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Independent Effects of Socioeconomic and Psychological Social Determinants of Health on Self-Care and Outcomes in Type 2 Diabetes

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Abstract

Objective—The purpose of this study was to investigate the independent effects of socioeconomic and psychological social determinants of health on diabetes knowledge, self-care, diabetes outcomes and quality of life.

Research Design and Methods—Cross-sectional sample of 615 adults from two adult primary care clinics in the southeastern United States. Primary outcome variables were diabetes knowledge, self-care behaviors (diet, exercise, medication adherence, blood sugar testing, foot care) and diabetes outcomes (HbA1c, LDL, blood pressure, PCS, MCS). Covariates included age,

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sex, race/ethnicity, marital status, health literacy and comorbidity. Linear regression models were used to assess independent associations controlling for covariates.

Results—In final adjusted models, significant associations for HbA1c included education (β= −0.72, 95% CI −1.36, −0.08), income (β= −0.66, CI −1.30, −0.16), self-efficacy (β= −0.12, CI −0.15, −0.08), and diabetes distress (β= 0.43, CI 0.14, 0.72). Significant associations for self-care included medication adherence with diabetes distress (β= −0.58, CI −0.91, −0.25), and perceived stress (β= −0.12, CI −0.18, −0.05); and exercise with depression (β= −0.06, CI −0.10, −0.01), and self-efficacy (β= 0.06, CI 0.01, 0.10). Significant associations for quality of life included depression (β= −0.08, CI −0.12, −0.03), SPD (β= −0.09, CI −0.12, −0.05), social support (β= 0.01, CI 0.001, 0.02), and perceived stress (β= −0.12, CI −0.19, −0.06).

Conclusions—Social determinants of health were significantly associated with diabetes self-care and outcomes with socioeconomic factors being most often associated with diabetes outcomes and psychological factors, specifically self-efficacy and perceived stress being most often associated with self-care and quality of life.

Keywords

Diabetes; social determinants; socioeconomic; psychological; self-care

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Globally, type 2 diabetes is a leading cause of death and disability, with an estimated 382 million people diagnosed and 5.1 million deaths in 2013. (1) In the United States, it is also the leading cause for kidney failure, non-traumatic lower-limb amputations, new cases of blindness among adults, and a major cause of heart disease and stroke. (2) Given the expected rise in prevalence and population impact, diabetes is considered one of the most challenging health problems of the 21st century. (1)

Social determinants of health include the social and economic conditions that influence health status, and can be defined as the circumstances in which people are born, live, work, and age, in addition to the health systems set up to address illness. (3,4) They encompass a range of interacting factors, broadly classified into: 1) socioeconomic circumstances, 2) neighborhood environment, 3) psychosocial factors, and 4) upstream political, economic and sociocultural drivers. (5,6) Based on an extensive review by the World Health Organization (WHO), pathways between social conditions and health outcomes may be influenced by perceptions and experiences of individuals, including material factors, psychosocial factors, behavioral/biological factors and the health system. (7) As such, understanding how social determinants of health are independently associated to outcomes will help in development of behavioral interventions.

While research shows important effects of social determinants on both individual and population health (7–10), work in diabetes has largely focused on the risk of developing diabetes. Specifically, considerable evidence exists linking increased diabetes incidence and prevalence to low socioeconomic status (SES). (10–13) Other social determinants of health have been less regularly studied and more evidence is needed on the impact of social determinants on diabetes processes and outcomes to provide an understanding of how to prevent complications and understand the overall relationship. (11,14,15) Much of the work

in diabetes has focused on lifestyle changes, however, social determinants of health may provide a better understanding of why these lifestyle changes are not improving outcomes. (10,11) The lack of research on social determinants of health precludes statements regarding whether these factors have direct or indirect effects and what the mechanisms underlying associations may be. The psychological demands of diabetes suggest a pathway may exist, but more work is needed to overcome the current gaps in knowledge.

