# Aerobic Activity Preferences among Older Canadians: A Time Use Perspective*

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## RÉSUMÉ

Une population physiquement active jouit de nombreux avantages pour la santé. Cette étude visait à découvrir les préférences de l'activité aérobie chez les Canadiens âgés. Quatre cycles de données indiquant l'usage national représentatif de temps ont été fusionnées avec des informations sur la dépense d'énergie pour déterminer les taux de participation et le temps consacré en dix activités aérobiques les plus fréquemment rapportées. Les activités préférés sont dominées par les tâches ménagères (15% à 30%, la participation d'environ deux heures par jour), la marche de loisirs (15% a 30%, la parti-cipation d'environ une heure par jour), et le transport actif (généralement moins de 5% de participation pendant moins de trente minutes par jour). Bien que plusieurs modifications ont été révelées dans les préférences de Canadiens plus âgés pour les activités aérobiques au cours des trois dernières décennies, la prévalence de tâches domestiques vise à l'importance des politiques qui soutiennent que les Canadiens plus âgés resteront dans leurs maisons, alors que la popularité de la marche suggère que le potentiel de rester « piétonnier » doit être pris en compte dans la conception des quartiers.

## ABSTRACT

Numerous health benefits are associated with a physically active population. This study sought to discover the aerobic activity preferences among older Canadians. Four cycles of nationally representative time use data were fused with energy expenditure information to determine both participation rates and time spent in the 10 most frequently reported aerobic activities. Aerobic activity preferences are dominated by domestic chores (15% to 30% participation for about two hours per day), recreational walking (15% to 30% participation for about one hour per day), and active transportation (generally less than 5% participation for less than 30 minutes per day). Although there have been several changes in older Canadians' revealed preferences for aerobic activities over the past three decades, the prevalence of domestic chores points towards the importance of policies that support older Canadians remaining in their homes, whereas the popularity of walking suggests that "walkability" needs to be considered in neighbourhood design.

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## Introduction

Being physically active affords many potential benefits to older adults (Ashe, Miller, Eng, & Noreau, 2009; Jones & O'Beney, 2004; Li et al., 2010; Stacey, Kozma, & Stones, 1985; Warburton, Katzmarzyk, Rhodes, & Shephard, 2007; World Health Organization, 1998). Consequently, it is important to develop a better understanding of older Canadians' revealed preferences for different types of moderate and vigorous physical activities (MVPA). As the Canadian population continues to age (Statistics

Canada, 2010) and health care costs associated with physical inactivity continue to rise (Katzmarzyk & Janssen, 2004), it is increasingly important to investigate changes in revealed preferences for MVPA activities of older Canadians (McCulloch, Clark, Pike, & Slobodian, 1994) in order to develop effective intervention strategies and programming.

Most programs and policies are developed and monitored using data from physical activity questionnaires that rely on indirect, general-recall survey techniques to capture mainly leisure-time physical activities (Klentrou, Hay, & Plyley, 2003; O'Loughlin, Paradis, Kishchuk, Barnett, & Renaud, 1999) which are particularly prone to both recall bias and social desirability bias (Klesges et al., 2003; LaMonte, Ainsworth, & Tudor-Locke, 2003; Rizzo, Ruiz, Ortega, Hurtig-Wennlöf, & Sjöström, 2007). However, considerable evidence suggests that leisure-time physical activity accounts for only a small portion of a person's total daily physical activity (Katzmarzyk & Tremblay, 2007; Millward, Spinney, & Scott, in press; Spinney, Millward, & Scott, 2011). Furthermore, participation in physical activities cannot be fully understood without consideration of the contexts in which they occur.

The most comprehensive source of information about activity engagement among Canadians is the General Social Survey on Time Use (GSS-TU), which is conducted quinquennially by Statistics Canada. Time diary surveys provide a direct record of the complete daily spectrum of all consecutive activities performed across all four generally accepted domains of physical activity (i.e., leisure, active transportation, chores, and occupation), and also capture concurrent contextual information. Consequently, time diary data are less susceptible to recall bias and social desirability bias (Juster & Stafford, 1991; Tudor-Locke, Bittman, Merom, & Bauman, 2005) than the more commonly used data from the Physical Activity Monitor (PAM) series of surveys. Furthermore, GSS-TU data enable analysis across a wide array of socio-demographic variables (e.g., age, sex, and income) and situational contexts (e.g., timing, location, and social contact). Moreover, due to the relative consistency in the time diary instrument, GSS-TU data provide a novel opportunity to investigate changing preferences for MVPA, or aerobic activities, among Canadians over the past three decades. Consequently, the objective of the study discussed in this article was to (a) use time diary data in order to explore the 10 aerobic activities most frequently reported by older Canadians, plus (b) report both the participation rates and daily time spent engaged in each over all four GSS-TU survey cycles.

