Diabetes Distress and Glycemic Control: The Buffering Effect of Autonomy Support From Important Family Members and Friends

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OBJECTIVE

To examine whether autonomy support (defined as social support for an individual's personal agency) for diabetes management from informal health supporters (family/friends) reduces the detrimental effects of diabetes distress on glycemic control.

RESEARCH DESIGN AND METHODS

Three hundred eight veterans with type 2 diabetes and one or more risk factors for diabetes complications completed a survey that included measures of diabetes distress and perceived autonomy support from their main informal health supporter. Hemoglobin A_{1c} (HbA_{1c}) data from 12 months before and after the survey were extracted from electronic medical records. Linear mixed modeling examined the main effects and interaction of autonomy support and diabetes distress on repeated measures of HbA_{1c} over the 12 months after the survey, controlling for mean prior 12-month HbA_{1c}, time, insulin use, age, and race/ethnicity.

RESULTS

Diabetes distress (B = 0.12 [SE 0.05]; P = 0.023) was associated with higher and autonomy support (B = −0.16 [SE 0.07]; P = 0.032) with lower subsequent HbA_{1c} levels. Autonomy support moderated the relationship between diabetes distress and HbA_{1c} (B = −0.13 [SE 0.06]; P = 0.027). Greater diabetes distress was associated with higher HbA_{1c} at low (B = 0.21 [SE 07]; P = 0.002) but not high (B = 0.01 [SE 0.07]; P = 0.890) levels of autonomy support.

CONCLUSIONS

Autonomy support from main health supporters may contribute to better glycemic control by ameliorating the effects of diabetes distress. Interventions that reduce diabetes distress and enhance the autonomy supportiveness of informal supporters may be effective approaches to improving glycemic control.

Effective diabetes management requires ongoing self-care regimens that often are complex and demanding (1,2). Many individuals with diabetes experience diabetes distress, which is defined as emotional distress resulting from burdensome symptoms, onerous self-management regimens, fear of complications, and loss of functioning (3). Diabetes distress is relatively stable over time, and approximately one-third of adults with type 2 diabetes experience clinically significant levels of diabetes distress (4,5).

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Adults with poorly controlled diabetes, who are at high risk for diabetes complications, are more likely to experience high levels of diabetes-related distress (6–8), which in turn is associated with poor diabetes self-management and glycemic control (9–14).

Social support consistently has been linked to better health outcomes among adults with chronic health conditions (15,16), including diabetes (17,18). Two general models have been proposed to elucidate the beneficial role of social support on health outcomes (19,20). First, the direct-effects model contends that social support has a direct positive effect on health through health-promoting behaviors, helpful psychological states, and physiological processes independent of stressful experiences. A large body of evidence supports the direct effect of social support on improved health outcomes among adults with diabetes (17,18). Second, the stress-buffering model postulates that social support mitigates the negative effects of stress on health outcomes. Baek et al. (21) found that the size of a patient's social network and his or her general support satisfaction moderate the relationship between diabetes-related burden (i.e., insulin use, diabetes complications) and diabetes distress, suggesting that general forms of social support may buffer the effect of diabetes-related stressors on the patient's experience of diabetes-related distress. Griffith et al. (22) found that greater support satisfaction is associated with better glycemic control at high, but not low, levels of life stress, indicating that general social support may play a role in moderating the impact of general stress on glycemic control. However, whether social support for diabetes self-management buffers the relationship between diabetes-related distress and glycemic control is not clear.

Family members and friends represent particularly important sources of support for individuals with diabetes. Most adults with diabetes obtain self-management support from family members (23), with older adults receiving an average of 10–14 h of assistance from informal supporters per week (24). However, social support from family members and friends may be most helpful when provided in the context of autonomy-supportive relationships (25,26). Autonomy support for chronic disease management involves acknowledging patients' perspectives, providing choices, responding to patients' self-care initiatives, and minimizing control of patients' self-care behavior (27). Greater autonomy support from health care providers is associated with lower diabetes distress (28) and better glycemic control (28–30). Yet, to date, no studies to our knowledge have examined the potential impact on glycemic control of autonomy support from informal sources of support, such as family and friends. Furthermore, no studies have examined the potential role of autonomy support from health supporters in buffering the relationship between diabetes distress and glycemic control.