Weaknesses in the current literature include studies limited to only one socioeconomic indicator, or lack of adjustment for other factors. (16,17) While a number of psychological factors have been investigated individually, with the exception of depression there is little work that conclusively ties these variables to outcomes. (15,18–21) As a result, heterogeneity of measures and definitions of social variables is a concern given the number of factors currently studied independently. Furthermore, few studies investigate multiple factors in the same patient population, allowing for an understanding of how different determinants relate to each other.

The purpose of this study was to investigate the independent effects of socioeconomic and psychological social determinants of health on diabetes knowledge, self-care, diabetes outcomes and quality of life. This study is unique based on incorporation of multiple factors within the same population, and on the use of a sample size large enough to allow analysis while controlling for important covariates. Inclusion of variables was derived from the conceptual model developed by Brown et al. regarding the influence of socioeconomic variables on diabetes outcomes. (22) This conceptual model hypothesizes direct effects of socioeconomic variables on outcomes, as well as, indirect effects through mediators of health behaviors, access to care, and processes of care. Additional psychological variables were added to this model based on the literature. We hypothesized that lower levels of socioeconomic factors (subjective social status, income, employment and education) would be associated with poor self care behaviors, worse diabetes outcomes (HbA1c, cholesterol, and blood pressure), and lower quality of life adjusting for relevant covariates. We also hypothesized that psychological factors (higher levels of depression, fatalism, diabetes distress, perceived stress, serious psychological distress, and lower levels of social support and self-efficacy) would be associated with poor self-care behaviors, worse diabetes outcomes and lower quality of life adjusting for relevant covariates.

Research Design and Methods

Sample

We recruited 615 patients from adult primary care clinics of an academic medical center and a Veterans Affairs Medical Center in the Southeastern United States. Clinics were located in the same geographical area, but provide services for different populations. Our institutional review board approved all procedures prior to study enrollment. Eligible patients were ages 18 years or older with a diagnosis of type 2 diabetes in their medical record and able to communicate in English. Patients were ineligible if the research assistants determined by interaction or chart documentation they were cognitively impaired as a result of significant dementia or active psychosis.

Eligible patients were sent letters of invitation or approached in the clinic waiting room. Those interested were provided a detailed explanation of the study and consented. Participants completed validated questionnaires that captured social determinants of health factors along with demographic, process of care and outcomes measures. Validated questionnaires were included based on a modified version of the conceptual framework by Brown et al. (22) Outcome measures were abstracted from the electronic medical record, including blood pressure, cholesterol (LDL), and HbA1c, using values within the previous 6 months for HbA1c and blood pressure, and 12 months for LDL

Demographic Variables

Age was categorized into 4 groups: 18–34, 35–44, 45–64 and 65+. Race was categorized as non-Hispanic Black, non-Hispanic White and Hispanic/other. Marital status was dichotomized as married or not married. Health literacy was measured by the literacy component of the short version of the Test of Functional Health Literacy in Adults (S-TOFHLA). (23) Medical comorbidity was calculated using the Charleson comorbidity index. (24)

Social Determinants of Health Variables

Socioeconomic Status—Previously validated items from the 2002 National Health Interview Survey (25) were used to capture household income, years of education and employment status. Household income was categorized into 4 income units: <$20,000, $20,000–$49,999, $50,000–$74,999, ≥ $75,000. Years of education were categorized into 4 units: less than high school, high school graduate, college education, and more than college education. Employment was dichotomized as not employed and employed.

Subjective Social Status—Subjective Social Status is a perceived measure of socioeconomic status where participants place themselves between 10 (people with the most money, education and well respected jobs), and 1 (people with the least money, education and well respected jobs). (26) Responses were categorized based on quartiles into a 4 category categorical variable.

Fatalism—Fatalism was assessed with the Diabetes Fatalism Scales (DFS); a 12-item scale where higher scores represent greater diabetes fatalism. (27) The DFS has a Cronbach's alpha of 0.80. (27)

Self-Efficacy—Self-efficacy was assessed with the Perceived Diabetes Self-Management Scale (PDSMS); an 8-item measure where higher scores indicate higher self-efficacy. (28) It is a valid and reliable measure of diabetes self efficacy (Cronbach alpha = 0.83).

