ORIGINAL ARTICLE

Pathways Between Discrimination and Quality of Life in Patients with Type 2 Diabetes

Obinna Achuko, BS,¹ Rebekah J. Walker, PhD,¹⁻³ Jennifer A. Campbell, BS,¹
Aprill Z. Dawson, MPH,¹ and Leonard E. Egede, MD, MS¹⁻³

Abstract

Background: Discrimination is a social determinant that has been linked to poor physical and mental health outcomes. This study aimed to examine the pathway whereby discrimination influences quality of life in patients with type 2 diabetes.

Subjects and Methods: Six hundred fifteen patients were recruited from two adult primary care clinics in the southeastern United States. Measures included perceived discrimination, perceived stress, social support, and social cohesion and were based on a theoretical model for the pathways by which perceived discrimination influences mental and physical health. Quality of life was measured using the SF-12 questionnaire.

Results: The final model [$\chi^2(106)=157.35$, $P=0.009$, $R^2=0.99$, root mean square error of approximation=0.03, comparative fit index=0.99] indicates direct effects of higher perceived stress ($r=-1.02$, $P<0.05$) and lower social support ($r=0.36$, $P<0.001$) significantly related to decreased mental health component score (MCS) of quality of life. Discrimination and social cohesion were not significantly directly related to MCS. However, higher discrimination ($r=0.47$, $P<0.001$), higher social cohesion ($r=0.14$, $P<0.05$), and lower social support ($r=-0.43$, $P<0.001$) were significantly directly related to increased stress. No significant paths were found for the physical component score of quality of life.

Conclusions: Perceived discrimination was significantly associated with stress and served as a pathway to influence the mental health component of quality of life (MCS). Social support had a direct and an indirect effect on MCS through a negative association with stress. These results suggest that future interventions should be developed to decrease stress and increase social support surrounding discrimination to improve the MCS of quality of life in patients with diabetes.

Introduction

DIABETES AFFECTS 29.1 MILLION Americans, or 9.3% of the U.S. population, and costs a total of \$245 billion to the United States.¹ Diabetes is the seventh leading cause of death in the United States and increases the risk of developing complications such as heart disease, stroke, blindness, kidney failure, and lower-limb amputation.¹ In addition, diabetes is associated with decreased health-related quality of life (QOL).^{2,3} Patients with type 2 diabetes are shown to have QOL health scores approximately 0.78 deviations below

patients who do not have a chronic illness.⁴ In addition, U.S. adults with diabetes reported 10 physically unhealthy days a month, compared with 5 days in patients without diabetes.⁵ The incidence of diabetes continues to increase, and by 2050, if trends continue, research estimates the disease will affect one in three adults in the United States.⁶

Discrimination is a class of stressors surrounding negative attitudes or unfair treatment toward members of a certain group.⁷ It is one of several social determinants of health that include the economic, social, cultural, political, and environmental conditions that influence the health of an individual.⁸⁻¹¹

¹Center for Health Disparities Research, Medical University of South Carolina, Charleston, South Carolina.

²Health Equity and Rural Outreach Innovation Center, Charleston VA Health Services Research and Development COIN, Ralph H. Johnson VA Medical Center, Charleston, South Carolina.

³Division of General Internal Medicine and Geriatrics, Department of Medicine, Medical University of South Carolina, Charleston, South Carolina.

This article represents the views of the authors and not those of the National Institutes of Health, the Veterans Health Administration, or the Health Services Research and Development.

In chronic diseases, such as diabetes, research shows a relationship between social determinants and disease incidence and health outcomes.⁷⁻⁹ Discrimination, specifically, has been linked to poor physical and mental health outcomes such as increased psychological distress, depression, high blood pressure, and substance abuse.¹²⁻²² In patients with diabetes, perceived discrimination is associated with worse diabetes management and has been shown to undermine the patient-provider relationship.²³⁻³⁰ There is evidence that the relationship between perceived discrimination and mental and physical health outcomes may occur through a mechanism involving stress response and health behaviors.^{7,12,15}

QOL is a multidimensional concept measuring physical, emotional, and social well-being.²⁴ In general, studies report that the QOL in patients with diabetes is lower than that of the general population, in part attributed to the psychological toll and demands the disease places on the patient.²⁴ Studies involving patients with various illnesses such as human immunodeficiency virus, obesity, schizophrenia, and epilepsy show that perceived discrimination is associated with lower QOL.^{25-27,31} Few studies have investigated the influence of discrimination on patients with type 2 diabetes, although a recent study showed that perceived discrimination had a negative association with QOL, specifically the mental health component score (MCS).³² More research is warranted, specifically to understand the pathway through which perceived discrimination influences QOL in patient with diabetes.^{20,33-36} Studies in other populations have suggested a variety of possible pathways, including internalized weight bias in patients with high body mass index, use of disengagement coping in patients with cancer, and hopelessness in patients receiving pain management.³⁷⁻³⁹ Stress has been suggested as a pathway for several social determinants of health but has not been investigated in relation to discrimination in patients with diabetes.^{7,12,15}

The aim of this study is to understand the pathway whereby discrimination influences QOL in patients with type 2 diabetes. Based on prior literature, we hypothesized that perceived discrimination would be associated with stress, which in turn would lead to poor QOL.^{7,12} We also hypothesized that social support and social cohesion would serve as mediating variables, buffering the effect of stress.^{7,15,40} We tested the pathway hypothesized by Pascoe and Smart Richman⁷ using structured equation modeling (SEM).