The current study examines whether autonomy support from patients' main health supporters (i.e., family members, friends) is directly associated with subsequent 12-month glycemic control and whether it buffers the relationship between high diabetes distress and subsequent glycemic control. Thus, we hypothesized that higher autonomy support from informal supporters is associated with lower HbA_{1c} levels and, in parallel with the stress-buffering model of support (20), moderates the relationship between diabetes distress and HbA_{1c} levels during the following 12-month period. Specifically, we predicted that increased levels of autonomy support would attenuate the relationship between greater diabetes distress and higher subsequent 12-month HbA_{1c}.

RESEARCH DESIGN AND METHODS

Study Sample

Adults with type 2 diabetes at high risk for complications were identified from an existing registry of patients with diabetes within a single U.S. Department of Veterans Affairs (VA) health care system. The registry included patients with *1*) an HbA_{1c} within 6 months $>$8.0% among those $<$55 years of age or an HbA_{1c} $>$9.0% for those $\geq$55 years of age, *2*) a blood pressure reading within 6 months $>$160/100 mmHg or average blood pressure over the prior 6 months $>$150/90 mmHg, or *3*) a diagnosis of lower-extremity ulcer and/or amputation. Age-based differences in HbA_{1c} criteria were determined by the health system clinical registry used for recruitment and reflect current clinical guidelines that recommend setting higher HbA_{1c} targets for older patients with type 2 diabetes (31–33). In June 2012, surveys with electronic medical record (EMR) release forms were mailed to a randomly selected sample of 1,000 registry patients; 588 surveys were returned. Of the returned surveys, 478 (81.3%) included signed EMR release forms. Hispanic respondents provided significantly lower rates of consent for EMR release (n = 12 [66.6%]) than non-Hispanic respondents (n = 442 [82.6%]; χ^2 = 3.94; P = 0.047). However, rates of EMR consent did not differ significantly by age, sex, race, education level, marital status, living situation (alone vs. with one or more persons), presence of a main health supporter, diabetes distress, or perceived autonomy support (all $P > 0.05$). HbA_{1c} data from June 2011 to June 2013 (i.e., 12 months before and after the survey) were extracted from consenting respondents' EMR. Four hundred eleven (86.0%) respondents had at least one HbA_{1c} measurement in the 12 months before and after the survey. These participants did not differ significantly from patients without HbA_{1c} in the 12 months before or after the survey on any of the study variables (all $P > 0.05$). Respondents were asked to identify one family member (i.e., spouse/partner, adult child, sibling, parent, other relative) or friend most involved in their health care (e.g., helping them to remember to take medications, encouraging them to exercise). This individual was designated as the respondent's main health supporter. Only respondents who indicated that they had a main health supporter (n = 315 [76.6%]) were included in this study. Respondents with a main health supporter did not differ from those without a main health supporter on any of the study variables (i.e., age, race/ethnicity, insulin use, diabetes distress, subsequent 12-month HbA_{1c}) (all $P > 0.05$). Seven (2.2%) respondents had data missing for one or more study variable and were excluded. Therefore, the resulting sample included 308 adults with a total of 734 valid HbA_{1c} tests (mean 2.38/participant) extracted from their EMR over the 12 months after the survey.

Outcome Variable

HbA_{1c} was used to assess participants' glycemic control. All HbA_{1c} values available in the health system EMR from the 12-month period before and after the survey were extracted. Participants' HbA_{1c} measurements during the 12 months after the survey were the primary outcome of

interest. Laboratory methods used to test each blood sample were consistent with the National Glycohemoglobin Standardization Program.