Depression—Depression was assessed with the PHQ-9; a 9-item scale based on the DSM-IV criteria for depression with higher scores indicating more severe depression. (29) Sensitivity is 88% and specificity is 88% for major depression. (30)

Diabetes Distress—Distress was assessed with the Diabetes Distress Scale (DDS); a 17-item measure with questions about disease management, support, emotional burden and access to care. (31) The sensitivity and specificity ranged from 0.85 to 0.97. (31)

Serious Psychological Distress—Serious Psychological Distress (SPD) was assessed with the K6; a 6-item scale with higher scores representing higher probability of severe mental illness. The scale has good precision and consistent psychometric properties across major sociodemographic samples. (32)

Social Support—Social Support was assessed with the Medical Outcomes Study (MOS) Social Support Survey; a 19-item scale measuring tangible support, affection, positive social interaction, and emotional or informational support. The total scale has high internal consistency (α=0.97), good criterion and discriminant validity, and one-year test-retest reliability (0.72 to 0.76). (33)

Perceived Stress—Stress was assessed with the Perceived Stress Scale (PSS); a 4-item scale assessing the frequency over the previous month with which the respondent finds situations stressful. (34) The Cronbach alpha value is 0.69 and scores are highly correlated with stress, depression and anxiety. (35)

Diabetes Processes and Outcomes

Diabetes Knowledge—Diabetes Knowledge was assessed with the Diabetes Knowledge Questionnaire (DKQ); a 24-item scale where the final score is based on the percentage of correct scores. (36)

Self-Reported Medication Adherence—Medication Adherence was assessed with the Morisky Medication Adherence Scale (MMAS); an 8-item scale with higher values indicating poorer adherence. (37)

Behavioral Skills—Diabetes behavior was assessed with the Summary of Diabetes Self-Care Activities (SDSCA) scale; an 11-item scale measuring frequency of self-care activity in the last 7 days for general diet (follow healthy diet), specific diet (ate fruits/two fat diet), exercise, blood glucose testing, and foot care (38).

Quality of Life—Quality of life was assessed using the SF-12; a 12-item scale yielding summary physical health (PCS-12) and mental health (MCS-12) outcome scores. The SF-12 is a valid and reliable instrument (alpha=0.89). (39,40)

Clinical Measures—Hemoglobin A1c, LDL and blood pressure were abstracted from the electronic medical record using values within the previous 6 months for HbA1c and blood pressure, and 12 months for LDL from the date of completion of the survey.

Statistical Analyses

Sample Size—The target sample size for the study was 600 adults to provide 80% power to detect an association of at least ρ=0.3, where ρ represents the population correlation

between the dependent (i.e. diabetes self-care and outcomes) and each primary independent variable. For the multivariate analyses adjusted for covariates, this will be able to detect with 80% power an increment of at least 10% in R^2 for a given primary independent variable, over and above the contribution of the covariates. We will have 80% power to detect between a small effect (primary independent variable accounts for 2% of the variance of the dependent variable) and a moderate effect (primary independent variable accounts for 13% of the variance).

Analysis—After ensuring that variables were normally distributed, we performed four sets of analyses to provide information on the individual and collective contribution of different social determinant of health. First, means and percentages for all variables were calculated. Second, Pearson's correlation was used to test the association among social determinant of health variables and diabetes self-care and outcomes. Third, series of multiple linear regression models were used to assess the associations between diabetes knowledge, self-care and outcomes and socioeconomic and psychological social determinants of health adjusting for relevant covariates. Separate hierarchical models were run for diabetes knowledge and each self-care and outcome variables as outcomes, socioeconomic and psychological variables as primary independent variables while adjusting for covariates. For each hierarchical model, variables were entered in blocks based on theoretical relationships: socioeconomic factors (block 1), psychological factors (block 2), demographic factors (block 3), health literacy (block 4), and comorbidity (block 5). Finally, we reran the final fully adjusted models and obtained standardized betas for the variables in the model in order to estimate the amount of variance in diabetes knowledge, self-care and outcomes explained by socioeconomic and psychological social determinant variables adjusting for covariates. All analyses were performed with STATA Version13 and a two-tailed alpha of 0.05 was used to assess for significance.