Subjects and Methods

Sample

After we received approval from the Medical University of South Carolina institutional review board, 615 patients were recruited from two adult primary care clinics in the southeastern United States. Patients who expressed interest after receiving letters of invitation or being approached in the clinic waiting room were provided a detailed explanation of the study and consented. Patients were ineligible if through interaction or chart documentation they were determined to be cognitively impaired as a result of significant dementia or active psychosis. Eligibility included 18 years of age or older, diagnosis of type 2 diabetes in their medical record, and ability to communicate in English. Participants completed validated questionnaires that captured social determinants of health factors along with demographic and self-care information. Validated questionnaires were included based on a modified version

of the conceptual framework by Brown et al.⁴¹ relating social determinants of health to diabetes processes and outcomes.

The theoretical model described by Pascoe and Smart Richman⁷ for pathways between discrimination and health outcomes guided selection of measures included in this analysis. Based on a meta-analysis of available research on discrimination, Pascoe and Smart Richman⁷ suggested perceived discrimination is directly associated with mental and physical health. Their meta-analysis also suggested two indirect pathways: stress and health behaviors.⁷ Positive influences such as social support, stigma identification, and coping style influence these indirect pathways but were not suggested as a direct association with stress.⁷

Demographic information

Previously validated items from the 2002 National Health Interview Survey were used to capture age, race, gender, marital status, number of hours worked, household income, years of education, and employment status.⁴²

Perceived discrimination

Perceived discrimination was measured using questions from the Diabetes Study of Northern California (DISTANCE) survey, a four-question measure where patients reported how often in the past 12 months they were made to feel inferior.⁴³ Respondents were asked whether they were felt to be made inferior based on four specific characteristics: race/ethnicity, education level, gender, and language.⁴³ Response options were never, sometimes, usually, and often. Higher scores indicate more experience with discrimination.

Social support

Social Support was measured with the Medical Outcomes Study (MOS) Social Support Survey, a 19-item scale measuring different aspects of social support, including tangible support, affection, positive social interaction, and emotional or informational support. The total scale ($\alpha=0.97$) has high internal consistency, good criterion and discriminant validity, and 1-year test-retest reliability (0.72–0.76).⁴⁴ Higher overall score indicate more social support.

Social cohesion

Social cohesion was measured using the five-item Sampson Scale. This Scale measures the patient's ability to trust and relate to individuals in his or her neighborhood, including shared values and norms. Answer choices range from 1 (strongly agree) to 5 (strongly disagree).⁴⁵ Higher scores indicate more social cohesion.

Perceived stress

Stress was measured with the Perceived Stress Scale, a four-item scale that assesses the frequency with which the patient finds situations stressful during the previous month.⁴⁶ Response options were never, almost never, sometimes, fairly often, and very often, indicating how often respondents felt they were in control, were able to handle their problems, felt things were going their way, or felt difficulties were piling up.⁴⁷ The Cronbach α value is 0.69, and scores are highly correlated with stress, depression, and anxiety.⁴⁷ Higher scores indicate more stress.

QOL

Physical and mental aspects of QOL were assessed using the Short-Form Version 1 (SF-12), a 12-item scale providing the physical health component score (PCS) and MCS of QOL.^{48,49} The SF-12 is a valid and reliable instrument for health-related QOL and is a widely used survey because of its comprehensive nature.^{48,49} The SF-12 scores are interchangeable with those of the longer SF-36 version and reproduce at least 90% of the variance in the longer version.^{48,49} The SF-12 provides information on functional health and well-being, with higher scores indicating greater quality of life.^{48,49}

Statistical analysis

The sample size of 615 adults provides the recommended 20:1 ratio of subjects to variables needed to maintain 80% power, given the number of variables included in the model.^{50,51} With a sample size of 615, parameter estimates and SEs can be estimated without oversaturating the model.^{50,51}