Predictor Variables

Participants' perceived autonomy support from their main health supporter was measured using a modified version of the Important Other Climate Questionnaire (IOCQ) (27). The scale comprises four items describing the patient's main health supporter (e.g., "My main health supporter respects my choices about how to care for my health"), which participants rated on a five-point Likert scale from strongly disagree to strongly agree. Total scores are calculated by averaging item responses. Higher scores indicate greater perceived autonomy support. The IOCQ is a reliable and valid predictor of short- and long-term changes in health behaviors, including smoking cessation and diet (27). Internal consistency of the scale is good ($\alpha = 0.86$).

The Diabetes Distress Scale 2 (DDS-2) was used to assess participants' emotional distress associated with the experience of living with diabetes (34). The scale comprises two items from the 17-item DDS (35) that are rated from 1 (not a problem) to 6 (a very serious problem). Item responses are averaged to generate a total score, with higher scores indicating greater diabetes distress. DDS-2 total scores are strongly associated with the 17-item DDS total scores and are predictive of diabetes self-care behaviors (e.g., diet, physical activity) and HbA_{1c} (14,34). Items demonstrated a high level of intercorrelation in the current sample (Spearman $r = 0.72$; $P < 0.001$).

Control Variables

Demographic variables were assessed by survey. Age, race, and ethnicity (i.e., Hispanic vs. non-Hispanic) were included as control variables. Given the small proportion of nonwhite and Hispanic participants, race and ethnicity were combined into a single binary variable (non-Hispanic white vs. other race/ethnicity). Participants' use of insulin was determined through pharmacy data extracted during the 12 months before and after the survey. HbA_{1c} values during the 12 months preceding the survey were averaged to generate a measure of each participant's prior glycemic control, which was included as a control variable in each model to better estimate the prospective association between each predictor (i.e., diabetes distress, autonomy support) and HbA_{1c} during the following 12-month period. The number of weeks between the survey date and the date of each HbA_{1c} measurement during the following 12-month period was calculated and included in each model to examine and control for the effects of time. Control variables were selected a priori on the basis of patient characteristics associated with both diabetes distress and glycemic control (8,21,36–38).

Data Analysis

Descriptive statistics were used to characterize the sample. A linear mixed model was used to examine the hypothesized main effects of diabetes distress and autonomy support on participants' HbA_{1c} measurements during the following 12-month period. HbA_{1c} values were clustered within each participant. The model was adjusted for their prior glycemic control, time, insulin use, age, and race/ethnicity and retested after including diabetes distress, autonomy support, and the interaction of autonomy support and diabetes distress. In both linear mixed models, diabetes distress, autonomy support, and each control variable (i.e., prior glycemic control, time, insulin use, age, race/ethnicity) were treated as fixed effects. Both models were tested with and without random intercepts to quantify and control for potential within-subject correlation on the repeated measurements of HbA_{1c} over the 12 months after the survey. The fits of competing models were compared using a likelihood ratio χ^2 test. All statistical tests were two-tailed, with α set to 0.05. Analyses were performed using the MIXED command in SPSS version 24.0.

The interaction between autonomy support and diabetes distress was further examined by plotting the simple intercepts and slopes representing the relationship between diabetes distress and HbA_{1c} during the following 12-month period at high (+1 SD) and low (−1 SD) levels of autonomy support (39). Simple slopes were tested against zero using asymptotic z values. Next, the region of significance was computed to determine the boundary value of autonomy support at which the relationship between diabetes distress and subsequent 12-month HbA_{1c} reached statistical significance ($P < 0.05$). To further visualize the interaction, we created plots for the linear relationship between the simple slope of autonomy support and HbA_{1c} measurements over the following 12 months (y-axis) with autonomy support (x-axis). Continuous variables were mean centered before testing each model.

