and self-reported self-management (2003). *Self-management rating refers to the number of self-management tasks (taking medications, exercising regularly, following recommended diet, checking blood sugar, checking feet for wounds or sores) that patient rated as “Not Difficult: I got it exactly right”.

self-management ratings correlate with worse glycemic control cross-sectionally and are strongly associated with worsening perceived diabetes status over one year. Much of this latter relationship may be attributed to high levels of diabetes-related emotional distress and other psychosocial attributes.

Our findings build on over two decades of work examining how individuals' self-management behaviors are influenced by specific attributes, such as their understanding about their diabetes care [\[11\]](#), their confidence in their ability to manage their disease [\[4,5,7,34–36\]](#), and their diabetes-related emotional distress [\[15\]](#). One of the strengths of this study is the simultaneous evaluation of multiple psychosocial attributes in a large national sample of middle-aged and older adults, which enabled a comparison of the relative impact of these characteristics on both self-management and glycemic control. Of the five psychosocial attributes that were assessed, high levels of diabetes self-efficacy, followed by high levels of diabetes care understanding and low levels of diabetes-related emotional distress, appeared to have the strongest association with performance of self-management tasks. This study also verifies previous findings that effective self-management [\[27,28,37\]](#), better diabetes care understanding [\[9,10\]](#), and low levels of diabetes distress [\[14–16\]](#), are associated with better glycemic control. Our results support a previously cited relationship between self-efficacy and glycemic control as well [\[8,23\]](#), although the association was not statistically significant in this study.

Our finding that poor self-management ratings were significantly associated with worsening perceived diabetes status over one year builds on previous research demonstrating a relationship between self-management and glycemic control over short time periods [\[38,39\]](#). Interestingly, in our sample, much of this relationship appears to be explained by high levels of diabetes distress. Furthermore, the effect of distress was virtually unchanged when the model accounted for concurrent depression, indicating that diabetes distress exerts an independent effect on perceived diabetes status [\[14\]](#). These results suggest that a central aim of diabetes self-management interventions should be to address and reduce some of the feelings of anxiety, worry, guilt, and fear that frequently accompany this condition. This may be especially important among middle-aged patients, who we found to have higher levels of emotional distress.

There are several potential limitations of this study that should be noted. HRS focuses on individuals aged 51 years and older, so results should not be generalized to younger individuals. All independent variables were based on HRS survey data, and are therefore subject to errors associated with self-reported information. In particular, social desirability bias may have influenced individuals' responses about their self-management behaviors. Another limitation is that given the breadth of HRS, some of the validated scales for psychosocial attributes (e.g., self-efficacy and diabetes distress) and other characteristics (e.g., depression) were shortened such that measurement error may have been introduced.

An additional limitation of this study is that certain relevant outcomes could not be evaluated. For example, although the HRS has recently started tracking hemoglobin A1C for all respondents, the sample of individuals with repeat measures of hemoglobin A1C is currently too small to examine change in glycemic control over time. We also did not have information after 2003 about the presence of diabetes complications such as retinopathy and neuropathy, which have been associated with poor glycemic control [\[40\]](#). Thus, the only outcome that specifically measured a change in diabetes severity was the measure of perceived change in diabetes status; a valuable patient-centered outcome, but one that has not been validated against objective measures of disease control.

4.2. Conclusion

Our findings suggest that multiple diabetes-specific psychosocial attributes, including self-efficacy, care understanding, and diabetes-related distress, are strongly associated with a person's self-management of their disease and their glycemic control. Diabetes distress, in particular, also appears to account for a substantial component of the relationship between self-management and perceived diabetes status change over a one year period. Future research should examine repeated patient assessments of these constructs to clarify the stability of these measures and the consistency of their relationship with glycemic control and other measures of disease status.

4.3. Practice implications

Interventions aiming to improve diabetes self-management activities and adherence should target psychosocial attributes that might account for difficulties with these tasks, such as disease-related emotional distress. Emphasizing these attributes may lead to improved glycemic control, and reduce the likelihood of complications and declining health secondary to diabetes.

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Conflict of interest

None disclosed

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at [doi:10.1016/j.pec.2011.07.013](https://doi.org/10.1016/j.pec.2011.07.013).

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