All analyses were conducted using Stata version 13 software (StataCorp, College Station, TX). First, we performed descriptive statistics to ensure normality and linearity. Analyses used the maximum likelihood estimation procedure with the “mlmv option” so variables were retained rather than using listwise deletion. A series of confirmatory factor

analysis (CFA) models were estimated prior to conducting SEM, as is recommended by best practices.^{51,52} For CFA, the α statistic and factor analysis using principal component factor analysis were used to examine loading, along with goodness of fit statistics. For SEM, all analyses were conducted using standardized estimates, which can be interpreted as the change in SD of the outcome due to a 1 SD increase in the predictor. Because the χ^2 statistic is sensitive to sample size, we evaluated the direction and magnitude of path coefficients, along with multiple fit statistics, including root mean square error of approximation (RSMEA) and comparative fit index (CFI).⁵³ Lower RSMEA values indicate better fit, with 0.05 indicating good fit and 0.08 indicating reasonable fit.⁵³ Higher CFI indicates good fit, with 1 indicating perfect fit, 0.9 indicating adequate fit, and 0.8 indicating marginal fit.⁵³

Results

Demographic characteristics for this sample of 615 adults with type 2 diabetes are shown in Table 1. The mean age was 61 years, 61.6% were males, 64.9% were non-Hispanic black, and 50.2% earned less than \$20,000 per year.

Descriptive information included in latent variables is presented in Table 2, and correlations for study variables are shown in Table 3.

TABLE 1. SAMPLE DEMOGRAPHIC CHARACTERISTICS (N=615)

Characteristic	Value
Age (years)	61.3 ± 10.9
Diabetes duration (years)	12.3 ± 9.1
Education (years)	13.4 ± 2.8
Employment hours	12.4 ± 19
Charlson Comorbidity Score	25.7 ± 2.2
Race	
White	33
Black	64.9
Other	2.1
Site	
MUSC	51.2
VA	48.8
Gender	
Women	38.4
Men	61.3
Marital status	
Never married	11.2
Married	49.7
Separated/divorced	28.2
Widowed	10.9
Income	
<\$10,000	20.2
\$10,000–\$14,999	11.9
\$15,000–\$19,999	10.1
\$20,000–\$24,999	10.4
\$25,000–\$34,999	14.7
\$35,000–\$49,999	13.8
\$50,000–\$74,999	10.1
\$75,000 or more	9.4

Data are mean ± SD values or percentages as indicated.
MUSC, Medical University of South Carolina; VA, Veterans Administration.

TABLE 2. DESCRIPTIVE CHARACTERISTICS OF STRUCTURAL EQUATION MODEL FACTORS

Measure	Mean ± SD value
MCS	56.6 ± 2.6
PCS	56.3 ± 1.0
Discrimination	
Race	1.3 ± 0.6
Education	1.2 ± 0.5
Language	1.1 ± 0.4
Gender	1.1 ± 0.4
Self-care	
General diet	4.7 ± 2.0
Special diet	4.0 ± 1.6
Exercise	2.6 ± 2.2
Blood sugar testing	4.6 ± 2.5
Foot care	4.3 ± 2.5
Medication adherence	5.9 ± 2.0
Social support	
MOS-16	4.0 ± 1.2
MOS-17	4.0 ± 1.3
MOS-18	4.0 ± 1.3
Serious psychological distress	
SPD-1	1.2 ± 1.1
SPD-2	1.4 ± 1.3
SPD-3	1.5 ± 1.1
SPD-4	1.3 ± 1.2
Social cohesion	
SOCIALCOH-1	2.6 ± 1.0
SOCIALCOH-2	2.3 ± 0.9
SOCIALCOH-3	2.3 ± 1.0
SOCIALCOH-4	2.5 ± 0.9
SOCIALCOH-5	2.8 ± 1.0

Mean and SD of each variable were used to create latent variables.
MCS, mental health component score; MOS, Medical Outcomes Study; PCS, physical health component score.

TABLE 3. PAIRWISE CORRELATIONS FOR QUALITY OF LIFE, SOCIAL SUPPORT, SOCIAL COHESION, STRESS, AND PERCEIVED DISCRIMINATION

