Health & Fitness Journal
of Canada

Volume 11 **January 30, 2018** **Number 1**

ARTICLE

Modes of physical activity reported by older adults living with osteoporosis in Canada

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Abstract

Background: Physical activity is recommended as an adjunct to treatment for persons living with osteoporosis. Results from numerous studies demonstrate the health benefits linked with physical activity for persons living with osteoporosis yet little is known about the types of leisure-time physical activities reported by adults living with osteoporosis in Canada. ***Purpose***: The purpose of this study was to address two questions: (1) What is the most common mode of physical activity reported by older adults living with osteoporosis in Canada? and (2) Does the mode of physical activity reported by older adults living with osteoporosis in Canada differ between males and females? ***Methods:*** Participants were enrolled in Cycle 2.2 of the Canadian Community Health Survey (CCHS) who reported a diagnosis of osteoporosis. Males (n = 167) and females (n = 1371) responded to select demographic questions and a modified version of the Physical Activity Monitor (m-PAM). ***Results:*** Walking for exercise was the most common mode of physical activity reported by males (60.5%) and females (60.7%) followed by gardening/yard work (34.8% to 44.9%) then home-based exercise (21.6% to 23.8%). Chi-square analyses revealed sex-differences in mode of participation for 11 of 21 physical activities assessed with the m-PAM. ***Conclusions:*** Overall, the findings of this study imply consideration of sex and mode of physical activity may be key issues for health professionals and policy developers to consider in designing and implementing physical activity programs for older adults living with osteoporosis in Canada. **Health & Fitness Journal of Canada 2018;11(1):20-30.**

Keywords: Health-Enhancing Physical Activity, Health Promotion, Physical Activity Programming, Measurement/Assessment, Population Health, Osteogenesis

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Introduction

Osteoporosis is a skeletal disease characterized by chronic loss of bone density that is projected to impact more than 200 million individuals worldwide (Kastner et al., 2018). Population-health studies report that osteoporosis is more common in women (1:3) than men (1:8) aged 50 or older (Bartl and Firsch, 2009; Cadarette and Burden, 2011). In Canada, previous estimates indicate that osteoporosis will be diagnosed in over 1.5 million people (Cadarette and Burden, 2011) resulting in an estimated $4.6 billion in health care expenditures (Hopkins et al., 2016).

Secondary complications often accompany osteoporosis including elevated risk for fragility fractures as the main clinical issue (Varacallo and Fox, 2014). Falls which result in fragility fractures in persons living with osteoporosis can result in substantial pain, acute and prolonged disability, and increased risk of premature mortality (Hernlund et al., 2013). Reports from data collected via the Canadian Multicentre Osteoporosis Study (CMOS) note that adults aged 50 or older who experience either a vertebral or hip fracture as a result of effects from osteoporosis have an increased likelihood of death within the next five years (Ioannidis et al., 2009). Other secondary health complications reported in persons living with

osteoporosis can include postural changes, gastrointestinal distress, decreased pulmonary function, lower self-esteem, and reduced quality of life (Alexandru and So, 2012; Ioannidis et al., 2009; Varacallo and Fox, 2014). As a result, calls to identify effective prevention and treatment strategies to manage disease progression and mitigate the likelihood of secondary health issues have been forthcoming (Johnell and Hertzman, 2006).

Physical activity has been proposed as an intervention modality to mitigate the negative health effects stemming from osteoporosis (Exercise is Medicine, 2017; Giangregorio et al., 2014). This is hardly surprising given that lack of regular physical activity has been identified as a predictor of mortality for persons living with osteoporosis (Ioannidis et al., 2009). Physical activity is linked with improved clinical endpoints such as mobility, functional balance, physical functioning, vitality, and pain management for adults living with osteoporosis (Mack et al., 2017; Varahra et al., 2018). Yet population-health studies consistently report that global physical activity levels in this population remain less than optimal (Gunnell et al., 2012) and trials using exercise as an intervention stimulus for persons living with osteoporosis have reported poor adherence rates (Rodrigues et al., 2017). These observations suggest that closer attention to factors likely to promote (and/or sustain) engagement in physical activity on a regular basis in this cohort are an important research agenda.