## Data and Methods

This study employed GSS-TU data from Cycles 7, 12, 19, and 24, which were collected in 1992, 1998, 2005, and 2010 respectively, from a sample of non-institutionalized Canadian adults who resided in the 10 provinces (Statistics Canada, 1993, 1999, 2006, 2011). Random-digit dialing was used to select households, and then one randomly selected household member aged 15 or older was chosen to complete the survey in their choice of official languages. A selection of socio-demographic characteristics of the older Canadian sub-sample that participated in each of the four GSS-TU survey cycles is illustrated in Table 1.

GSS-TU data were collected by Statistics Canada under the authority of the Statistics Act, Revised Statutes of Canada, 1985, with consent being implied by the respondents' participation. The response rates for each survey cycle were 77 per cent in Cycle 7 (Statistics Canada, 1993), 77.6 per cent in Cycle 12 (Statistics Canada, 1999), 59 per cent in Cycle 19 (Statistics Canada, 2006), and 55 per cent in Cycle 24 (Statistics Canada, 2011). The GSS-TU survey instrument captures the respondents' self-reported descriptions of their activities, which are coded by interviewers using specially designed computer-assisted telephone interview (CATI) software. Along with the respondents' descriptions of their activities, concurrent contextual information (e.g., start time, end time, location, and social contact) was also collected for each consecutive activity episode, or event, performed over a 24-hour period. Harvey (1990) described an "event or episode" as the "basic construct" of time diary data and defined it as "a single act engaged in by an individual at a specified place and time under certain conditions" (p. 312). GSS-TU data provide a complete daily record of the types and durations of 161 different activities in Cycle 7, 178 activities in Cycle 12, and 183 activities in Cycle 19 (the coding scheme was significantly disaggregated in Cycle 24 and included 266 different activities[1]). However, GSS-TU data do not include any information about the intensity, or effort level, associated with each activity.

The Compendium of Physical Activities (CPA) Tracking Guide (see Ainsworth et al., 1993, 2000) provides objective measures of energy expenditure for more than 600 activity codes using metabolic equivalent of task (MET) values. According to Ainsworth et al. (2000), one MET is defined as the amount of energy expended while at rest and is equal to 1 kcal/kg/h, or the oxygen uptake equivalent to 3.5 ml/kg/min. The CPA coding scheme was harmonised with the coding scheme from each GSS-TU survey cycle in order to apply MET values to each activity episode in the four GSS-TU survey cycles. For example, meal preparation (GSS-TU code 101) has a MET value of 2.0 and golfing (GSS-TU code 803) has a MET value of 4.3, whereas stacking and cutting firewood (GSS-TU code 182) has a MET value of 6.0. The methods, heuristics, and challenges in fusing GSS-TU

**Table 1: Demographic characteristics of sub-sample of older respondents**

| Characteristic | Cycle 7 – 1992 | | Cycle 12 – 1998 | | Cycle 19 – 2005 | | Cycle 24 – 2010 | |
|---|---|---|---|---|---|---|---|---|
| | *n* | % | *n* | % | *n* | % | *n* | % |
| **Overall** | 1,382 | 15.4 | 1,889 | 17.6 | 3,589 | 18.3 | 3,639 | 23.6 |
| **Age** | | | | | | | | |
| 65 to 69 | 475 | 34.4 | 555 | 29.4 | 1,134 | 31.6 | 1,171 | 32.2 |
| 70 to 74 | 401 | 29.0 | 545 | 28.9 | 937 | 26.1 | 890 | 24.5 |
| 75 to 79 | 261 | 18.9 | 384 | 20.3 | 741 | 20.6 | 693 | 19.0 |
| 80 years + | 245 | 17.7 | 405 | 21.4 | 777 | 21.6 | 885 | 24.3 |
| **Sex** | | | | | | | | |
| Male | 472 | 34.2 | 696 | 36.8 | 1,428 | 39.8 | 1,500 | 41.2 |
| Female | 910 | 65.8 | 1,193 | 63.2 | 2161 | 60.2 | 2,139 | 58.8 |
| **Income** | | | | | | | | |
| Less than $20,000 | 543 | 39.3 | 363 | 19.2 | 605 | 16.9 | 491 | 13.5 |
| $20,000–$39,999 | 315 | 22.8 | 335 | 17.7 | 808 | 22.5 | 856 | 23.5 |
| $40,000–$59,999 | 96 | 6.9 | 141 | 7.5 | 389 | 10.8 | 529 | 14.5 |
| $60,000 or more | 51 | 3.7 | 60 | 3.2 | 318 | 8.9 | 677 | 18.6 |
| DK/Not stated | 377 | 27.3 | 990 | 52.4 | 1,469 | 40.9 | 1,086 | 29.8 |
| **Living situation** | | | | | | | | |
| Live with others | 650 | 47.0 | 919 | 48.7 | 1,774 | 49.4 | 1,988 | 54.6 |
| Live alone | 732 | 53.0 | 970 | 51.3 | 1,815 | 50.6 | 1,651 | 45.4 |
| **Residential location** | | | | | | | | |
| Urban | 510 | 36.9 | 775 | 41.0 | 2,577 | 71.8 | 2,641 | 72.6 |
| Rural | 460 | 33.3 | 597 | 31.6 | 901 | 25.1 | 886 | 24.3 |
| Suppressed* | 412 | 29.8 | 517 | 27.4 | 111 | 3.1 | 112 | 3.1 |
| **Education** | | | | | | | | |
| < High school | 728 | 52.7 | 953 | 50.4 | 1,464 | 40.8 | 1,158 | 31.8 |
| High school grad | 303 | 21.9 | 410 | 21.7 | 944 | 26.3 | 880 | 24.2 |
| Post-secondary grad | 297 | 21.5 | 365 | 19.3 | 1,089 | 30.3 | 1,488 | 40.9 |
| DK/Not stated | 54 | 3.9 | 161 | 8.5 | 92 | 2.6 | 113 | 3.1 |