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1. MCS	—																								
2. PCS	-0.18 ^a	—																							
3. Race discrimination	-0.20 ^a	0.05	—																						
4. Education discrimination	-0.15 ^a	0.02	0.70 ^a	—																					
5. Language discrimination	-0.15 ^a	<0.01	0.52 ^a	0.51 ^a	—																				
6. Gender discrimination	-0.14 ^a	-0.02	0.64 ^a	0.65 ^a	0.55 ^a	—																			
7. General diet	0.14 ^a	-0.06	-0.14 ^a	-0.03 ^a	-0.08 ^a	-0.09 ^a	—																		
8. Specific diet	0.13 ^a	-0.01	-0.14 ^a	-0.09 ^a	-0.1 ^a	-0.07	0.36 ^a	—																	
9. Exercise	0.18 ^a	0.04	<0.01	0.02	0.01	-0.02	0.15 ^a	0.15 ^a	—																
10. Blood glucose test	<0.01	-0.02	-0.06	0.02	<0.01	-0.04	0.21 ^a	0.19 ^a	0.11 ^a	—															
11. Foot care	-0.02	-0.02	-0.03	0.02	<0.01	-0.04	0.22 ^a	0.22 ^a	0.12 ^a	0.18 ^a	—														
12. Medication adherence	0.21	-0.02	-0.16 ^a	-0.14 ^a	-0.12 ^a	-0.12 ^a	0.28 ^a	0.26 ^a	0.13 ^a	0.17 ^a	0.22 ^a	—													
13. Social support (MOS 16)	0.37 ^a	<0.01	-0.19 ^a	-0.21 ^a	-0.14 ^a	-0.11 ^a	0.19 ^a	0.15 ^a	0.13 ^a	0.07	0.09 ^a	0.17 ^a	—												
14. Social support (MOS 17)	0.36 ^a	<0.01	-0.19 ^a	-0.21 ^a	-0.14 ^a	0.12 ^a	0.22 ^a	0.18 ^a	0.14 ^a	0.08 ^a	0.12 ^a	0.16 ^a	0.91 ^a	—											
15. Social support (MOS 18)	0.37 ^a	<0.01	-0.19 ^a	-0.19 ^a	-0.14 ^a	0.11 ^a	0.22 ^a	0.17 ^a	0.15 ^a	0.09 ^a	0.12 ^a	0.18 ^a	0.92 ^a	0.94 ^a	—										
16. Perceived stress 1	-0.40 ^a	0.07	0.27 ^a	0.26 ^a	0.20 ^a	0.25 ^a	-0.18 ^a	-0.23 ^a	-0.18 ^a	-0.13 ^a	0.11 ^a	-0.31 ^a	-0.37 ^a	-0.42 ^a	-0.41 ^a	—									
17. Perceived stress 2	-0.24 ^a	0.03	0.02	0.05	0.03	0.09 ^a	-0.07	-0.07 ^a	-0.03	-0.02	0.03	-0.13 ^a	-0.14 ^a	-0.14 ^a	-0.14 ^a	0.11 ^a	—								
18. Perceived stress 3	-0.30 ^a	0.04	0.17 ^a	0.12 ^a	0.08	0.17 ^a	-0.18 ^a	-0.11 ^a	-0.06	-0.03	-0.04	-0.19 ^a	-0.29 ^a	-0.28 ^a	-0.30 ^a	0.27 ^a	0.56 ^a	—							
19. Perceived stress 4	-0.33 ^a	0.01	0.25 ^a	0.22 ^a	0.20 ^a	0.21 ^a	-0.19 ^a	-0.21 ^a	-0.11 ^a	-0.13 ^a	-0.10 ^a	-0.29 ^a	-0.36 ^a	-0.37 ^a	-0.38 ^a	0.64 ^a	0.11 ^a	0.26 ^a	—						
20. SOCIAL COH-1	-0.14 ^a	<0.01	0.16 ^a	0.13 ^a	0.15 ^a	0.16 ^a	-0.14 ^a	-0.07	-0.13 ^a	-0.13 ^a	-0.05	-0.06	-0.22 ^a	-0.23 ^a	-0.22 ^a	0.20 ^a	0.01	0.11 ^a	0.13 ^a	—					
21. SOCIAL COH-2	-0.18 ^a	-0.02	0.19 ^a	0.14 ^a	0.11 ^a	0.13 ^a	-0.13 ^a	-0.03	-0.09 ^a	-0.13 ^a	-0.02	-0.09 ^a	0.24 ^a	-0.25 ^a	-0.27 ^a	0.22 ^a	0.04	0.16 ^a	0.18 ^a	-0.65 ^a	—				
22. SOCIAL COH-3	-0.13 ^a	-0.02	0.08 ^a	0.09 ^a	0.10	0.10 ^a	-0.12 ^a	-0.06	-0.05	-0.04	0.03	-0.13 ^a	-0.13 ^a	-0.13 ^a	-0.12 ^a	0.12 ^a	0.14 ^a	0.17 ^a	0.16 ^a	0.27 ^a	0.28 ^a	—			
23. SOCIAL COH-4	-0.19 ^a	0.02	0.19 ^a	0.14 ^a	0.09 ^a	0.11 ^a	-0.15 ^a	-0.10 ^a	-0.10 ^a	-0.07	-0.02	-0.13 ^a	-0.25 ^a	-0.25 ^a	-0.26 ^a	0.20 ^a	0.06	0.15 ^a	0.18 ^a	0.52 ^a	0.60 ^a	0.17 ^a	—		
24. SOCIAL COH-5	-0.22 ^a	0.01	0.20 ^a	0.11 ^a	0.13 ^a	0.11 ^a	-0.09 ^a	-0.09 ^a	-0.07	-0.04	<0.01	-0.14 ^a	-0.09 ^a	-0.11 ^a	-0.12 ^a	0.15 ^a	0.05	0.11 ^a	0.09 ^a	0.27 ^a	0.20 ^a	0.41 ^a	0.25 ^a	—	

^a $P < 0.05$, indicating a significant difference.