RESULTS

Sample Characteristics

The sample was primarily male (98.1%) and white and non-Hispanic (84.1%), with a mean age of 66.49 years (SD 10.15) (Table 1). Most of the sample had a high-school or higher level of education (86.4%). Spouses/partners were the most common health supporter (69.2%). The mean DDS-2 score was 2.22 (SD 1.19) and within the moderate range of diabetes distress suggested by Fisher et al. (5). Most participants used insulin with or without oral diabetes medication (60.4%), and approximately one-third used oral diabetes medication only (35.7%). The mean of each participants' average HbA_{1c} during the 12 months after the survey was 7.9% (63 mmol/mol) (SD 1.4%). In accordance with clinical recommendations for monitoring glycemic control, most participants (96.1%) had between one and four HbA_{1c} measurements (range one to seven) in the 12 months after the survey (32). The average time between the survey and each HbA_{1c} measurement was 25.8 weeks (SD 7.7).

Model Fit

The fit for each linear mixed model was compared with and without including random intercepts. Inclusion of random intercepts yielded a significantly better fit for both models (all $P < 0.001$). The random intercepts (i.e., between-participant variance in HbA_{1c} measurements over the 12 months after the survey) accounted for 43.4% and 42.9% of the total variance in HbA_{1c} in the direct and buffering models, respectively.

Direct Effects of Diabetes Distress and Autonomy Support

Linear mixed modeling was used to simultaneously test the association of diabetes distress and autonomy support with participants' HbA_{1c} levels over the 12 months after the survey when controlling for prior glycemic control, time, insulin use, age, and race/ethnicity. Greater diabetes distress ($B = 0.12$ [SE 0.05]; $P = 0.021$) was significantly associated with higher HbA_{1c} during the subsequent 12 months. Greater autonomy support ($B = -0.16$ [SE 0.08]; $P = 0.032$) was significantly associated with

Table 1—Sample characteristics

	Value (N = 308)
Age (years)	66.5 ± 10.15
Male sex	98.1
Education	
Less than high school diploma	13.6
High school diploma	33.6
More than high school	52.8
Non-Hispanic white	84.1
MHS lives in home	57.3
MHS relationship to patient	
Spouse/partner	69.2
Adult child	14.3
Sibling	5.6
Other family	5.5
Friend	5.2
One or more diabetes complications	22.1
Diabetes medication type	
Insulin (with or without oral medication)	60.4
Oral medications only	35.7
DDS-2	2.2 ± 1.19
IOCQ	3.9 ± 0.76
12-month average HbA_{1c} (% [mmol/mol])	7.9 ± 1.4 [63]

Data are mean ± SD or %. DDS-2 scale range is 1–6, with higher scores indicating greater distress. IOCQ scale range is 1–5, with higher scores indicating greater autonomy support. MHS, main health supporter.

lower HbA_{1c} measurements over the following 12 months (direct-effect model) (Table 2). Of the control variables, only prior glycemic control (B = 0.53 [SE 0.04]; $P < 0.001$) and insulin use (B = 0.39 [SE 0.12]; P = 0.001) were significantly associated with higher HbA_{1c} measurements over the following 12 months. Time from the survey to HbA_{1c} measurement, age, and race/ethnicity were not significantly associated with HbA_{1c} measurements during the following 12 months.

Buffering Effect of Autonomy Support

The linear mixed model was then retested after including diabetes distress and the interaction of diabetes distress with autonomy support (distress-buffering model) (Table 2). Consistent with the stress-buffering hypothesis, a significant interaction of diabetes distress and autonomy support with HbA_{1c} during the following 12 months (B = −0.13 [SE 0.06]; P = 0.027) was found after adjusting for control variables. Of the control variables, only prior glycemic control (B = 0.52 [SE 0.04]; $P < 0.001$) and insulin status (B = 0.38 [SE 0.12]; P = 0.002) significantly predicted HbA_{1c} measurements over the 12 months after the survey.

