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Original Research

## Association between Physical Activity and Health-Related Quality of Life in Adults with Type 2 Diabetes

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### ABSTRACT

**Objectives:** To examine the association between meeting physical-activity recommendations and health-related quality of life (HRQL) in adults with type 2 diabetes.

**Methods:** Data from the Alberta's Caring for Diabetes cohort were used. Self-report questionnaires were mailed to patients with type 2 diabetes who were living in Alberta, Canada. Weekly moderate-vigorous physical activity (MVPA) was reported using the Godin Leisure Time Physical Activity Questionnaire, and HRQL was reported using the Medical Outcomes Study (MOS) 12-Item Short-Form Health Survey v. 2 (SF-12 v. 2) and the 5-level EuroQol 5-Dimensions (EQ-5D). Based on current guidelines for patients with type 2 diabetes in Canada, participants were grouped according to whether they accrued 150 minutes of MVPA per week. Multivariable linear regression models were used to explore associations between physical activity and HRQL.

**Results:** The mean age of participants (N=1948) was 64.5±10.8, and 45% were female. Participants reported a mean of 84.1±172.4 minutes of MVPA per week, and 21% (n=416) met recommendations for physical activity. Those who met physical activity recommendations reported higher scores on physical functioning (b=9.58; p<0.001); role-physical (b=8.87; p=0.001); bodily pain (b=5.12; p=0.001); general health (b=6.66; p<0.001); vitality (b=9.05; p<0.001); social functioning (b=3.32; p=0.040); and role-emotional (b=3.08; p=0.010); physical component summary (b=3.31; p<0.001); mental component summary (b=1.43; p=0.001) and EQ-5D-5L index score (b=0.022; p=0.005) compared to those not meeting recommendations.

**Conclusions:** The majority of the sample did not meet the guidelines for physical activity. Among those who did, a significant positive association was observed with HRQL, particularly physical health.

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### R É S U M É

**Objectifs :** Examiner l'association entre le respect des recommandations en matière d'activité physique et la qualité de vie liée à la santé (QVLS) chez les adultes souffrant du diabète de type 2.

**Méthodes :** Les données de la cohorte Alberta's Caring for Diabetes (ABCD) étaient utilisées. Les questionnaires d'auto-évaluation étaient postés aux patients souffrant du diabète de type 2 qui vivaient en Alberta, au Canada. L'activité physique modérée à vigoureuse (APMV) hebdomadaire était rapportée au moyen du questionnaire Godin Leisure-Time Exercise Questionnaire (GLTEQ), et la QVLS était rapportée au moyen de l'enquête Medical Outcomes Study (MOS) 12-Item Short-Form Health Survey v. 2 (SF-12 v. 2) et du questionnaire 5-Level EuroQol 5-Dimensions (EQ-5D-5L). En s'appuyant sur les lignes directrices actuelles concernant les patients souffrant du diabète de type 2 du Canada, les participants étaient regroupés selon qu'ils accumulaient 150 minutes d'APMV par semaine. Les modèles de régression linéaire multivariée étaient utilisés pour étudier les associations entre l'activité physique et la QVLS.

**Résultats :** L'âge moyen des participants (n=1948), dont 45 % étaient des femmes, était de 64,5±10,8 ans. Parmi les participants qui rapportaient une moyenne de 84,1±172,4 minutes d'APMV par semaine, 21 % (n=416) respectaient les recommandations en matière d'activité physique. Ceux qui respectaient les recommandations en matière d'activité physique rapportaient des scores plus élevés de fonctionnement

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physique ( $b=9,58$ ;  $p<0,001$ ); de limitation physique ( $b=8,87$ ;  $p=0,001$ ); de douleur corporelle ( $b=5,12$ ;  $p=0,001$ ); de santé générale ( $b=6,66$ ;  $p<0,001$ ); de vitalité ( $b=9,05$ ;  $p<0,001$ ); de fonctionnement social ( $b=3,32$ ;  $p=0,040$ ); de limitation émotionnelle ( $b=3,08$ ;  $p=0,010$ ); au sommaire de la composante physique ( $b=3,31$ ;  $p<0,001$ ); au sommaire de la composante mentale ( $b=1,43$ ;  $p=0,001$ ) et du score indiciel EQ-5D-5L ( $b=0,022$ ;  $p=0,005$ ) comparativement à ceux qui ne respectaient pas les recommandations. *Conclusions* : La majorité de l'échantillon ne respectait pas les lignes directrices en matière d'activité physique. Parmi ceux qui les respectaient, une association positive significative avec la QVLS était observée, particulièrement avec la santé physique.