In their attempt to link physical activity to outcomes in those living with osteoporosis, researchers have typically focused on frequency (number of individual sessions), intensity (rate of energy expenditure) and/or time (duration/minutes per week; Exercise is Medicine, 2017; Giangregorio et al., 2014). Other than broad statements concerning mode of engagement (e.g., resistance training, aerobic exercise, etc.), it seems that previous studies have largely ignored providing details concerning the mode of physical activity undertaken by persons living with osteoporosis. This is despite the belief that mode of physical activity may play an important role in deciding to initiate (and/or sustain) participation in physical activity. Researchers have suggested that individual preferences (e.g., location, scheduling options, etc.) may impact the success of health programming initiatives designed to foster physical activity in cohorts known to be at risk for inactivity (Burton et al., 2010; van Uffelen et al., 2017) including those living with osteoporosis (Peeters et al., 2014; Rodrigues et al., 2017). Research with clinical groups highlights the important role of preferences – including mode of participation – relative to initiation and adherence to physical activity. For example, numerous studies of cancer survivors make it apparent that walking is the most preferred mode of physical activity (e.g., Craike et al., 2017), home-based exercise programs are more desirable than using community-fitness centers (e.g., Lowe et al., 2010; McGowan et al., 2013; Trinh et al., 2012), and options for unsupervised activity using a low-to-moderate intensity seem most popular (e.g., Jones and Courneya, 2002). Notably absent in the preferences literature on individuals living with osteoporosis (e.g., Peeters et al., 2014; Rodrigues et al., 2017) has been attention to the preferred mode of physical activity. The importance of these observations is tied to issues of physical activity initiation and adherence that can impact both

future research development and programming efforts designed to advance health in older adults living with osteoporosis. Currently there is no evidence attesting to the physical activity preferences of older adults living with osteoporosis. Previous work has focused on documenting global physical activity levels (not modes) in this cohort (e.g., Gunnell et al., 2012), used global physical activity levels to predict discrete criterion (e.g., well-being; Gunnell et al., 2011), or used a fixed mode of physical activity for interventions to optimize a set of clinical endpoints (e.g., low intensity, supervised balance and strength exercises; Otero et al., 2017). Overall, a considerable gap in research exists from this oversight which renders it difficult to make evidence-based recommendations for program planning, intervention design, and policy development concerning physical activity for adults living with osteoporosis.

Using a population-based sample, the purpose of this study was to identify the most frequent mode of physical activity reported by men and women over 50 years of age living with osteoporosis in Canada. This purpose was addressed by examining the following questions: (1) What is the most common mode of physical activity reported by older adults living in Canada with osteoporosis? and (2) Does the mode of physical activity reported by older adults living with osteoporosis in Canada differ between males and females? No *a priori* hypotheses were advanced for this study because this research was descriptive and mainly exploratory in nature. Sex-based differences were explored as a point of comparison since (a) osteoporosis prevalence varies as a function of sex (Bonnick, 2006) and (b) sex-differences in global physical activity levels are commonly observed in population-health studies (Hallal et al., 2012) which may logically extend to mode of activity in this cohort (see Burton et al., 2012).

Methods

Study Design and Data Collection

This study used a non-experimental, cross-sectional research design that relied on self-report data extracted from Cycle 2.2 of the Canadian Community Health Survey (CCHS; Health Canada, 2009). Participants (N = 1538) included persons living with osteoporosis for respondents aged 50 years of age or older at the time of data collection. Complete details concerning the sampling approach taken in Cycle 2.2 of the CCHS are available (see Health Canada, 2006). In brief, Cycle 2.2 of the CCHS used a multistage stratified cluster design where dwelling served as the key sampling unit. Data were collected using computer-assisted, in-person interviews by a trained interviewer between January 14th (2004) and January 21st (2005) during the following seasons: (a) Winter (n = 19.2%), (b) Spring (n = 28.0%), (c) Summer (n = 31.7%), and (d) Fall (n = 21.0%). The following subgroups were excluded from the sampling frame: (a) Full-time members of the Canadian military, (b) Residents of the North-West Territories, Yukon Territories, and Nunavut, (c) Persons living on a First Nations Reserve or Crown Lands, (d) Prisoners, (e) Persons living in care facilities and select remote locations.

Instruments

Demographics

Each participant was asked to respond to a series of demographic items (e.g., age, sex, etc.). Age was assessed by identifying with one of five categorical responses (see Table 1 for categories).

