



## The pattern of depressive symptoms in people with type 2 diabetes: A prospective community study

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### ABSTRACT

**Objective:** The aim of the present study was to identify and describe longitudinal patterns of depression in a community sample of people with type 2 diabetes in Quebec, Canada.

**Methods:** A prospective community based study in Quebec, Canada, was carried out between 2008 and 2011. Participants with diabetes were assessed at baseline and at 1, 2 and 3 years follow-up (n = 1388). Depression was assessed using the Patient Health Questionnaire (PHQ-9).

**Results:** Longitudinal latent class analysis yielded four clusters representing different longitudinal patterns of depression: Cluster 1 (“no depression”; 67%): participants had neither minor nor major depression over time. Cluster 2 (“slowly increasing prevalence of minor and major depression over time”; 20%): participants had low levels of depression at baseline but increasing levels of minor and major depression over time; while most of the Cluster 3 (“increasing major depression”; 6%) participants had high and increasing levels of major depression over time. Participants in Cluster 4 (“improved depression”; 7%) started with high levels of depression but progressed to low levels of depression.

**Conclusions:** Our results provide important evidence of different longitudinal patterns of depression in people with type 2 diabetes. Identification of four distinct groups of participants might improve our understanding of the course of depression and may provide a basis of classification for intervention.

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### Introduction

Type 2 diabetes is a progressive chronic disease that is recognized as an important public health problem. Recent national surveys show that the incidence of type 2 diabetes mellitus is increasing at epidemic rates [1].

Depression has been shown to be a common co-morbidity in diabetes, affecting 10% to 30% of the diabetic population [2]. Growing evidence indicates that people with diabetes with comorbid depression demonstrate poor adherence to antidiabetic regimens and are at increased risk for morbidity and mortality [3–6].

The natural course of depression in general population samples is poorly understood. Only a few prospective studies have attempted to evaluate the longitudinal course of depression using more than two time points [7–11]. In a recent review, Richards [12] concluded that a) the majority of individuals in the general population who experience depression will recover within one year (50%–70%), but some may not experience recovery even after 5 years or more; and b) that recovery is not permanent and that for many people with depression, recurrence after recovery is the rule.

Mapping the trajectories of mental disorders is one of the main objectives of the US National Institute of Mental Health. As pointed out in their 2008 *Strategic Plan* [13], the “developmental trajectory of illnesses opens the possibility that we could intervene and alter trajectories.” Identification of depression trajectories is an important issue in diabetes. Although there is evidence that prevalence and incidence of depression are higher in people with diabetes than in people without diabetes, there is only very limited information about the

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course of depression in this condition, e.g. there is no information about the development, persistence and recurrence of both minor and major depression.

The aim of the present study was to identify and describe groups of people with type 2 diabetes defined by their pattern of both minor and major depression over time using a community sample of people with diabetes in Quebec, Canada. The two specific objectives were a) to identify whether there were distinct groups of people with type 2 diabetes with different longitudinal patterns of depression in the past 3 years; and b) to determine whether membership in the groups was associated with demographic and clinical characteristics at baseline assessment or during the three year follow ups.

## Method

Data from the Montreal Diabetes Health and Well Being Study (DHS) were used. The DHS is a telephone survey of adults with diabetes in Quebec, Canada. Participants were recruited in 2008 through random digit dialling. Eligible participants were individuals who were between 18 and 80 years of age and had a diagnosis of diabetes. Three follow-up interviews were conducted approximately 12, 24 and 36 months after baseline interview (late winter/early spring). More details from the baseline assessment are published elsewhere [14]. The survey was administered to respondents who gave verbal informed consent to participate. The Douglas Mental Health University Institute Ethics Board approved the consent procedures and the study protocol. All participants gave their informed consent prior to their inclusion in the study.

The Patient Health Questionnaire (PHQ-9) [15–17] was used to assess major and minor depression syndromes. The criteria for major depression according to the Diagnostic and Statistical Manual for Mental Disorders (DSM-IV) criteria require the patient to have, for at least 2 weeks, five or more depressive symptoms present for more than half of the days, with at least one of these symptoms being either depressed mood or anhedonia. To meet the criteria for minor depression, patients have to have, for at least 2 weeks, two to four symptoms present for more than half of the days, with one of the symptoms being either depressed mood or anhedonia. Our classification of minor and major is based on this DSM-IV algorithm [15] rather than dividing the summary score in low and high categories based on sample specific cutoff points. In addition, participants were asked if they had a) outpatient visits with any type of physician who prescribed either an antidepressant or mood stabilizer for a minimum of 30 days in the last year and b) outpatient visits with any professional in the specialty mental health sector for psychotherapy lasting at least 30 min.

