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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.

Mots clés :
qualité de vie liée à la santé
sante mentale
activité physique
sante physique
diabète de type 2

RÉSUMÉ

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.

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 (≥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 ≥$80 000); level of education (less than high school, high school, more than high

school); employment status (employed; not employed); family history of diabetes (yes, no); smoking status; diabetes duration; number of comorbidities (of 16 common diabetes comorbidities); and depressive symptoms (using the Patient Health Questionnaire-8 items (PHQ-8) were also collected (18).

Statistical analyses

CDA guidelines were used to categorize participants based on their physical activity into 2 levels:

- Those who did not meet recommendations: <150 MVPA min/week
- Those who did meet recommendations: ≥150 MVPA min/week

A secondary analysis included 3 levels:

- Those who did not meet recommendations: <150 MVPA min/week
- Those who met the baseline recommendations: 150 to 299.9 MVPA min/week
- Those who exceeded the baseline recommendations: ≥300 MVPA min/week.

Descriptive statistics were computed for all variables in the overall sample and by physical activity level. Differences were tested using the t test or the chi-square test, as appropriate. Univariable analyses were performed to determine associations between physical activity and HRQL indicators. The association of possible covariates was tested using simple linear regression, and variables were included in the final model if they were significant in univariable analysis or if they have been shown to be clinically relevant in other studies. In this study, these included the categorical variables of income, number of comorbidities (0, 1 or ≥2), depressive symptoms, and smoking status as well as age and duration of diabetes as continuous variables. Multivariable linear regression was used to examine differences among groups in each HRQL indicator. Unstandardized beta coefficients were interpreted by both statistical significance and clinical importance. All final model assumptions were checked. Statistical inferences were based on a significance level of p<0.05 (2-sided). The data were analyzed using Stata 13.1 for Mac (Stata Corp, College Station, Texas, USA).

Table 1
Characteristics of participants

Characteristic	Overall (N=1948) mean ± SD or N(%)	Met PA recommendations		p value
		Yes (n=416) mean ± SD or n (%)	No (n=1532) mean ± SD or n (%)	
Female sex	875 (45.2)	158 (38.0)	717 (46.8)	0.001
Age (years)	64.5±10.8	63.4±10.3	64.9±10.9	0.013
Annual household income*				0.012
<$80 000	1122 (57.6)	228 (54.8)	894 (58.4)	
≥$80 000	454 (23.3)	119 (28.6)	335 (21.9)	
Education				<0.001
Less than high school	275 (14.1)	37 (8.9)	238 (15.5)	
Completed high school	780 (40.0)	139 (33.4)	641 (41.8)	
More than high school	881 (45.2)	250 (57.7)	641 (41.8)	
Employment status: unemployed/retired	1127 (58.8)	238 (57.9)	889 (59.0)	0.682
Ethnicity				0.448
White	1765 (90.6)	379 (91.1)	1386 (90.5)	
Aboriginal	46 (2.4)	8 (1.9)	38 (2.5)	
Other	106 (5.4)	27 (6.5)	79 (5.2)	
Current smoker	199 (10.2)	28 (6.7)	171 (11.2)	0.008
Diabetes duration (years)	12.6±10.0	12.0±9.5	12.8±10.2	0.262
Number of comorbidities	4.2±2.3	3.5±2.1	4.4±2.3	<0.001
Depressive symptoms	5.2±5.4	3.7±4.7	5.6±5.5	<0.001
No (PHQ-8<10)	1532 (78.6)	366 (88.0)	1166 (76.1)	
Yes (PHQ-8≥10)	416 (21.4)	50 (12.0)	366 (23.9)	
HRQL indicators				
EQ-5D-5L				
Mobility	1030 (52.9)	151 (36.4)	879 (58.0)	<0.001
Self-care	223 (11.5)	26 (6.3)	197 (12.9)	<0.001
Usual activities	928 (47.6)	123 (29.6)	805 (52.6)	<0.001
Pain/discomfort	1431 (73.5)	269 (64.7)	1162 (75.9)	<0.001
Anxiety/depression	905 (46.5)	169 (40.6)	736 (48.0)	0.004
Index score	0.79±0.17	0.84±0.13	0.78±0.18	<0.001
SF-12 indicators				
Physical functioning	66.3±34.8	80.7±29.1	62.3±35.2	<0.001
Role-physical	65.8±30.2	78.7±25.7	62.3±30.4	<0.001
Bodily pain	67.5±30.7	76.5±27.3	65.1±31.1	<0.001
General health	60.9±24.0	70.2±19.7	58.4±24.4	<0.001
Vitality	53.0±24.8	63.7±23.0	50.1±24.4	<0.001
Role-emotional	77.9±25.5	84.8±21.5	76.0±26.1	<0.001
Social functioning	76.1±28.2	84.0±24.9	73.9±28.6	<0.001
Mental health	71.1±20.6	74.6±20.0	70.1±20.7	<0.001
PCS	44.2±10.8	49.1±9.0	42.9±10.9	<0.001
MCS	48.9±9.8	50.7±9.3	47.1±9.8	<0.001

HRQL, health-related quality of life; *MCS*, mental component summary score; *PA*, physical activity; *PCS*, physical component summary score; *SD*, standard deviation.
Notes: Data are presented as mean (SD) for continuous variables and frequency (%) for categorical variables. Numbers may not add up to 1948 due to missing data.
* Canadian dollars.