The significant interaction of diabetes distress with autonomy support was probed using tests of simple slopes. At low (−1 SD) levels of autonomy support, a 1-unit increase in diabetes distress (range 1–6 units) was associated with a 0.2 increase in HbA_{1c} over the following 12 months (B = 0.21 [SE 0.07]; z = 3.21; P = 0.001) (Fig. 1*A*). However, this association was not significant at high (+1 SD) levels of autonomy support (B = 0.02 [SE 0.07]; z = 0.16; P = 0.874).

A region-of-significance analysis was used to determine the level of autonomy support at which diabetes distress predicted subsequent HbA_{1c} measurements. The boundary value of the mean-centered autonomy support variable was ~0.1 (range −2.89 to 1.11). Thus, greater diabetes distress was significantly associated with higher subsequent 12-month HbA_{1c} measurements approximately at or below the mean level of autonomy support (Fig. 1*B*).

Table 2—Results of linear mixed models of direct and diabetes distress–buffering effects of autonomy support on subsequent 12-month HbA_{1c} percent

	Direct-effect model			Distress-buffering model		
	B	SE	P value	B	SE	P value
Predictor						
Autonomy support	−0.16	0.07	**0.023**	−0.14	0.08	0.064
Diabetes distress	0.12	0.05	**0.032**	0.11	0.05	**0.029**
Autonomy support × diabetes distress				−0.13	0.06	**0.027**
Control variable						
Age	−0.01	0.01	0.856	−0.01	0.01	0.878
Race/ethnicity*	0.17	0.15	0.248	0.18	0.15	0.229
Insulin use†	0.39	0.12	**0.001**	0.38	0.12	**0.002**
Time‡	0.01	0.01	0.972	0.01	0.01	0.961
Prior average HbA_{1c} (%)	0.53	0.04	**<0.001**	0.52	0.04	**<0.001**

All coefficients are unstandardized and represent fixed effects. Boldface indicates significance at $P < 0.05$. The sample included 734 HbA_{1c} values clustered within 308 individuals. *Non-Hispanic white vs. other race and/or ethnicity. †No insulin use = 0 vs. insulin use = 1. ‡Months between assessment of predictor variables (i.e., diabetes distress, autonomy support) and each HbA_{1c} measurement.

CONCLUSIONS

This study is the first to our knowledge to examine both the direct and the diabetes distress–buffering effects of autonomy support from a main informal health supporter on subsequent 12-month glycemic control among adults with type 2 diabetes. It provides evidence for a direct relationship between perceived autonomy support from main health supporters and better subsequent glycemic control (i.e., lower 12-month HbA_{1c}). Consistent with the stress-buffering model of social support, the findings suggest that autonomy support from a main health supporter may mitigate the negative effect of diabetes distress on glycemic control. Although greater diabetes distress was strongly associated with higher subsequent 12-month HbA_{1c} among patients with moderate to low levels of perceived autonomy support from their main health supporter, this relationship was completely attenuated among those with high levels of perceived autonomy support. These findings suggest that autonomy support may contribute to better glycemic control both directly and through buffering the effect of diabetes-related distress.