MCS, mental health component score; MOS, Medical Outcomes Study; PCS, physical health component score.

Latent variable for perceived discrimination

CFA was used to assess a perceived discrimination latent variable using four items: race discrimination, education discrimination, language discrimination, and gender discrimination. The α statistic for perceived discrimination was 0.84. The variables loaded onto one factor explaining 70% of the variance, and factor loadings ranged from 0.75 to 0.87. The fit of the final model was satisfactory: $\chi^2(2)=7.97$, $P=0.02$, RMSEA=0.07, and CFI=0.99, with standardized loadings for all four measures significant at the $P<0.001$ level and ranging from 0.66 to 0.84.

Latent variable for social support

CFA was used to assess a social support latent variable using three items from the MOS Social Support Survey: someone to have a good time with, someone to get together with for relaxation, and someone to do something enjoyable with. The α statistic for social support was 0.97. The variables loaded onto one factor explaining 95% of the variance, and factor loadings ranged from 0.97 to 0.99. The final model was just fit, with standardized loadings for all three measures significant at the $P<0.001$ level and ranging from 0.94 to 0.97.

Latent variable for social cohesion

CFA was used to assess a social cohesion latent variable using five items from the Sampson Scale. The α statistic for social cohesion was 0.73. The variables loaded onto one factor explaining 50% of the variance, and factor loadings ranged from 0.53 to 0.83. The final model fit well: $\chi^2(3)=5.50$, $P=0.14$, RMSEA=0.04, and CFI=0.997, with standardized

loadings for all five measures of social cohesion significant at the $P<0.001$ level and ranging from 0.32 to 0.88.

Latent variable for perceived stress

CFA was used to assess a perceived stress latent variable using four items from the Perceived Stress Scale. The α statistic for perceived stress was 0.65. The variables loaded onto one factor explaining 50% of the variance, and factor loading ranged from 0.59 to 0.75. The final model was just fit, with standardized loadings for all four measures of perceived stress significant at the $P<0.001$ level and ranging from 0.15 to 0.82.

Structural model for MCS of QOL

The final model is shown in Figure 1. Direct, indirect, and total effects are shown in Table 4. The final model fit well: $\chi^2(106)=157.35$, $P=0.009$, $R^2=0.99$, RMSEA=0.03, and CFI=0.99. Direct effects give insight into direct associations and show that higher perceived stress ($r=-1.02$, $P<0.05$) and lower social support ($r=0.36$, $P<0.001$) are significantly related to a decreased MCS. Discrimination and social cohesion were not significantly directly related to MCS. There were indirect associations, however, with higher discrimination ($r=-0.48$, $P<0.001$), lower social support ($r=0.36$, $P<0.001$), and higher social cohesion ($r=0.14$, $P<0.05$) significantly indirectly associated with decreased MCS. This indirect association is explained in this model through the direct association with stress as the model shows that higher discrimination ($r=0.47$, $P<0.001$), higher social cohesion ($r=0.14$, $P<0.05$), and lower social support ($r=-0.35$, $P<0.001$) are significantly directly related to increased stress.

FIG. 1. Structured equation modeling model of influence of discrimination on the mental health component of quality of life. Coefficients are standardized path coefficients. Overall model fit was $\chi^2(106)=190.69$, $P<0.001$, $R^2=0.99$, root mean square error of approximation=0.036, comparative fit index=0.984. * $P<0.05$, ** $P<0.01$, *** $P<0.001$.

TABLE 4. STANDARDIZED DIRECT, INDIRECT, AND TOTAL EFFECTS FOR RELATIONSHIP OF DISCRIMINATION ON QUALITY OF LIFE

	<i>Direct effects</i>	<i>Indirect effects</i>	<i>Total effects</i>
MCS			
→ Stress	−1.02 ^a	—	−1.02 ^b
→ Discrimination	−0.04	−0.48 ^b	−0.52 ^a
→ Social support	0.36 ^b	0.36 ^b	0.71 ^b
→ Cohesion	−0.24	−0.14 ^a	−0.38 ^a
Stress			
→ Discrimination	0.47 ^b	—	0.47 ^b
→ Social support	−0.35 ^b	—	−0.35 ^b
→ Cohesion	0.14 ^a	—	0.14 ^a

Significant direct effects indicate direct association between variables; for example, increased stress is associated with decreased mental health component score (MCS). Significant indirect effects indicate the pathway through which variables influence MCS.

^a $P < 0.05$, ^b $P < 0.001$.

Structural model for PCS of QOL

No significant paths existed when using the PCS of QOL as an outcome.

