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Effect of neighborhood factors on diabetes self-care behaviors in adults with type 2 diabetes

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ABSTRACT

Objective: The objective of this study was to identify latent variables for neighborhood factors and diabetes self-care and examine the effect of neighborhood factors on diabetes self-care in adults with type 2 diabetes.

Research design and methods: 615 subjects were recruited from an academic medical center and a Veterans affairs medical center in the southeastern United States. Validated scales were used to assess neighborhood factors and diabetes-related self-care. Confirmatory factor analysis (CFA) was used to determine the latent constructs. Structural equation modeling (SEM) was then used to assess the relationship between neighborhood factors and diabetes self-care.

Results: Based on a theoretical framework, CFA yielded four latent variables for neighborhood factors (neighborhood violence, access to healthy food, social support, and neighborhood esthetics) and one latent variable diabetes self-care (including diet, exercise, foot care, blood sugar testing and medication adherence). SEM showed that social support ($r = 0.28$, $p < 0.001$) and access to healthy foods ($r = -0.16$, $p = 0.003$) were significantly associated with self-care behaviors, while neighborhood violence ($r = -0.06$, $p < 0.001$) and esthetics ($r = -0.07$, $p = 0.278$) were not χ^2 (180, $N = 611$) = 192, $p = 0.26$, RMSEA = 0.01, CFI = 0.999). In the final trimmed model, social support ($r = 0.31$, $p < 0.001$) and access to healthy foods ($r = -0.20$, $p < 0.001$) remained significantly associated with self-care behaviors χ^2 (76, $N = 611$) = 60, $p = 0.91$, RMSEA = 0.00, CFI = 1.0).

Conclusion: This study developed latent factors for neighborhood characteristics and diabetes self-care and found that social support and access to healthy foods were significantly associated with diabetes self-care and should be considered as targets for future interventions.

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1. Introduction

Type 2 diabetes mellitus is a chronic illness that affects more than 25.3 million people in the United States (US) and 366 million people worldwide [1,2]. To attain optimal type 2 diabetes health outcomes, patients must participate in self-care behaviors, including eating a recommended diet, regular exercise, monitoring blood glucose, medication adherence, and foot care [3,4]. Emphasis has been placed on optimizing these behaviors in adults with type 2 diabetes in order to reduce the risk of type 2 diabetes related complications and to improve health outcomes [5]. Additionally, self-care behaviors account for over 90% of the variance in glycemic control, in patients with type 2 diabetes [6]. Yet, socio-environmental factors have been shown to contribute to up to 85% of patients' nonadherence to self-care behaviors in adults with diabetes [5,7–11]. However, there is limited information on which socio-environmental elements have direct effects on self-care behaviors.

Previous studies have shown that socio-environmental factors, specifically neighborhood characteristics, can impact health outcomes of those with chronic illness, including type 2 diabetes [8,12,13]. Neighborhood characteristics that have been identified as barriers to type 2 diabetes self-care behaviors include, but are not limited to, crime, violence, social cohesion, social support, and lack of resources [7,8,12,14–16]. Neighborhood characteristics have been shown to decrease medication adherence by 21.9%, reduce overall physical health, and contribute to poor dietary patterns [7,19]. Thus, identifying which neighborhood characteristics have the most significant impact on type 2 diabetes self-care behaviors can direct future initiatives.

An overview of the literature indicates various elements of the socio-environment are predictors of health outcomes [7,8,12–14]. However, few studies have examined the structural pathways that link the social environment/neighborhood to self-care behaviors in patients with type 2 diabetes. Structural equation modeling (SEM) is an appropriate methodology to examine these relationships. In SEM, a theoretical framework and existing empirical evidence is tested using an available dataset [20]. Predictive paths and covariance are tested to understand how well the hypothesized relationship is supported by goodness-of-fit statistics. SEM also allows testing of relationships among multiple dependent/outcome variables, which is important in understanding the role of neighborhood factors in diabetes.

The previously published theoretical framework by Brown and colleagues [13] examines the relationship between components of socioeconomic position and health outcomes in patients with type 2 diabetes. The framework indicates that an individual's socioeconomic position, which includes education, income, employment, and community crime rates among other characteristics, can contribute to health outcomes as an adult. Furthermore, the framework hypothesizes that socioeconomic position has an impact on type 2 diabetes health outcomes. Subsequently, socioeconomic position influences proximal and distal moderators/mediators, that take into account health behaviors, access to care, and process of care, an individual's stress level, provider decision-making

style, community availability of health foods, and the health care system. As a result, socioeconomic position and distal and proximal moderators/mediators are thought to impact health outcomes (e.g., health status, quality of life, glycemic control).

Using the aforementioned theoretical framework, this study assessed the relationship between neighborhood characteristics and self-care behaviors using confirmatory factor analysis (CFA) to create latent variables for neighborhood factors and diabetes self-care. We then used SEM to test the structural relationships between neighborhood factors and self-care [21]. Based on the aforementioned theoretical framework [13], we hypothesized that neighborhood factors would load under four latent variables (neighborhood violence, neighborhood esthetics, access to healthy foods and social support), while diet, exercise, blood sugar testing, foot care and medication adherence would load on a type 2 diabetes self-care behavior latent factor. We further hypothesized that the neighborhood latent factors would be significantly associated with diabetes self-care behavior latent factors.

2. Research design and methods

2.1. Sample selection and setting

Patients with type 2 diabetes ($N = 615$) were recruited from an academic medical center and a Veterans affairs medical center in the southeastern United States. Approvals were obtained from the institutional review board and research and development committee for both institutions prior to study enrollment. Eligible patients had to be 18 years of age or older, a patient at either facility with a diagnosis of type 2 diabetes in their medical record, and able to communicate in English. Subjects were ineligible if they exhibited mental confusion during the screening interview or reported alcohol or drug abuse/dependency, active psychosis or acute mental disorder using validated screening instruments.

2.2. Data collection

Program Coordinators reviewed the electronic clinic roster to identify eligible patients. Eligible patients were approached in the clinic waiting room and provided a description of the study. Those interested and eligible were then consented and given the questionnaire to complete. Patients were able to complete the assessment before or after their scheduled clinic appointments, depending on clinic flow. Six hundred and fifteen participants were consented and completed the study. Study personnel who had direct contact with patients were required to conduct mock study visits with fellow study personnel to insure that the consent process and administration of the study assessment were standardized. Outcome measures were abstracted from each patient's electronic medical record.

2.3. Self-care behaviors

2.3.1. Self-reported medication adherence
This was measured with the 8-item self-report Morisky medication adherence scale (MMAS) [22]. Each of the 8 items