Table 1: Demographic characteristics of study participants

Variables	*Males*	*Females*
Age		
51-55 yrs.	8.4	7.7
56-60 yrs.	12.0	9.0
61-65 yrs.	12.6	11.8
66-70 yrs.	6.6	12.1
≥ 71 yrs.	60.5	59.4
Marital Status		
Married/Common-Law	64.7	38.7
Not Married/Common-Law	35.3	61.3
Cultural/Racial Origin		
White	95.2	95.0
Other	4.8	5.0
Highest Educational Level		
Secondary School	56.1	60.1
Post-Secondary School	44.0	39.9
Total Household Income		
$0 to $49,999	69.3	83.4
≥ $50,000	30.7	11.8
Province of Residence		
Newfoundland & Labrador	6.6	4.3
Prince Edward Island	5.4	2.3
Nova Scotia	3.6	3.4
New Brunswick	1.8	3.4
Quebec	8.4	11.2
Ontario	45.5	47.3
Manitoba	10.2	7.5
Saskatchewan	7.8	5.0
Alberta	3.6	7.2
British Columbia	7.2	8.6

Note. All values shown in this table are percentages. Marital status was recorded as "married", "common-law", "widowed/separated/divorced", or "single/never married". Highest education level was recorded as "less than secondary school graduation", "secondary school graduation", "some post-secondary", "post-secondary graduation". Total household income was recorded as "no income" and "less than $15,000", "$15,000-29,999", "$30,000-49,999", "$50,000-79,999", and "more than $80,000" per household per annum.

Mode of Physical Activity

A modified version of the Physical Activity Monitor (m-PAM; Craig et al., 2002) was used to assess physical activity behaviour in this study. In Cycle 2.2 of the CCHS, twenty-one modes of physical activity were measured using the m-PAM which included, but were not limited to, items capturing active transportation (e.g., bicycling, etc.), sports (e.g., golf, etc.), as well as, structured forms of exercise (e.g., aerobic classes, etc.). Each item was presented following an instructional stem that specified a fixed time-frame to guide participant responses (i.e., "Have you done any of the following in the past 3 months…?"). Participants then indicated 'Yes' or 'No' to each m-PAM item plus had the option of inserting other modes of physical activity they had undertaken

Table 2: Physical activity by mode of behaviour and participant sex

Modes of Physical Activity	*Males*	*Females*
Walking for Exercise	60.5	60.7
Gardening or Yard Work	44.9	34.8
Home Exercises	21.6	23.8
Bicycling	9.6	4.7
Exercise Classes or Aerobics	3.6	8.2
Fishing	7.8	1.2
Popular or Social Dance	1.8	7.7
Golf	7.2	3.1
Swimming	2.4	7.2
Weight-Training	5.4	2.8
Bowling	3.0	3.7
Tennis	2.4	0.4
Ice Hockey	1.8	0.0
Jogging or Running	1.8	0.9
Ice Skating	1.8	0.5
Basketball	1.2	0.1
Volleyball	0.6	0.0
Downhill Skiing or Snow Boarding	0.6	0.1
Soccer	0.0	0.1
In-Line Skating or Rollerblading	0.0	0.1
Soccer	0.0	0.1
Baseball or Softball	0.0	0.0

Note. All values shown in this table are percentages. Values represent the percentage of respondents who indicates 'Yes' they had engaged in each mode of physical activity over the past 3 months.

during the previous three months that were not listed in the m-PAM. Craig et al. (2002) published research evaluating both test-retest reliability and construct validity of scores derived from the Physical Activity Monitor.

Data Analysis

Data addressing the first research question were analyzed using percentages. Chi-square analyses and estimates of effect size (i.e., phi coefficients) were used to test the second research question. Phi coefficients (ϕ) ranging between 0.10 and <0.20 and 0.20 to 0.40 represent 'weak' and 'small' effect sizes respectively (Rea and Parker, 1992). All data analyses were performed using IBM® SPSS® (Version 24.0).

Results

A detailed breakdown of participant characteristics is provided in Table 1. Hypertension (males = 34.1%; females = 46.4%) and heart disease (males = 30.5%; females = 20.5%) were the most frequently reported comorbidities. Body Mass Index (BMI) values were, on average, unremarkable for both the males (M = 25.9±4.8 kg·m^{-2}; n = 65) and females (M = 25.8±5.4 kg·m^{-2}; n = 519) reporting height and weight data in this study. The majority of males (88.1%) and females (83.1%) indicated they were born in Canada.