Global disability was assessed using the 12-item version of the World Health Organization Disability Assessment Schedule II (WHO-DAS-II) [18,19]. The WHO-DAS-II assesses disability in the following domains: self-care, mobility, understanding and communication, interpersonal relations, work and domestic responsibilities, and participation in community activities. The WHO-DAS-II summary score was transformed to percent score (0% to 100%), with higher scores reflecting greater disability.

The DHS collected data on socio-demographic characteristics: age, sex, marital status, ethnicity, and educational level. Social support was measured using the brief Rand Medical Outcomes Study Social Support Survey scale [20]. This scale measures four categories of functional social support: affectionate support (3 items), positive social interaction (1 item), emotional/informational (2 items) and tangible support (3 items). The first three categories were combined into an emotional support category. Social support scores were transformed linearly to a 0–100 scale, where 0 and 100 are assigned to the lowest and highest possible scores, respectively.

Physical activity levels were measured by asking participants to rate the number of days they exercised or participated in sports activity for at least 15 min in the previous month. The response was

collapsed into three categories based on exercise guidelines to improve cardiorespiratory fitness: inactive (0 days), moderately active (1 to 12 days) and active (more than 12 days). Participants were asked whether they currently smoked, had formerly smoked, or had never smoked [21]. Problematic drinking was assessed using the Alcohol Use Disorders Identification Test (AUDIT-C) [22]. The AUDIT-C scores were calculated by summing the scores for questions 1 to 3 (0–4 points each) with possible AUDIT-C scores ranging from 0 to 12 points. An AUDIT-C score of  $\geq 4$  points was used as a cutoff point for problematic drinking in men, whereas an AUDIT-C threshold  $\geq 3$  was used as a cutoff point for problematic drinking in women [22].

Body mass index (BMI) was calculated based on self-reported weight and height. Body mass index (BMI) was calculated based on self-reported weight and height ( $\text{kg}/\text{m}^2$ ). Health care access problems were assessed by three questions: “Do you have a regular family doctor?”, “In the past 12 months, did you ever experience any difficulties getting specialist care you needed for a diagnosis or consultation?”, and “In the past 12 months, did you ever experience any difficulties getting the health information or advice you needed for yourself?”

Self-rated health status and self-perceived diabetes control were assessed by asking participants “Would you say that in general your health is” and “In the past month, would you say that the control of your diabetes was,” respectively. Response categories for both questions were excellent, very good, good, fair or poor. Confidence in being able to control the amount of food eaten was assessed by asking the question “In general, how confident do you feel that you can control the amount of food you eat?” [23]. Response categories were not at all, a little, moderately and very much.

Participants were asked whether they suffered from various chronic health conditions (asthma, high blood pressure, heart disease, stomach or intestinal ulcers, arthritis/rheumatism, migraine headaches, cancer, kidney disease, and back problems). Diabetes complications were assessed using the 17-item Diabetes Complications Index (DCI) [24]. The DCI assesses diabetes complications on the basis of patient self-report (retinopathy, neuropathy, large-vessel atherosclerotic disease, peripheral vascular disease, cerebrovascular disease and foot problems). Duration of diabetes was calculated based on the age at which participants were first diagnosed with diabetes. Participants' treatment regimen was assessed by asking participants if they took insulin or pills to control their diabetes in the past month.

## Statistical analysis

Longitudinal latent class analysis (LCA) was used to identify different patterns of both minor and major depression over the course of three years [25]. The main idea of latent class analysis is that there exist a certain number of distinct patterns of depression, and subjects can be grouped into a small number of distinct (unobserved) clusters known as latent classes based on their profile of depression over the 3 years (baseline and three follow-up assessments). Within each class, individuals will have a similar pattern of responses. Cluster-specific probabilities of having minor or major depression at each assessment, given membership in that cluster, allow profiles of the longitudinal patterns of depression to be developed for individuals in each cluster. Membership in a particular cluster for a given individual is accomplished by assigning the individual to the cluster to which the individual has the highest posterior probability of belonging. Latent class analysis is related to cluster analysis: it is used to discover groups of cases based on observed data, and to also assign cases to groups. Latent class analysis is model-based in contrast to traditional approaches that are based on ad-hoc distance measures. The general probability model underlying latent class analysis has several advantages, including, among others, unequal variances in each cluster and formal statistical procedures for determining the number of clusters.

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