Results

Demographic characteristics for this sample of 615 adults with type 2 diabetes are shown in Table 1. The mean age was 61 years, with the majority being men (61.6%), non-Hispanic black (64.9%), and employed (65.3%). 13% had less than a high school diploma, and 41.6% earned less than $20,000 annually. Mean systolic blood pressure was 129.7 mm/Hg, mean LDL was 96.9 mg/dL, and mean HbA1c was 7.9% (63 mmol/mol).

Table 2 shows the final models of the relationship between socioeconomic and psychological factors on knowledge and self care. Knowledge was significantly positively associated with college education (β= 5.76, 95% CI 1.47, 10.05), more than college education (β= 8.19, CI 2.57, 13.80), income <$50,000 (β= 3.39, CI 0.19, 6.58), and income <$75,000 (β= 6.91, CI 2.08, 11.73). Medication adherence was significantly positively associated with fatalism (β= 0.03, CI 0.01, 0.05), and self-efficacy (β= 0.05, CI 0.01, 0.09), and negatively associated with diabetes distress (β= −0.58, CI −0.91, −0.25), and perceived stress (β= −0.12, CI −0.18, −0.05). General diet was significantly positively associated with fatalism (β= 0.03, CI 0.01, 0.05), and self-efficacy (β= 0.12, CI 0.08, 0.15), and negatively associated with diabetes distress (β= −0.46, CI −0.79, −0.13). Specific diet was significantly positively associated with self-efficacy (β= 0.05, CI 0.02, 0.08) and negatively associated

with perceived stress (β= −0.06, CI −0.11, −0.01). Exercise was significantly positively associated with more than college education (β= 1.24, CI 0.38, 2.10), and self-efficacy (β= 0.06, CI 0.01, 0.10), and negatively associated with <$20,000 income (β= −1.06, CI −1.55, −0.57), <$50,000 income (β= −0.85, CI −1.58, −0.11), and depression (β= −0.06, CI −0.10, −0.01),. Blood sugar testing was significantly negatively associated with perceived stress (β= −0.09, CI −0.17, −0.01). Foot care was significantly negatively associated with perceive stress (β= −0.09, CI −0.17, −0.001).

Table 3 shows the final models of the relationship on diabetes outcomes and quality of life. HbA1c was significantly negatively associated with more than college education (β= −0.72, 95% CI −1.36, −0.08), more than $75,000 income (β= −0.66, CI −1.30, −0.16), and self-efficacy (β= −0.12, CI −0.15, −0.08), and positively associated with 4th quartile of social subjective status (β= 0.78, CI 0.28, 1.29), and diabetes distress (β= 0.43, CI 0.14, 0.72). LDL was not significantly associated with socioeconomic or psychological factors. Systolic blood pressure was significantly negatively associated with college education (β= −5.47, CI −10.49, −0.44), and perceived stress (β= −0.67, CI −1.21, −0.11), and positively associated with more than $75,000 income (β= 6.86, CI 0.29, 13.41). PCS was significantly positively associated with SPD (β= 0.02, CI 0.0001, 0.03). MCS was significantly positively associated with high school education (β= 0.82, CI 0.19, 1.45), and social support (β= 0.01, CI 0.001, 0.02), and negatively associated with depression (β= −0.08, CI −0.12, −0.03), SPD (β= −0.09, CI −0.12, −0.05), and perceived stress (β= −0.12, CI −0.19, −0.06).