Prevalence estimates for each mode of physical activity measured with the m-PAM are presented in Table 2. Walking for exercise was the most popular mode of

physical activity reported within this sample followed by gardening or yard work then home exercises (see Table 2 for specific values). Limited participation in sport-based physical activities was reported (Range = 0.00% to 7.2% across sexes and modes). Exercise class or aerobics and weight-training was reported over the previous three months by less than 10.0% of this sample. No participation in either baseball or softball was reported by males or females providing data in this study.

Chi-square analyses revealed sex-based differences in mode of physical activity reported during the preceding 3 months for 11 of the 21 physical activities measured by the m-PAM: (a) Ice Hockey ($\chi^2 = 24.7$, $p < .01$, $\phi = 0.1$), (b) Golf ($\chi^2 = 7.5$, $p < .05$, $\phi = 0.1$), (c) Tennis ($\chi^2 = 10.5$, $p < .01$, $\phi = 0.1$), (d) Volleyball ($\chi^2 = 8.2$, $p < .01$, $\phi = 0.1$), (e) Basketball ($\chi^2 = 9.7$, $p < .01$, $\phi = 0.1$), (f) Exercise class or aerobics ($\chi^2 = 4.4$, $p < .05$, $\phi = 0.1$), (g) Gardening or Yard Work ($\chi^2 = 6.6$, $p < .01$, $\phi = 0.1$), (h) Swimming ($\chi^2 = 5.4$, $p < .05$, $\phi = 0.1$), (i) Bicycling ($\chi^2 = 7.3$, $p < .05$, $\phi = 0.1$), (j) Popular or Social Dance ($\chi^2 = 7.8$, $p < .05$, $\phi = 0.1$), and (k) Fishing ($\chi^2 = 33.3$, $p < .01$, $\phi = 0.2$).

Discussion

The purpose of this study was to identify the most common modes of physical activity behaviour reported by older adults living with osteoporosis in Canada. To address this aim, the following questions were pursued in this study: (1) What is the most common mode of physical activity reported by older adults living in Canada with osteoporosis? and (2) Does the mode of physical activity reported by older adults living with osteoporosis in Canada differ between males and females? Using a subset of the data collected within Cycle 2.2 of the CCHS, the results of this study provide the first detailed account of differences between men and women living with osteoporosis in Canada in terms of the most common – and least common - modes of physical activity engaged in during their day-to-day lives. Walking for exercise was the most common mode of physical activity reported by both males and females living with osteoporosis in Canada followed by gardening or yard work then home-based exercises. Physical activity in the form of sports (e.g., tennis, golf, etc.) or other modes of physical activity that may confer osteoprotective effects (e.g., jogging/running, bicycling, etc.) were reported by less than 10 percent of this sample. Structured exercise or aerobics classes and weight-training were not common modes of physical activity reported by this sample. Differences in mode of physical activity performed were evident between males and females; however, the magnitude of the effect sizes aligned with these differences were mostly 'weak' in nature.

Results from this population-health study make it apparent that both males and females living in Canada with osteoporosis report walking for exercise as the most common mode of physical activity. This finding is largely aligned with previous studies of cancer survivors who consistently identify walking as their 'preferred' mode of physical activity (Craike et al., 2017; Jones and Courneya, 2002; Lowe et al., 2010). Links with these previous studies warrant caution given this study measured actual behaviour whereas previous research has focused on individual preferences for physical activity without assessing behaviour.

These findings also corroborate previous research concerning exercise preferences reported by people living with osteoporosis who favour solitary (or

individual) activities, close to home, that involve little to no cost (Peeters et al., 2014). The implications of these results are twofold. First, it would seem prudent for exercise professionals working with this cohort to utilize walking as a mode of physical activity in the design and delivery of specialized programs geared towards initiating a physically active lifestyle. Second, it is very likely that greater adherence to a regimen of physical activity will be observed if individual preferences – such as the mode of exercise – are taken into account by exercise professionals overseeing community-based programs for this cohort.