Discussion

Consistent with our hypothesis, perceived discrimination was significantly associated with stress and in this model served as a pathway to influence the MCS of QOL. In addition, social support had both a direct and an indirect effect on MCS through a negative association with stress. Conflicting with our hypothesis, social cohesion was positively linked to stress, suggesting that in this population, social cohesion had an adverse effect on stress levels. Also contrary to our hypothesis, no significant paths were found among perceived discrimination, stress, and the PCS of QOL.

By using SEM, this study is the first of its kind to test a theoretical model of the mechanisms through which perceived discrimination influences QOL in patients with diabetes. Based on our results, an indirect pathway through increased stress is a plausible mechanism for the relationship between discrimination and QOL. Social support also decreases stress and increase QOL directly. Our results are complementary to a recent study concerning African American women living in low-income neighborhoods.⁵⁴ This study showed both moderate and high frequency of discrimination was associated with psychological distress, and availability of emotional and instrumental support was negatively associated with psychological distress.⁵⁴ Interventions aimed at decreasing stress related to discrimination may serve to increase the mental health-related QOL for patients with diabetes. Current studies on stress reduction interventions in patients with diabetes show that there are noninvasive methods to significantly decrease stress, including educational sessions and cognitive-behavior therapy.^{55–57} Furthermore, teaching mindfulness stress reduction in patients with severe cases of diabetes significantly reduced cardiovascular risk factors.⁵⁸ To our knowledge there is limited research on interventions focused on decreasing stress in relation to perceived discrimination. Because higher social support was

associated with lower levels of stress in our population, future research should consider ways in which social support can mediate the relationship between perceived discrimination and stress. Development of interventions that address stress and social support in patients with diabetes may address the influence of discrimination on the MCS of QOL in this population.

The strengths of the study include a large sample size, as well as the use of SEM, which allowed testing of theoretical models previously hypothesized based on individual associations. Limitations include the study population living in the southeast United States. Although we do not expect pathways to differ by region, the strength of different aspects may differ and should be tested in other areas before generalizing to the entire nation. Second, nonexperimental data can be used in SEM analyses but do not provide evidence of causation. Therefore causality cannot be established. In addition, recall bias in self-report data is generally observed, with patients more likely to remember severe experiences. Finally, although the analysis was based on a theoretical model, additional confounding variables may exist.

In conclusion, this study tested the theoretical framework suggested by Pascoe and Smart Richman⁷ for the relationship between perceived discrimination and MCS and PCS of QOL. In patients with type 2 diabetes, this relationship seems to indirectly influence the MCS of QOL, through its direct effect on stress. Social support is negatively associated with stress and positively associated with MCS. Based on these insights into the pathway through which discrimination influences QOL in patients with diabetes, interventions should be developed to decrease stress and increase social support surrounding experiences with discrimination to improve QOL in patients with diabetes.

Acknowledgments

This study was supported by grant K24DK093699-01 from the National Institute of Diabetes and Digestive and Kidney Disease (Principal Investigator: L.E.E.).

Author Disclosure Statement

No competing financial interests exist.

L.E.E. obtained funding for the study. R.J.W. and L.E.E. acquired the data. All authors designed the study, analyzed and interpreted the data, drafted the article, critically revised the manuscript for important intellectual content, and approved the final manuscript.

References

- Centers for Disease Control and Prevention: National Diabetes Statistics Report, 2014. Atlanta: Centers for Disease Control and Prevention, U.S. Department of Health and Human Services, 2014.
- Marks JS: Health-related quality of life reveals full impact of chronic diseases. *Chronic Dis Notes Rep* 2003;16:2.
- Thommasen H, Zhang W: Health-related quality of life and type 2 diabetes: A study of people living in the Bella Coola Valley. *BC Med J* 2006;48:272–278.
- Stewart AL, Greenfield S, Hays RD, et al.: Functional status and well-being of patients with chronic conditions. Results from the Medical Outcomes Study. *JAMA* 1989; 262:907–913.

