



## Diabetes distress and neighborhood characteristics in people with type 2 diabetes



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### ABSTRACT

**Objective:** Diabetes-specific distress is an important psychological issue in people with diabetes. The neighborhood environment has the potential to be an important factor for diabetes distress. This study investigates the associations between neighborhood characteristics and diabetes distress in adults with type 2 diabetes.

**Methods:** We used cross-sectional data from a community-based sample of 578 adults with type 2 diabetes from Quebec, Canada. Information on perceived neighborhood characteristics and diabetes distress was collected from phone interviews. We used factor analysis to combine questionnaire items into neighborhood factors. Information on neighborhood deprivation was derived from census data. We performed linear regressions for diabetes distress and specific domains of diabetes distress (emotional, regimen-related, physician-related and interpersonal distress), adjusting for individual-level variables.

**Results:** Factorial analysis uncovered 3 important neighborhood constructs: perceived order (social and physical order), culture (social and cultural environment) and access (access to services and facilities). After adjusting for individual-level confounders, neighborhood order was significantly associated with diabetes distress and all specific domains of distress; neighborhood culture was specifically associated with regimen-related distress; and neighborhood access was specifically associated with physician-related distress. The objective measure of neighborhood material deprivation was associated with regimen-related distress.

**Conclusions:** Neighborhood characteristics are associated with diabetes distress in people with type 2 diabetes. Clinicians should consider the neighborhood environment reported by their patients with diabetes when assessing and addressing diabetes-specific distress.

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### Introduction

The prevalence of diabetes in Canada is estimated at 5.5% and is expected to increase steadily in coming years [1]. Individuals living with diabetes often face lifelong self-management regimens often involving significant changes in their lifestyle and adherence to complex medication procedures. Individuals with diabetes also need to prevent and manage diabetes complications, concurrent health problems and functional limitations [1,2]. Diabetes distress is a multi-domain construct which captures the worry, frustration and discouragement that may accompany life with diabetes. It encompasses regimen-related distress, physician-related distress, emotional burden and diabetes-related interpersonal distress [3–5]. Distress over diabetes regimen relates to the worries and discouragements that patients may have about self-managing their disease, such

as perceived difficulties in following their diet or maintaining their diabetes routine [6–8]. Distress related to physician concerns about access to healthcare and quality of care, such as worries that recommendations provided by healthcare professionals may be incomplete [6,9]. Emotional burden is another source of diabetes distress that refers to the negative mental and emotional aspects of life with diabetes. This includes feelings such as despair, anger or fear when thinking about a lifetime with diabetes or feeling overwhelmed by the demands of diabetes. Finally, interpersonal distress such as lack of social support may contribute to diabetes distress by limiting emotional support or making it more difficult to maintain a healthy lifestyle [6]. Diabetes distress is a psychological issue distinct from depression and anxiety [10]. It has been found to be more common and persistent than depression in people with diabetes [5,10,11]. It is associated with poorer glycemic control, self-care behaviors and medication adherence, even above and beyond depressive symptoms [12–16].

Although diabetes distress is an important outcome for people with diabetes, relatively little is known of the predictors and correlates of diabetes distress. One study identified individual-level variables associated with diabetes distress, including a greater number

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of diabetes complications, negative life events or chronic stress, a history of depression and an unhealthy lifestyle [17]. The neighborhood where people live could be an important additional factor for diabetes distress. People with diabetes are often recommended to exercise more frequently and improve their diet. Living in a neighborhood with limited access to healthy food and safe places to exercise can be an important barrier for diabetes self-care [18] and may be a source of diabetes distress. A lack of community resources and support may also limit a person's ability to manage and function with their diabetes [19]. Neighborhood factors have further been linked to physical health outcomes and complications in people with diabetes [19,20], which could affect distress. Only one study investigated the link between neighborhood environment and mental wellbeing in people with diabetes [21]. Results showed an association between neighborhood socioeconomic status and depressive symptoms in a clinical sample of obese patients with type 2 diabetes. No study has specifically focused on neighborhood factors in diabetes distress.

The primary objective of this study was to investigate the associations between a range of neighborhood characteristics and diabetes distress, in a representative sample of adults with type 2 diabetes. The secondary objective was to examine the association between neighborhood characteristics and the specific domains of diabetes distress (regimen-related, physician-related, emotional, interpersonal distress).