Results

General characteristics of participants

Of the full cohort, 92 individuals received slightly different versions of the HRQL measures and thus were excluded from this study. The average age of participants (N=1948) was 64.5±10.8; 45% were female, and 91% were white. The majority of participants had at least high school educations and household incomes of less than $80 000. On average, participants had lived with diabetes for 12.6±10 years and had an average of 4.2±2.3 comorbidities in addition to diabetes. Participants reported a mean EQ-5D index score of 0.79±0.17, a mean PCS of 44.2±10.8 and a mean MCS of 48.9±9.8 (Table 1), suggesting that their health statuses were slightly lower than average when compared with population norms (i.e. a mean PCS/MCS of 50.0).

The majority (n=1532; 78.6%) of participants did not meet physical activity recommendations, with a mean duration of 84.1±172.4 minutes of MVPA per week. Participants who did not meet recommendations were more likely to have less education, be smokers, have more comorbidities and report more depressive symptoms (Table 1). Participants who exceeded the base recommendations for physical activity (≥300 MVPA min per week) (n=167) were more likely to be male, earn more than $80 000, have more than a high school education, have fewer comorbidities and be less likely to be depressed (Table 1).

Physical activity and HRQL indicators

After adjustment for age, sex, income, smoking status, number of comorbidities, diabetes duration and depressive symptoms, multivariable regression analyses revealed differences in HRQL between those who met the CDA recommendations and those who did not (Table 2). Those who met recommendations reported higher HRQL scores in the 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) domains when compared with those who did not meet recommendations. The PCS scores (b=3.31; p<0.001); MCS scores (b=1.43; p=0.001); and EQ-5D-5L index scores (b=0.022; p=0.005) were also strongly associated with physical activity when the

Table 2
Results of adjusted multivariable linear regression models of the relationship between meeting guidelines for PA (2 categories) and HRQL

HRQL indicator	Met PA recommendations		b	SE	p value
	Yes (n=416) mean ± SE	No (n=1532) mean ± SE			
SF-12					
Physical functioning	73.92±1.45	64.33±0.75	9.58	1.64	<0.001
Role-physical	72.85±1.24	63.98±0.64	8.87	1.41	<0.001
Bodily pain	71.56±1.39	66.44±0.71	5.12	1.57	0.001
General health	66.36±1.03	59.69±0.53	6.66	1.17	<0.001
Vitality	60.23±1.07	51.18±0.56	9.05	1.22	<0.001
Role-emotional	80.41±1.05	77.33±0.55	3.08	1.20	0.010
Social functioning	78.65±1.14	75.32±0.59	3.32	1.29	0.010
Mental health	71.97±0.88	70.90±0.45	1.06	0.99	0.284
PCS	46.81±0.42	43.50±0.22	3.31	0.48	<0.001
MCS	48.97±0.38	47.54±0.20	1.43	0.43	0.001
EQ-5D-5L					
Index score	0.81±0.007	0.79±0.003	0.022	0.007	0.005

b, beta coefficient; *EQ-5D-5L,* EuroQol 5-Dimensions; *HRQL,* health-related quality of life; *MCS,* mental component summary score; *PA,* physical activity; *PCS,* physical component summary score; *SD,* standard deviation; *SE,* standard error; *SF-12,* 12-Item Short-Form Health Survey, version 2.
Note: Reference: group not meeting recommendations (<150 min of moderate-vigorous physical activity per week).

meeting-recommendations group was compared to the not-meeting-recommendations group.

Those who exceeded the recommended amount of physical activity (≥300 MPVA min per week) reported higher HRQL scores than those who did not achieve physical activity recommendations (Table 3). Differences in the physical functioning (b=14.68; p<0.001); role-physical (b=12.13; p<0.001); bodily pain (b=5.66; p=0.018); general health (b=9.62; p<0.001) and vitality (b=12.13; p<0.001) dimensions were statistically significant, as were differences in the PCS (b=4.64; p<0.001); MCS (b=1.76; p=0.006) and EQ-5D index scores (b=0.035; p=0.003). When comparing those who exceeded recommendations (≥300 MPVA min per week) to those who met the baseline recommendations (150 to 299.9 MVPA min per week), no significant differences in any HRQL parameters were found (Table 3).