Table 4 shows the standardized betas for significant associations in the fully adjusted models. This shows the amount of variance explained in the outcome variables by the socioeconomic and psychological social determinants of health variables adjusting for covariates. For HbA1c, 36% of the variance was explained by self-efficacy, 20% by social subjective status, 17% by distress, 13% by education and 11% by income. For systolic blood pressure, 16% of the variance was explained by college education, 13% by perceived stress and 12% by income. For knowledge, 18% was explained by college education, 18% by more than college education, 14% by income between $50,000–$74,000 and 11% by income between $20,000–$49,000. For medication adherence, 21% was explained by distress, 20% by perceived stress, 13% by self-efficacy and 12% by fatalism. For general diet, 32% was explained by self-efficacy, 17% by distress and 14% by fatalism. For specific diet, 17% was explained by self-efficacy, and 14% by perceived stress. For exercise, 23% was explained by income between $20,000–$49,999, 18% by more than college education, 15% by depression 15% by college education, 14% by self-efficacy and 12% by income between $50,000–$74,000. 12% of the variance for blood sugar testing was explained by perceived stress. 11% of the variance for foot care was explained by perceived stress. 11% of the variance for PCS was explained by SPD. For MCS, 22% was explained by SPD, 19% by depression, 16% by perceived stress, 14% by education and 9% by social support.

Conclusions

This study found that in fully adjusted hierarchical models with variables entered in blocks based on theoretical relationships between variables, socioeconomic and psychological components of social determinants of health were significantly associated with diabetes

knowledge, self-care and outcomes. Diabetes outcomes were significantly associated with higher socioeconomic status, higher self-efficacy, lower diabetes distress and lower perceived stress. Diabetes knowledge was associated with higher socioeconomic status (education and income). Self-care was associated with lower fatalism, lower diabetes distress, lower perceived stress, and higher self-efficacy. Quality of life was significantly associated with higher education, lower depression, lower SPD, lower perceived stress, and higher social support. Overall, socioeconomic factors were most often associated with diabetes outcomes and knowledge, while psychological factors, specifically self-efficacy and perceived stress, were most often associated with self-care and quality of life.

The main contribution of these findings is an understanding of the individual and collective contribution of various social determinants of health on diabetes self-care and outcomes. Previous research has focused on one or two factors, and generally one outcome, so was unable to discuss the incremental effect of social determinants of health on self-care or outcomes in patients with type 2 diabetes. This study was designed to analyze multiple social determinant variables in the same patient population, and investigate multiple diabetes outcomes and self-care behaviors. It also used a conceptual model to provide a theoretical basis for determination of which factors have the strongest relationship. Based on these results, the strongest socioeconomic factors were education and income and the strongest psychological factors varied by the outcome, but overall higher self-efficacy and lower perceived stress were associated with better self-care, diabetes outcomes and quality of life. As expected depression, SPD and perceived stress were significantly associated with mental health component of quality of life. These results suggest that social determinants of health have an influence on diabetes outcomes and should be considered in clinical care. In addition, these results suggest that some factors have a greater influence than other, and depending on patient goals certain factors should be addressed as a part of clinical care.

These results are consistent with the current literature, which suggest that individuals with lower SES and lower levels of education have higher mortality and more frequent diabetes complications. (11,16,17) Additionally, previous studies suggest the importance of self-efficacy and perceived stress, however, this study provides information on their importance relative to other psychological variables. Perceived stress has been associated with fair to poor self-rated health, but the evidence is inconsistent regarding glycemic control. (19) Similarly, we found perceived stress to be significantly associated with many self-care and quality of life outcomes, but not glycemic control. Studies have consistently shown an association between self-efficacy and self care behaviors (20), and a recent study using structured equation modeling found that glycemic control may be indirectly associated with self-efficacy through self-care (21) This study adds to that literature by elucidating the strength of association self-efficacy has relative to other factors.

Overall, self-efficacy and perceived stress had the strongest and most consistent significant associations with self-care, while depression, serious psychological distress and social support had the strongest and most consistent significant associations with MCS and PCS. While this improves the understanding of different social determinant of health factors, a better elucidation of the mechanisms and pathways through which social determinants of

health factors influence diabetes outcomes, and the overlap between different constructs is needed to fully inform intervention development.

The strengths of this study are the large sample size and theoretical basis for inclusion of variables, however, there are three limitations that should be noted. First, the study design was cross-sectional, limiting the ability to address causality or direction of the associations observed. Future work should collect data longitudinally, or use path analysis and structured equation modeling on cross-sectional data as ways to understand the underlying relationships. Second, there may be additional confounding factors that could influence the results, such as disease duration, disease severity, and health care access. Since the models were based on a theoretical framework these may not be relevant, but could be accounted for in future studies. Third, the study was conducted in the southeast United States and may not be representative of populations in other areas. Similar work conducted in other regions of the United States and in other countries is warranted to identify similarities and differences in the influence of social determinants of health in different populations.