5. Centers for Disease Control and Prevention: Measuring Healthy Days: Population Assessment of Health-Related Quality of Life. Atlanta: Centers for Disease Control and Prevention, 2000;44. www.cdc.gov/hrqol/pdfs/mhd.pdf (accessed August 5, 2015).
6. Boyle JP, Thompson TJ, Gregg EW, et al.: Projection of the year 2050 burden of diabetes in the US adult population: dynamic modeling of incidence, mortality, and prediabetes prevalence. *Popul Health Metr* 2010;8:29.
7. Pascoe EA, Smart Richman L. Perceived discrimination and health: a meta-analytic review. *Psychol Bull* 2009;135: 531–554.
8. Healthy People. Secretary's Advisory Committee on Health Promotion and Disease Prevention Objectives for 2020. HealthyPeople 2020: An Opportunity to Address the Societal Determinants of Health in the United States. www.healthy people.gov/2020/topics-objectives/topic/social-determinants-health (last accessed December 21, 2015).
9. Walker RJ, Smalls BL, Campbell JA, et al.: Impact of social determinants of health on outcomes for type 2 diabetes: a systematic review. *Endocrine* 2014;47:29–48.
10. Braveman P, Egerter S, Williams DR: The social determinants of health: coming of age. *Annu Rev Public Health* 2011;32:381–398.
11. Viner RM, Ozer EM, Denny S, et al.: Adolescence and the social determinants of health. *Lancet* 2012;379:1641–1652.
12. Marmot M, Friel S, Bell R, et al.: Closing the gap in a generation: health equity through action on the social determinants of health. *Lancet* 2008;372:1661–1669.
13. Slopen N, Lewis TT, Williams DR: Discrimination and sleep: a systematic review. *Sleep Med* 2015 January 28 [Epub ahead of print]. doi: 10.1016/j.sleep.2015.01.012.
14. Williams DR, Sternthal M: Understanding racial-ethnic disparities in health: sociological contributions. *J Health Soc Behav* 2010;51(Suppl):S15–S27.
15. Williams DR, Mohammed SA: Discrimination and racial disparities in health: evidence and needed research. *J Behav Med* 2009;32:20–47.
16. Harris R, Tobias M, Jeffreys M, et al.: Effects of self-reported racial discrimination and deprivation on Māori health and inequalities in New Zealand: cross-sectional study. *Lancet* 2006;367:2005–2009.
17. Walls ML, Gonzalez J, Gladney T, et al.: Unconscious biases: racial microaggressions in American Indian health care. *J Am Board Fam Med* 2015;28:231–239.
18. Pavão AL, Ploubidis GB, Werneck G, et al.: Racial discrimination and health in Brazil: evidence from a population-based survey. *Ethn Dis* 2012;22:353–359.
19. Sevillano V, Basabe N, Bobowik M, et al.: Health-related quality of life, ethnicity and perceived discrimination among immigrants and natives in Spain. *Ethn Health* 2014;19:178–197.
20. Earnshaw VA, Rosenthal L, Carroll-Scott A, et al.: Everyday discrimination and physical health: exploring mental health processes. *J Health Psychol* 2015 March 2 [Epub ahead of print]. pii: 1359105315572456.
21. Szanton SL, Rifkind JM, Mohanty JG, et al.: Racial discrimination is associated with a measure of red blood cell oxidative stress: a potential pathway for racial health disparities. *Int J Behav Med* 2012;19:489–495.
22. Banks KH, Kohn-Wood LP, Spencer M: An examination of the African American experience of everyday discrimination and symptoms of psychological distress. *Community Ment Health J* 2006;42:555–570.
23. Ryan AM, Gee GC, Griffith D: The effects of perceived discrimination on diabetes management. *J Health Care Poor Underserved* 2008;19:149–163.
24. Rubin RR, Peyrot M: Quality of life and diabetes. *Diabetes Metab Res Rev* 1999;15:205–218.
25. Cowderly JE, Pesa JA: Assessing quality of life in women living with HIV infection. *AIDS Care* 2002;14:235–245.
26. Chan S, Yu IuW: Quality of life of clients with schizophrenia. *J Adv Nurs* 2004;45:72–83.
27. Jackson SE, Beeken RJ, Wardle J: Obesity, perceived weight discrimination, and psychological well-being in older adults in England. *Obesity (Silver Spring)* 2015;23:1105–1111.
28. Peek ME, Wagner J, Tang H, et al.: Self-reported racial discrimination in health care and diabetes outcomes. *Med Care* 2011;49:618–625.
29. Reynolds DB, Walker RJ, Campbell JA, et al.: Differential effect of race, education, gender, and language discrimination on glycemic control in adults with type 2 diabetes. *Diabetes Technol Ther* 2015;17:243–247.
30. Lyles CR, Karter AJ, Young BA, et al.: Provider factors and patient-reported healthcare discrimination in the Diabetes Study of California (DISTANCE). *Patient Educ Couns* 2011;85:e216–e224.
31. Préau M, Marcellin F, Carrieri MP, et al.: Health-related quality of life in French people living with HIV in 2003: results from the national ANRS-EN12-VESPA Study. *AIDS* 2007;21(Suppl 1):S19–S27.
32. Dawson AZ, Walker RJ, Campbell JA, et al.: Effect of perceived racial discrimination on self-care behaviors, glycemic control, and quality of life in adults with type 2 diabetes. *Endocrine* 2015;49:422–428.
33. Williams DR, Neighbors HW, Jackson JS: Racial/ethnic discrimination and health: findings from community studies. *Am J Public Health* 2003;93:200–208.
34. Dyrbye LN, Thomas MR, Eacker A, et al.: Race, ethnicity, and medical student well-being in the United States. *Arch Intern Med* 2007;167:2103–2109.
35. Otiniano AD, Gee GC: Self-reported discrimination and health-related quality of life among Whites, Blacks, Mexicans and Central Americans. *J Immigr Minor Health* 2012;14:189–197.
36. Johansson P, Muller CJ, Samos MW, et al.: The influence of perceived discrimination on health-related quality of life in an East Coast American Indian tribe. *J Health Care Poor Underserved* 2013;24:1531–1541.
37. Latner JD, Barile JP, Durso LE, et al.: Weight and health-related quality of life: the moderating role of weight discrimination and internalized weight bias. *Eat Behav* 2014;15:586–590.
38. Merluzzi TV, Zhang Z, Philip EJ, et al.: Perceived discrimination, coping, and quality of life for African American and Caucasian persons with cancer. *Cultur Divers Ethn Minor Psychol* 2015;21:337–344.
39. Ezenwa MO, Fleming MF: Racial disparities in pain management in primary care. *J Health Dispar Res Pract* 2014;5:12–26.
40. Andrews JO, Mueller M, Newman SD, et al.: The association of individual and neighborhood social cohesion, stressors, and crime on smoking status among African-American women in southeastern US subsidized housing neighborhoods. *J Urban Health* 2014;91:1158–1174.
41. Brown AF, Ettner SL, Piette J, et al.: Socioeconomic position and health among persons with diabetes mellitus: a conceptual framework and review of the literature. *Epidemiol Rev* 2004;26:63–77.