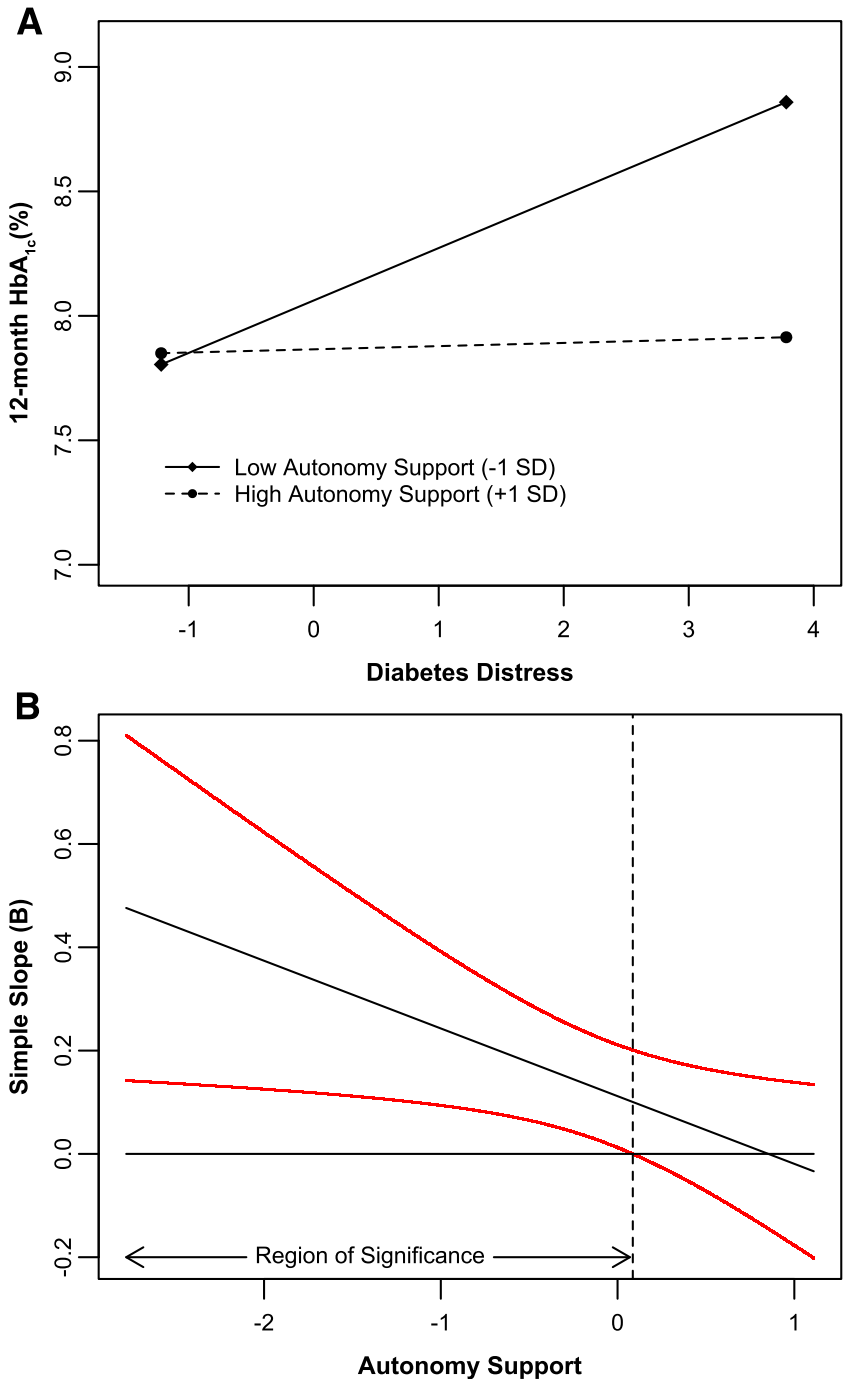

Figure 1—Simple slopes depicting the relationship of diabetes distress to prospective 12-month HbA_{1c} at high and low levels of autonomy support (*A*) and region-of-significance plot representing the same interaction (*B*) while controlling for age, race/ethnicity, insulin use, prior average 12-month HbA_{1c}, and support satisfaction. The dashed line in *B* represents the boundary value of the mean-centered autonomy support variable below which the simple slope between diabetes distress and 12-month HbA_{1c} is significant ($P < 0.05$).