In conclusion, this study found that in fully adjusted hierarchical models with variables entered in blocks based on theoretical relationships between variables, socioeconomic and psychological components of social determinants of health were significantly associated with diabetes knowledge, self-care and outcomes. Overall, self-efficacy and perceived stress had the strongest and most consistent significant associations with self-care, while depression, serious psychological distress and social support had the strongest and most consistent significant associations with MCS and PCS. Further studies are needed to elucidate mechanisms and pathways across various populations and these factors should be incorporated into future interventions designed to improve self-care and outcomes for patients with type 2 diabetes.

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Table 1

Sample demographic characteristics (n=615)

	% or Mean ± standard deviation
Age	61.3 ± 10.9
18–34 years	1.6
35–44 years	5.2
45–64 years	53.6
65+ years	39.6
Gender	
Women	38.4
Men	61.6
Race/Ethnicity	
Non-Hispanic Black	64.9
Non-Hispanic Whites	33.0
Hispanic/Other	2.1
Marital Status	
Married	49.7
Not Married	50.3
Educational level	
Less than high school graduate	13.0
High school graduate	28.2
College education	47.1
More than college	11.7
Employment status	
Employed	34.7
Not employed	65.3
Annual income level	
<$20,000	41.6
$20,000–$49,000	38.9
$50,000–$74,999	10.1
$75,000+	9.4
Subjective Social Status	
1st quartile	13.85
2nd quartile	32.50
3rd quartile	19.89
4th quartile	33.75
Systolic Blood Pressure (mm/Hg)	129.7 ± 16.6
Blood Pressure Control (<140/80 mm/Hg)	
Controlled	58.9
Not Controlled	41.1
LDL (mg/dL)	96.9 ± 66.7
Lipid Control (LDL<100 mg/dL)	

	% or Mean ± standard deviation
Controlled	62.8
Not Controlled	37.2
HbA1c % (mmol/mol)	7.9 ± 1.8 (63 ± 19.7)
Glycemic Control (HbA1c<8% or 64 mmol/mol)	
Controlled	57.9
Not Controlled	42.1

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Table 2

Final models of relationship between socioeconomic status and psychological factors on knowledge and self care behaviors

	Knowledge	Medication Adherence	General Diet	Specific Diet	Exercise	Blood Sugar Testing	Foot Care
Education							
Less than high school (ref)	---	---	---	---	---	---	---
High school graduate	2.69	−0.03	−0.34	−0.37	0.53	0.13	−0.03
College	5.76 *	−0.20	−0.16	−0.19	0.66	0.39	−0.09
More than college	8.19 *	−0.10	−0.12	−0.15	1.24 *	−0.31	0.15
Employment							
Not employed (ref)	---	---	---	---	---	---	---
Employed	−0.99	−0.27	0.14	−0.09	0.34	0.06	0.08
Income							
<$20,000 (ref)	---	---	---	---	---	---	---
<$50,000	3.39 *	−0.02	−0.09	−0.14	−1.06 **	−0.37	−0.17
<$75,000	6.91 *	−0.33	−0.25	−0.01	−0.85 *	−0.69	−0.17
$75,000 +	5.49	−0.02	0.05	0.33	−0.59	−0.60	−0.62
Social Subjective Status							
1st quartile (ref)	---	---	---	---	---	---	---
2nd quartile	−1.58	−0.20	0.21	0.17	0.03	−0.14	−0.18
3rd quartile	−4.32	−0.21	−0.26	0.18	0.22	−0.31	−0.19
4th quartile	−2.76	−0.28	0.22	0.14	0.20	−0.08	−0.43
Fatalism	0.07	0.03 *	0.03 *	0.01	0.004	0.02	0.01
Depression	−0.004	0.002	0.003	0.02	−0.06 *	0.002	0.004
Self-efficacy	0.16	0.05 *	0.12 **	0.05 *	0.06 *	0.03	0.03
Diabetes Distress	0.47	−0.58 **	−0.46 *	−0.21	−0.14	−0.27	−0.24
Serious Psychological Distress	−0.13	0.004	0.01	−0.01	0.01	0.03	0.03
Social Support	−0.01	0.001	0.01	0.004	−0.003	0.01	0.01
Perceived Stress	−0.25	−0.12 **	−0.05	−0.06 *	−0.03	−0.09 *	−0.09 *