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## Introduction

More than 2 million Canadians are currently living with diabetes, the vast majority with type 2 diabetes. Diabetes is the seventh leading cause of death in Canada and is a major driver of total healthcare costs (1). If current incidence and mortality trends continue, approximately 3.8 million Canadians will be living with type 2 diabetes by 2018 (1). Because there is currently no cure for the disease, the focus of diabetes care is improving functioning and quality of life while working to minimize the healthcare costs associated with the disease.

Health-related quality of life (HRQL) is an important outcome in type 2 diabetes research. HRQL is a multidimensional construct that incorporates physical, mental, emotional and social well-being. Research indicates that those with type 2 diabetes typically report diminished HRQL, in part due to the complications and comorbidities that often accompany the disease (2). Additionally, individuals with type 2 diabetes tend to be older and overweight or obese, both of which are associated with lower HRQL (3).

The Canadian Diabetes Association (CDA) recommends at least 150 minutes per week of moderate-vigorous aerobic exercise, such as brisk walking, jogging or biking plus at least 2 sessions per week of resistance exercise (4). Despite these recommendations, many Canadians with type 2 diabetes are sedentary or insufficiently active (5). Previous research has demonstrated a positive relationship between physical activity and HRQL in the general adult population (6). Some studies suggest that this relationship holds true in populations with type 2 diabetes; however, some randomized controlled trials have indicated that participation in aerobic physical-activity programs did not result in improved physical or mental health scores (3,7–9). Therefore, more research is required for better understanding of the relationship between physical activity and HRQL in this population.

The aim of this study was to examine the differences in HRQL between patients with type 2 diabetes who meet the CDA recommendations for physical activity compared with those who do not. We hypothesized that people who meet recommendations for physical activity will have better HRQLs than those who do not. Additionally, we sought to investigate whether exceeding the baseline recommendations ( $\geq 300$  moderate-vigorous physical activity [MVPA] minutes per week) was associated with better HRQL in patients with type 2 diabetes compared to meeting baseline recommendations.

## Methods

### Data source

This study used baseline data from the Alberta Caring for Diabetes (ABCD) cohort study, which has been described elsewhere (10). Briefly, English-speaking individuals with type 2 diabetes who were living in Alberta and were older than 18 years of age were eligible to participate. Participants were recruited over a 2-year period (December 2011 to December 2013) through primary care networks and diabetes clinics as well as public advertisements. Those

who agreed to participate were mailed self-administered surveys, which contained various items and measures that have been developed, validated and used in previous studies of populations with diabetes. Surveys included information about disease management, health and lifestyle, HRQL, emotional and psychosocial well-being and sociodemographics. The sample was considered to be generally representative of the adult population with type 2 diabetes in Alberta (10).

### Physical activity

Physical activity was assessed using the Godin Leisure Time Physical Activity Questionnaire (GLTEQ) (11). Participants were asked to report the frequency and duration of light-intensity (easy walking, yoga, golf); moderate-intensity (brisk walking, easy bicycling, tennis); and vigorous-intensity (aerobics, jogging, swimming laps) leisure-time physical activity performed in a typical week. The number of weekly minutes was calculated by multiplying the frequency of physical activity by the duration in minutes. The sum of the unweighted weekly minutes of moderate and vigorous physical activity gave the total MVPA minutes per week.

### Health-related quality of life

HRQL was assessed using both the Medical Outcomes Study (MOS) 12-Item Short-Form Health Survey version 2 (SF-12) and the 5-level EuroQol 5-Dimensions (EQ-5D-5L) questionnaire. The SF-12 is a condensed 12-item version of the SF-36, a commonly used generic health-status tool. An 8-dimension profile (physical functioning, role limitations due to physical problems, bodily pain, general health, vitality, limitations due to emotional problems and mental health) is created, from which physical and mental component summary scores (PCS, MCS) are derived. This study used scoring coefficients from oblique factor analysis (12). SF-12 summary scores follow a T distribution with a mean of 50 and a standard deviation of 10, which is normalized for the general United States population. Thus, observed scores can be interpreted as deviations from the norm, with lower scores on the PCS and MCS indicating greater disability (13). For domain and summary scores, a clinically important difference is in the range of 3 to 5 points (14).

The EQ-5D-5L is a preference-based health status measure consisting of 5 dimensions (mobility, self-care, usual activities, pain or discomfort and anxiety or depression), each with 5 levels (no problems, mild problems, moderate problems, severe problems, extreme problems), which yield a single index score (15). The index score was calculated using a scoring function derived from Canadian preferences (16). Each described health state has a unique score, anchored at 0.0 for “dead” and 1.0 for “full health,” with higher scores indicating better HRQL. A clinically important difference on this scale is 0.03 points (17).

### Other measures

Data on age; sex; ethnicity (white, Aboriginal, other); annual household income in Canadian dollars ( $< \$80\,000$  or  $\geq \$80\,000$ ); level of education (less than high school, high school, more than high

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