Another important observation from this study highlighted by the data presented in Table 2 is the role of unsupervised forms of physical activity in the daily lives of older adults living with osteoporosis. Specifically, gardening or yard work and home exercise were the second and third most frequently reported mode of physical activity noted in this study. In retrospect, it is hardly surprising that gardening or yard work were frequent modes of physical activity reported in this study considering previous research identified these approaches to being physically active as popular in older adults (Nicklett et al., 2016). Previous studies of cancer survivors have also demonstrated strong preferences for home-based exercise programs (e.g., Craike et al., 2017; McGowen et al., 2013; Trinh et al., 2012). This study was not designed to explore 'why' each mode of physical activity was undertaken to any extent and remains a limitation of this line of research. Yet it is reasonable to speculate that home-based exercise offers certain advantages compared to traditional gym-based programs (e.g., YMCA®, GoodLife Fitness©, etc.) for persons living with osteoporosis. Such advantages include, but may not be limited to, improved feasibility associated with reducing accessibility barriers that can impact adherence behaviour when initiating or trying to sustain a physical activity regimen.

Differences between men and women across select modes of physical activity in the present investigation align with findings on preferences in older adults reported by van Uffelen et al. (2017). Most notably, van Uffelen et al. (2017) reported differences between men and women across eight of 14 physical activities with men reporting greater preference for activities involving competition plus those requiring skill and practice. The statistical differences between men and women providing data for this study across select modes of physical activity assessed with the m-PAM warrant further consideration. First, the pattern of 'weak' effect sizes between groups plus the relatively large sample of men and women providing data for this study leave open the possibility that the observed differences are merely a statistical artifact. It is well-known that probability values are sensitive to a number of factors including variation in sample size (Harlow et al., 1999). Second, it is plausible that the observed differences are 'real' thereby offering greater insight into the dynamics of physical activity decision-making between men and women living with osteoporosis in Canada. Barry et al. (2016) suggested that small effects should not be discounted and may be noteworthy when the outcome variable is important, potentially resistant to change via intervention, and caused by multiple factors all of which apply to physical activity behaviour. If future replication

studies also identify a similar pattern of differences, then it may be useful to extrapolate key implications from this study for program planning in terms of boosting physical activity in this cohort. Sport-based programing, for example, may be useful for males living with osteoporosis but not females who seem to prefer other modes of physical activity.

Several limitations of this study deserve recognition alongside future directions that could advance physical activity research in older adults living with osteoporosis. First, this study relied on self-report data collected using the m-PAM to assess physical activity behaviour. Self-report instruments are prone to several problems – including recall and social desirability response biases – that can distort participant responses. The m-PAM also includes a limited array of physical activity modes in the item content which may – or may not – be most relevant to older adults living with osteoporosis. Additional consideration of other ways to assess mode of physical activity, as well as, other modes of physical activity not expressly stated in the m-PAM for this cohort (i.e., flexibility, balance, etc.), seems justified in future work. Second, the sampling approach used in Cycle 2.2 of the CCHS excluded select groups which could influence the external validity of the data. Future studies could explore this issue further by collecting data from persons living with osteoporosis excluded from this sampling frame (e.g., persons living in First Nations Reserves, etc.) to determine the generalizability of the findings reported in this study. Third, the wording of the instructional stem presented with the m-PAM items may have influenced participant responses given the focus targeted the three months prior to data collection. Seasonal variability is known to impact physical activity behaviour (Merchant et al., 2007) yet it is unclear if this also impacts mode of engagement or merely global levels of physical activity. Future work addressing this issue seems justified.

Conclusions

Overall, physical activity is recommended for persons living with osteoporosis to maximize quality of life and minimize adverse secondary health complications (e.g., fragility fractures; Ioannidis et al., 2009). Understanding the preferred mode of physical activity reported by this cohort is an important consideration. Physical activity programming that relies on sports-based activities or traditional 'exercise' modes (e.g., working out at the 'gym') seem of limited utility for initiating and sustaining habitual physical activity behaviours in older adults living with osteoporosis in Canada. As such, health professionals and policy-makers focused on physical activity programming and/or policy development may wish to structure options that consider mode of delivery as an important component to maximize the likelihood of uptake and adherence to physical activity in this cohort.

Acknowledgements

This research was supported by a grant awarded to Drs. Wilson and Mack by the Social Sciences and Humanities Research Council of Canada (Grant No. 820-2006-0017). The authors thank the participants who provided data in the CCHS (Cycle 2.2) used in this study. The authors extend thanks to the research assistant(s) who aided with the data management phases associated with this study. Both Dr. Mack and Dr. Wilson are members of the Centre for Bone and Muscle Health (Brock University).

Authors' Qualifications

The authors' qualifications are as follows: Philip M. Wilson (BSc, MSc, PhD); Diane E. Mack (BA, MA, PhD); Caitlin Kelley (BA).

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