The direct association between autonomy support from a main health supporter and subsequent measures of glycemic control observed in the current study builds on findings from other observational studies linking greater autonomy support from health care providers with better prospective glycemic control (29,30,40). A randomized trial of a computer-based intervention targeting patients' perceived autonomy support from their health care providers demonstrated improvements in glycemic control relative to the control condition (28). Taken together, results from prior studies and the current findings suggest that autonomy support may facilitate better self-management and glycemic control across relationship types (i.e., informal supporter, health care provider).

As hypothesized, autonomy support buffered the relationship between diabetes distress and subsequent glycemic control in models adjusted for established correlates of both diabetes distress and glycemic control. Diabetes distress was associated with subsequent glycemic control only among patients with low to moderate levels of perceived autonomy support. These findings suggest that patients with lower levels of autonomy support from family and friends may be at particularly high risk for poor outcomes when experiencing high levels of diabetes distress. In contrast, high levels of autonomy support from a main health supporter appear to attenuate the relationship between patients' diabetes distress and subsequent glycemic control. Of note, Baek et al. (21) found that general social support buffers the negative impact of diabetes-related stressors (i.e., diabetes complications, insulin use) on patients' reported diabetes distress. The current findings suggest that autonomy support for disease self-management from a main health supporter buffers the negative effect of reported diabetes distress on glycemic control. Greater autonomy support from important others may bolster patients' ability to cope with their diabetes-related distress, which may otherwise interfere with their ability to successfully manage their blood glucose levels. Additional research is needed to identify mechanisms by which autonomy support from informal health supporters facilitates adaptive coping in response to diabetes-related distress.

The current findings also build on prior studies that examined the cross-sectional and longitudinal relationship between diabetes-related distress and HbA_{1c}. We found that greater diabetes distress predicted higher HbA_{1c} over a 12-month period when accounting for within-participant variability in HbA_{1c} as well as participants' recent history of glycemic control. These findings are consistent with other research indicating that diabetes distress is associated with poor prospective glycemic control (6,9,10). However, other studies have found a nonsignificant relationship between diabetes distress

and prospective HbA_{1c} when controlling for baseline HbA_{1c} (10,12,14). In contrast with previous studies, the current study included individuals with one or more risk factors for diabetes complications for whom greater diabetes distress (e.g., feeling overwhelmed and less confident in diabetes self-management) may have made a comparatively greater contribution toward poor subsequent glycemic control through diminished diabetes self-efficacy and self-care behaviors (38).

Findings from this study are qualified by four notable limitations. First, the study sample comprised primarily non-Hispanic, white, male veterans. Thus, the study findings may not generalize to more diverse populations. We were unable to compare the characteristics of survey respondents and nonrespondents and, thus, were unable to assess potential sources of nonresponse bias. Results suggest that Hispanic respondents were less likely than non-Hispanic respondents to provide consent for use of their EMR data and, therefore, were less likely to be included in the study sample. Second, the study focused on patients' perceived autonomy support from a single main health supporter. However, adults with diabetes may receive multiple kinds of disease-related support and may receive support from multiple people across relationship types. The findings do not account for sources of disease-related support from participants' broader social networks. Third, we did not assess participants' experience of general emotional distress, which may also influence glycemic control (38). Finally, the study sample included patients with one or more separate risk factors for diabetes complications, so we were unable to assess the extent to which these individual risk factors affected patients' level of diabetes distress or perceived autonomy support.

Autonomy support from a main health supporter may contribute to better glycemic control both directly and by buffering against the negative effects of diabetes distress. Adults with low autonomy support from family health supporters may be at risk for poor glycemic control, particularly in the setting of high diabetes-related distress. The findings suggest that increased autonomy support from a key health supporter contributes to better glycemic control, particularly among individuals with elevated diabetes distress. For patients experiencing diabetes distress, health care providers could consider counseling family members in the use of autonomy-supportive strategies to facilitate patients' diabetes self-management and improved glycemic control. Future studies could test whether interventions to increase autonomy support from existing health supporters help to improve glycemic control among patients who experience high levels of diabetes distress.

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