Table 3
Results of adjusted multivariable linear regression models of the relationship between meeting guidelines for PA (3 categories) and HRQL*

HRQL indicator	Adjusted score mean ± SE	b	SE	p value
SF-12				
Physical functioning				
Not meeting recommendations (Ref)	63.73±0.81			
Meeting recommendations	74.47±2.00	10.74	2.16	<0.001
Exceeding recommendations	78.42±2.41	14.68	2.56	<0.001
Role-physical				
Not meeting recommendations (Ref)	63.52±0.68			
Meeting recommendations	73.71±1.69	10.19	1.83	<0.001
Exceeding recommendations	75.65±2.96	12.13	2.18	<0.001
Bodily pain				
Not meeting recommendations (Ref)	66.08±0.74			
Meeting recommendations	73.69±1.84	7.61	1.99	<0.001
Exceeding recommendations	71.74±2.25	5.66	2.39	0.018
General health				
Not meeting recommendations (Ref)	59.40±0.56			
Meeting recommendations	66.36±1.38	6.96	1.50	<0.001
Exceeding recommendations	69.02±1.68	9.62	1.78	<0.001
Vitality				
Not meeting recommendations (Ref)	50.88±0.58			
Meeting recommendations	60.16±1.42	9.28	1.54	<0.001
Exceeding recommendations	63.01±1.74	12.13	1.84	<0.001
Role-emotional				
Not meeting recommendations (Ref)	77.14±0.55			
Meeting recommendations	81.66±1.37	4.52	1.48	0.002
Exceeding recommendations	80.29±1.67	3.15	1.76	0.074
Social functioning				
Not meeting recommendations (Ref)	75.10±0.60			
Meeting recommendations	81.52±1.48	6.52	1.60	<0.001
Exceeding recommendations	76.41±1.81	1.31	1.91	0.495
Mental health				
Not meeting recommendations (Ref)	70.72±0.46			
Meeting recommendations	72.59±1.13	1.83	1.22	0.135
Exceeding recommendations	72.29±1.38	1.53	1.46	0.295
PCS				
Not meeting recommendations (Ref)	43.32±0.24			
Meeting recommendations	47.10±0.59	3.77	0.64	<0.001
Exceeding recommendations	47.96±0.71	4.64	0.75	<0.001
MCS				
Not meeting recommendations (Ref)	47.45±0.20			
Meeting recommendations	49.35±0.50	1.90	0.54	<0.001
Exceeding recommendations	40.20±0.61	1.76	0.64	0.006
EQ-5D-5L index score				
Not meeting recommendations (Ref)	0.78±0.004			
Meeting recommendations	0.82±0.009	0.032	0.0010	0.001
Exceeding recommendations	0.82±0.011	0.035	0.012	0.003

b, beta coefficient; *EQ-5D-5L,* EuroQol 5-Dimensions; *HRQL,* health-related quality of life; *MCS,* mental component summary score; *MVPA,* moderate-vigorous physical activity; *PA,* physical activity; *PCS,* physical component summary score; *SD,* standard deviation; *SE,* standard error; *SF-12,* 12-Item Short-Form Health Survey, v. 2.
Notes: Reference: Not meeting recommendations (<150 min of MVPA per week); meeting recommendations (150 to 299.9 min of MVPA per week); exceeding recommendations (≥300 min of MVPA per week).
* Differences between the meeting-recommendations group and the exceeding-recommendations group were not statistically significant on any HRQL indicator.

Discussion

The aim of this study was to examine the association between meeting CDA recommendations for physical activity and HRQL among adults with type 2 diabetes who were living in Alberta. Overall, the results confirmed our hypothesis—that meeting the CDA recommendations for physical activity would be associated with better HRQL when compared with not meeting recommendations. These associations persisted after adjustment for relevant demographic and clinical variables. Specifically, meeting recommendations was associated with higher scores in the physical functioning, role-physical, bodily pain, general health, vitality, social functioning and mental health dimensions. Moreover, the observed differences were meaningful, based on guidelines for minimal important differences. A 3- to 5-point difference is considered clinically important in the SF-12 domains, and the difference between the group who met recommendations and the group who did not exceeded this difference in the dimensions related to physical health (i.e. physical functioning, role-physical, bodily pain, general health and vitality). When considering mental health or overall HRQL, the relationship is not as strong, and differences were not considered clinically important.

The results from this study are generally consistent with previous research, which indicates positive associations between physical activity and HRQL. In healthy adults, those who attain recommended levels of physical activity have previously reported higher scores on the physical functioning, general health and vitality dimensions as well as on the PCS (19,20). In diabetes-specific populations, HRQL has been found, in other cross-sectional studies, to decrease with decreasing levels of physical activity (8,9). The results from this study contribute to this body of knowledge by providing evidence from a large population-based cohort of patients with type 2 diabetes. Additionally, this study used current clinical practice guidelines to categorize participants into physical activity groups so as to assess the difference in HRQL between those who were meeting the guidelines and those who were not.