## Methods

### Study population

We used data from a sub-sample of the Diabetes Health and Well-being Study (DHS), a random digit-dialing survey of 2003 community-dwelling adults with diabetes, living in Quebec, Canada [22]. The DHS started in 2008 and follow-ups are annual. In 2011, we conducted a sub-study using a sub-sample of DHS participants with type 2 diabetes who lived in urban and semi-urban areas (determined from postal codes). The purpose of the sub-study was to add missing information on diet, physical activity and neighborhood environment to the DHS. A total of 680 participants accepted and provided verbal consent and 600 were subsequently telephone interviewed. For this study, we included participants with information on diabetes distress ( $n = 578$ ). We found no significant differences in baseline socio-demographic and lifestyle characteristics between DHS sub-study participants and non-participants with type 2 diabetes living in urban or semi-urban areas, except that DHS sub-study participants were slightly more likely to be working (39.0% vs 31.5%,  $p = 0.007$ ) and less likely to be smokers (17.5% vs 23.0%,  $p = 0.006$ ) than non-participants.

### Diabetes distress

Diabetes distress was measured using the 17-item Diabetes Distress Scale (DDS) [4]. The DDS has shown good validity and internal consistency ( $\alpha = 0.93$ ) [4]. The scale explores four domains of distress potentially related to living with diabetes: emotional burden (5 items, such as “feeling that diabetes is taking up too much of my mental and physical energy every day”), physician-related distress (4 items, such as “feeling that my doctor doesn't give me clear enough directions on how to manage my diabetes”), regimen-related distress (5 items, such as “feeling that I am often failing with my diabetes routine”) and diabetes-related interpersonal distress (3 items, such as “feeling that friends or family are not supportive enough of self-care efforts”). Items are rated on a Likert scale from 1 (not a problem) to 6 (very serious problem). We calculated a mean global diabetes distress score and mean scores for each domain-specific subscale by dividing the total score of the scales by the number of questions (range between 1

and 6). Previous research suggests a mean score of  $\geq 2$  to indicate moderate to high diabetes distress [3].

### Neighborhood characteristics

Based on a review of the literature, we developed a 35-item neighborhood questionnaire using existing items from different works [23–28]. Items were rated on a yes/no scale or on a 4- or 5-point Likert scale. The questionnaire was pilot tested and translated to French. The measurement of residential environment from self-report is a relatively new area of research, and single item measures have shown overall moderate validity [23] and reliability [29].

Neighborhood deprivation was estimated using the Pampalon Deprivation Index [30]. The Pampalon Index uses aggregate census data to estimate material and social deprivation at the level of the dissemination area, the smallest census geographic unit in Canada. The index was calculated using data from the 2006 Canadian census, the most recently available census. Both material and social deprivation scores were divided into quintiles to stay consistent with previous literature [22]. Because we were interested in neighborhood deprivation, we compared the most deprived areas (4th and 5th quintiles) with the least deprived areas (1st to 3rd quintiles). The items in the Pampalon Index have good content validity [30]. The Pampalon index has been successfully used in several studies, including the DHS study sample [22].

### Individual-level covariates

Based on our literature review, we selected variables that could confound the relationship between neighborhood selection and diabetes distress. We included socio-demographic information on sex, age, marital status, highest attained education (less than secondary school, secondary school graduation, some post-secondary school), working status (working, not working, retired) and family income (<\$15,000, \$15,000–\$50,000 > \$50,000), as well as information on number of chronic conditions (0, 1, >1) and duration of diabetes (in years). Race was not included because the majority of the sample was non-Hispanic Caucasian (94%).

### Statistical analysis

Because many of the neighborhood items were highly correlated, their full inclusion in the model could lead to unstable estimates. We therefore performed a factor analysis to combine the neighborhood questionnaire items into a few meaningful constructs. Factor analysis is a method to examine the structure of items by identifying the smallest number of factors explaining the relationship among observed variables. We conducted the analysis using a principal component analysis with an orthogonal varimax rotation. Because of potential for central tendency bias and response set bias and because of small cell sizes for many of the extreme answer categories, we dichotomized the categorical responses of neighborhood items (strongly agree/agree vs strongly disagree/disagree; excellent/very good/good vs fair/poor). We used smoothed tetrachoric correlation matrices. The number of retained factors was based on the scree plot and interpretability of factors. A summary score for each neighborhood factor was calculated by summing the items related to each of the factors. We allowed for up to one missing item response per factor by replacing the missing value with the mean score of the other non-missing items. Some items were reverse-coded such that a higher score could be interpreted as better neighborhood qualities.

We performed linear regressions for each neighborhood construct. We used log transformed diabetes distress scores as the dependent variable because continuous scores were highly skewed. We reported the beta coefficient of each neighborhood construct for 3 models: 1) model 1 adjusted for age and sex only; 2) model 2 adjusted for

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