42. National Center for Health Statistics: Survey Questionnaire, National Health Interview Survey. Hyattsville, MD: National Center for Health Statistics, 2002–2004. www.cdc.gov/nchs/nhis.htm (last accessed December 21, 2015).
43. Moffet HH, Adler N, Schillinger D, et al.: Cohort profile: The Diabetes Study of Northern California (DISTANCE)—objectives and design of a survey follow-up study of social health disparities in a managed care population. *Int J Epidemiol* 2009;38:38–47.
44. Sherbourne CD, Stewart AL: The MOS social support survey. *Soc Sci Med* 1991;32:705–714.
45. Cohen S, Williamson G: Perceived stress in a probability sample of the United States. In: Spacapan S, Oskamp S, eds. *The Social Psychology of Health*. Newbury Park, CA; Sage, 1988.
46. Andreou E, Alexopoulos EC, Lionis C, et al.: Perceived Stress Scale: reliability and validity study in Greece. *Int J Environ Res Public Health* 2011;8:3287–3298.
47. Sampson RJ, Raudenbush SW, Earls F: Neighborhoods and violent crime: a multilevel study of collective efficacy. *Science* 1997;277:918–24.
48. Ware J, Kosinski M, Keller SD: A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. *Med Care* 1996;34:220–233.
49. Resnick B, Parker R: Simplified scoring and psychometrics of the revised 12-item Short-Form Health Survey. *Outcomes Manag Nurs Pract* 2001;5:161–166.
50. Schumacker RE, Lomax RG: *A Beginner's Guide to Structural Equation Modeling*, 3rd ed. New York: Taylor and Francis Group, 2010.
51. Costello AB, Osborne JW: Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. *Pract Assess Res Eval* 2005;10:173–178.
52. Schreiber JB: Core reporting practices in structural equation modeling. *Res Soc Admin Pharm* 2008;4:83–97.
53. Hooper D, Caughlan J, Mullen MR: Structural equation modeling: guidelines for determining model fit. *Electron J Business Res Methods* 2008;6:53–60.
54. Ajrouch K, Reisine S, Lim S, et al.: Perceived everyday discrimination and psychological distress: does social support matter? *Ethn Health* 2010;15:417–434.
55. Amsberg S, Anderbro T, Wredling R, et al.: A cognitive behavior therapy-based intervention among poorly controlled adult type 1 diabetes patients—a randomized controlled trial. *Patient Educ Counsel* 2009;77:72–80.
56. Attari A, Sartippour M, Amini M, et al.: Effect of stress management training on glycemic control in patients with type 1 diabetes. *Diabetes Res Clin Pract* 2006;73:23–28.
57. Patnaik L, Joshi A, Sahu T: Mobile phone-based education and counseling to reduce stress among patients with diabetes mellitus attending a tertiary care hospital of India. *Int J Prev Med* 2015;6:37.
58. Kopf S, Oikonomou D, Hartmann M, et al.: Effects of stress reduction on cardiovascular risk factors in type 2 diabetes patients with early kidney disease—results of a randomized controlled trial (HEIDIS). *Exp Clin Endocrinol Diabetes* 2014;122:341–349.

Address correspondence to:
 Leonard E. Egede, MD, MS
 Center for Health Disparities Research
 Medical University of South Carolina
 135 Rutledge Avenue, Room 280
 Charleston, SC 29425
 E-mail: egedel@musc.edu