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	Knowledge	Medication Adherence	General Diet	Specific Diet	Exercise	Blood Sugar Testing	Foot Care
Age							
18–34 (ref)	---	---	---	---	---	---	---
35–44 years	1.37	0.63	1.46	1.02	0.55	0.48	0.79
45–64 years	2.19	0.89	1.37 *	0.98	0.55	0.03	1.53
65+ years	−1.40	1.21	1.66 *	1.25 *	0.50	0.18	1.76
Gender							
Male (ref)	---	---	---	---	---	---	---
Female	2.48	0.44 *	0.06	0.21	−0.53 *	0.15	0.26
Race							
Non-Hispanic White (ref)	---	---	---	---	---	---	---
Non-Hispanic Black	−2.71	−0.34	−0.02	0.28	0.02	0.07	0.46
Hispanic/Other	−1.71	−0.66	−0.49	0.86	0.24	0.55	1.14
Marital Status							
Not married (ref)	---	---	---	---	---	---	---
Married	1.40	0.28	−0.16	0.03	−0.26	0.21	0.06
Health Literacy							
Low (ref)	---	---	---	---	---	---	---
Marginal	0.04	0.58	0.22	0.02	−0.04	−0.11	0.54
Adequate	9.10 **	0.26	0.07	−0.23	−0.08	0.05	0.21
Comorbidity	0.27	−0.09 *	0.07	−0.01	−0.01	0.20 **	0.22 **
R^2	0.2039	0.2384	0.2302	0.1381	0.1358	0.0737	0.0927

* p<0.05,

** p<0.001,

ref = reference group

Adjusted beta estimates are given for final linear model for each outcome and for each hierarchical model, variables were entered in blocks based on theoretical relationships: socioeconomic factors (block 1), psychological factors (block 2), demographic factors (block 3), health literacy (block 4), and comorbidity (block 5).

Table 3

Final models of relationship between socioeconomic status and psychological factors on diabetes outcomes and quality of life

	HbA1c	LDL	Systolic Blood Pressure	PCS	MCS
Education					
Less than high school (ref)	---	---	---	---	---
High school graduate	−0.32	11.06	−4.44	−0.15	0.82 *
College	−0.27	3.64	−5.47 *	0.04	0.61
More than college	−0.72 *	20.63	−1.83	0.15	0.52
Employment					
Not employed (ref)	---	---	---	---	---
Employed	0.14	7.00	−2.16	0.16	0.36
Income					
<$20,000 (ref)	---	---	---	---	---
<$50,000	0.12	2.59	1.19	−0.02	0.22
<$75,000	−0.14	15.51	0.28	−0.01	−0.14
$75,000 +	−0.66 *	−5.05	6.86 *	0.01	0.37
Social Subjective Status					
1st quartile (ref)	---	---	---	---	---
2nd quartile	0.11	11.19	1.54	0.03	−0.28
3rd quartile	0.14	1.31	−0.88	−0.09	−0.10
4th quartile	0.78 *	7.31	1.87	−0.05	0.08
Fatalism	−0.01	−0.22	0.01	0.004	−0.01
Depression	−0.02	0.70	0.03	−0.01	−0.08 *
Self-efficacy	−0.12 **	0.74	−0.29	−0.01	0.01
Diabetes Distress	0.43 *	−3.29	0.16	0.08	−0.07
Serious Psychological Distress	0.01	1.16	0.02	0.02 *	−0.09 **
Social Support	0.01	−0.02	−0.003	0.002	0.01 *
Perceived Stress	−0.02	2.18	−0.67 *	0.002	−0.12 **