In general, these study results also confirm previous research that indicates that the physical aspects of HRQL are more closely associated with physical activity than the mental aspects (21–23).

Vitality is classified as a mental health dimension but seeks to measure the level of energy, pep or tiredness experienced and is moderately correlated with both mental and physical functioning (13). The relationship between physical activity and the mental components of HRQL are not entirely clear. Given the prevalence of mental disorders in people with diabetes, there are likely to be many factors that influence the relationship between physical activity and HRQL in patients with type 2 diabetes. Most likely, a bidirectional relationship between physical activity and HRQL exists, whereby those individuals who perceive themselves as having better physical and mental health are more likely to participate in physical activity. Due to the cross-sectional nature of this study, we were unable to draw a conclusion about the direction of this relationship.

Despite evidence that participation in physical activity is associated with better HRQL, the majority of participants (78%) did not meet current recommendations, which is consistent with similar studies in this population (5). Despite the existence of clinical guidelines that seek to educate patients with diabetes about the importance of physical activity, it is challenging to motivate individuals to make lifestyle modifications and maintain new habits (9). The results of this study provide more evidence that there are significant associations between meeting the current clinical practice guidelines for physical activity and better HRQL in this patient population.

The U. S. Department of Health and Human Services suggests that additional health benefits can be accrued by achieving at least 300 minutes per week of moderate-vigorous physical activity (24). We sought to investigate whether there was an association between higher levels of physical activity and HRQL in individuals with type 2 diabetes. Those individuals who exceeded the baseline recommendations (≥300 MPVA min per week) reported higher HRQL scores across all dimensions than did those who did not meet the baseline recommendations (<150 MVPA min per week). The differences in HRQL between those who exceeded recommendations and those who did not meet recommendations were larger than the differences between those who met baseline recommendations and those who did not in the physical functioning, role-physical, general health and vitality dimensions, as well as on the PCS. These results suggest that an association exists between achieving more than 300 minutes of MVPA per week and higher HRQL in dimensions related to physical health. Differences between those who met baseline recommendations and those who exceeded baseline recommendations were not statistically significant; however, this may have been due to a lack of statistical power to detect differences. Previous studies in both the general population and in community-dwelling older adults have demonstrated similar associations between higher levels of physical activity and HRQL but there is little evidence to date concerning this relationship in type 2 diabetes (6,25–27).

The strengths of this study include the use of a large, population-based cohort that is representative of the population with type 2 diabetes in Alberta, based on estimates from the Alberta Diabetes Surveillance System as well as the use of validated questionnaires and multiple indicators of HRQL (10). Nonetheless, the results should be interpreted in light of a few limitations. First, the use of cross-sectional data precluded us from establishing temporality or causality. We found a positive association between physical activity and HRQL, but we were unable to confirm the direction of this association. Second, data were collected using self-reported questionnaires. In particular, the use of the GLTEQ for self-reported physical activity could have led to overestimates (28). Accelerometer data have been collected in a subset of this cohort and could be used in a future study to assess the validity of the self-reported questionnaire in this population. Additionally, the GLTEQ assesses only leisure-time physical activity, so physical activity associated with work was not captured in this study. Third, we did not have a measure dedicated to resistance exercise and, therefore, it is impossible to know whether those meeting recommendations for aerobic exercise were also meeting recommendations for resistance exercise or whether that would impact HRQL. Finally, although we adjusted for several variables that might be associated with physical activity and HRQL, we cannot rule out that there could be other factors (including physical injury, access to facilities, medications and other habits related to health) that might have impacted this relationship.

Conclusions

In summary, the findings in this study indicate that individuals with type 2 diabetes who meet recommendations for physical activity report better HRQL compared with those who do not. Meeting recommendations for physical activity is more strongly related to physical health than to mental health. Our findings also suggested that there may be an association between higher weekly levels of physical activity and the physical components of HRQL in this population. This suggests that individuals with type 2 diabetes who are capable of exceeding the recommended amount of physical activity may experience better HRQL in dimensions related to physical health than those who simply meet the baseline recommendations. To better assess this relationship, both longitudinal and experimental studies are needed to determine whether changes in physical activity are associated with changes in HRQL. Additionally, only 21.5% of the sample reported physical activity levels that were congruent with the recommendations set forth by the CDA, indicating that public health efforts to promote physical activity and decrease sedentary lifestyle habits must be continued in order to improve care and health outcomes for patients with type 2 diabetes.

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Author Contributions

DMT and JAJ conceived the study; DMT conducted the analysis and wrote the first draft of the manuscript; all authors provided feedback and approved the final version. JJ is the guarantor and takes full responsibility for the contents of this article.

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