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	HbA1c	LDL	Systolic Blood Pressure	PCS	MCS
Age					
18–34 (ref)	---	---	---	---	---
35–44 years	0.41	−12.59	−1.75	−0.01	0.21
45–64 years	−0.07	7.38	−2.59	0.24	0.47
65+ years	−0.49	0.35	−2.54	0.41	−0.11
Gender					
Male (ref)	---	---	---	---	---
Female	−0.36 *	12.20	5.66 *	0.10	−0.29
Race					
Non-Hispanic White (ref)	---	---	---	---	---
Non-Hispanic Black	0.06	9.61	3.28	−0.07	−0.13
Hispanic/Other	−0.53	19.38	−1.84	−0.06	−0.41
Marital Status					
Not married (ref)	---	---	---	---	---
Married	−0.08	5.16	−0.15	−0.19 *	−0.21
Health Literacy					
Low (ref)	---	---	---	---	---
Marginal	−0.50	−13.95	−0.16	−0.09	−0.40
Adequate	−0.13	−5.70	2.04	0.04	−0.74 *
Comorbidity	0.01	0.14	0.31	−0.02	−0.16 **
R^2	0.2321	0.0757	0.0867	0.0697	0.4030

* p<0.05,

** p<0.001,

ref = reference group, PCS = physical component summary score of SF12 quality of life, MCS = mental component summary score of SF12 quality of life

Adjusted beta estimates are given for final linear model for each outcome and for each hierarchical model, variables were entered in blocks based on theoretical relationships: socioeconomic factors (block 1), psychological factors (block 2), demographic factors (block 3), health literacy (block 4), and comorbidity (block 5).

Table 4

Standardized betas for socioeconomic and psychological factors for each modeled outcome

Outcome Variable	Education	Employment	Income	SSS	Fatalism	Depression	Self-Efficacy	Distress	SPD	Social Support	Stress
HbA1c	−0.13 *	0.04	−0.11 *	− 0.21 *	−0.05	−0.08	−0.36 **	0.18 *	0.04	0.08	−0.03
LDL	0.10	0.05	0.07	0.07	−0.03	0.06	0.06	−0.03	0.10	−0.01	0.10
Systolic BP	−0.16 *	−0.06	0.12 *	0.05	0.01	0.01	−0.10	0.01	0.01	−0.01	−0.13 *
Knowledge	0.18 *	−0.03	0.14 *	− 0.11	0.04	−0.002	0.06	0.02	− 0.05	−0.01	−0.06
PCS	−0.07	0.09	−0.01	− 0.03	0.04	−0.08	−0.07	0.06	0.11 *	0.07	0.01
MCS	0.14 *	0.07	0.04	− 0.05	−0.05	−0.19 *	0.03	−0.02	− 0.22 **	0.09 *	−0.16 **
Medication Adherence	−0.05	−0.06	−0.05	− 0.07	0.13 *	0.01	0.13 *	−0.21 **	0.02	0.02	−0.19 **
General Diet	−0.07	0.03	−0.03	0.05	0.14 *	0.01	0.32 **	−0.17 *	0.04	0.07	−0.08
Specific Diet	−0.10	−0.03	0.06	0.05	0.09	0.09	0.17 *	−0.10	− 0.02	0.07	−0.13 *
Exercise	0.18 *	0.07	−0.23 **	0.04	0.002	−0.15 *	0.14 *	−0.05	0.02	−0.04	−0.04
Blood Sugar Testing	0.07	0.01	−0.08	− 0.04	0.07	0.004	0.06	−0.08	0.08	0.08	−0.12 *
Foot Care	0.02	0.02	−0.07	− 0.08	0.02	0.01	0.06	−0.07	0.07	0.07	−0.11 *

* p<0.05,

** p<0.001

Largest standardized beta included in table for socioeconomic variables with multiple categories.

Systolic BP = systolic blood pressure, SSS = social subjective status, SPD = serious psychological distress PCS = physical component summary score of SF12 quality of life, MCS = mental component summary score of SF12 quality of life