**DK = Don't know**
*****Suppressed indicates this information is not publicly available for Manitoba, Newfoundland, Prince Edward Island, Nova Scotia, or New Brunswick**

and CPA coding schemes is described in detail elsewhere (Spinney et al., 2011), with a copy of the MET values and corresponding IBM Statistical Package for the Social Sciences (SPSS) syntax available from the corresponding author. The application of MET values to the GSS-TU episodes enabled the classification of each episode into light, moderate, and vigorous effort levels. Based on the examples provided in the new physical activity guidelines for older adults (Canadian Society for Exercise Physiology, 2011), which define aerobic activity as all moderate and vigorous activity, activities with MET values in excess of 3.0 were considered moderate or vigorous and were selected for analysis.

A variety of metrics can be used to summarize and analyse activity engagement in time use data. Two of the most commonly used measures of activity engagement are participation rates (i.e., the percentage of respondents who reported an activity) and total time spent engaged in that activity on their diary day (i.e., "time budget" in economic vernacular). For this study, we used SPSS software version 20 to generate (a) frequency distributions of the most frequently reported MVPA by respondents aged 65 years and older; (b) the participation rates for each MVPA; and (c) the median total daily durations (in minutes per day) for each MVPA for those who participated in the activity (i.e., participant sub-sample). The median was chosen in preference to the mean to summarise total daily durations because the distributions are highly positively skewed (i.e., extreme values would artificially inflate mean values). Furthermore, the participant sub-sample was chosen to summarise total daily durations in order to eliminate the impact of non-participants' zero-minute daily time budgets, because any activity with a participation rate lower than 50 per cent would always have a median value of zero.

## Results

The 10 most frequently reported MVPAs by older Canadians are illustrated for each of the four survey cycles in Table 2. The number of occurrences for each

**Table 2: Most frequently reported MVPA with rank and participation rate (as a percentage)**

| Activity | Cycle 7 – 1992 | | Cycle 12 – 1998 | | Cycle 19 – 2005 | | Cycle 24 – 2010 | |
|---|---|---|---|---|---|---|---|---|
| | Rank | Rate* | Rank | Rate* | Rank | Rate* | Rank | Rate* |
| Travel: Goods/Services | 1 | 16.2 | 1 | 18.9 | 17 | 0.5 | 24 | 0.3 |
| Gardening/Grounds Maintenance | 2 | 15.6 | 3 | 17.7 | 1 | 30.4 | 2,3 | 28.9 |
| Other Domestic Work | 3 | 13.3 | 14 | 1.3 | 8 | 2.1 | – | 0.0 |
| Walking, Jogging, Hiking | 4 | 13.0 | 2 | 18.0 | 2 | 30.1 | 1 | 24.2 |
| Travel: In-Home Socializing | 5 | 5.2 | 4 | 9.5 | ** | 0.0 | ** | 0.0 |
| Travel: Religious Services | 6 | 3.9 | 8 | 2.4 | ** | 0.0 | ** | 0.0 |
| Exercises, Yoga, Weight Lifting | 7 | 3.7 | 7 | 3.2 | 3 | 9.0 | 4,8,17 | 11.5 |
| Stacking and Cutting Firewood | 8 | 3.4 | 10 | 1.6 | 6 | 2.9 | 9 | 2.7 |
| Travel: Restaurant Meals | 9 | 2.4 | 5 | 4.0 | 22 | 0.2 | ** | 0.0 |
| Interior Maintenance and Repair | 10 | 2.4 | 11 | 1.5 | 5 | 4.1 | 5 | 4.7 |
| Travel: Other Socializing | 13 | 1.8 | 6 | 3.5 | 30 | <0.01 | 36 | <0.01 |
| Travel: Civic & Voluntary | 11 | 2.4 | 9 | 2.2 | ** | 0.0 | 29 | 0.1 |
| Exterior Maintenance and Repair | 14 | 1.2 | 16 | 1.1 | 4 | 4.9 | 6 | 3.3 |
| Swimming, Waterskiing | 25 | 0.4 | 19 | 0.9 | 7 | 2.1 | 12 | 1.4 |
| Golf, Miniature Golf | 23 | 0.5 | 17 | 1.1 | 9 | 1.9 | 11 | 1.8 |
| Packing/Unpacking for Move | – | 0 | 36 | 0.1 | 10 | 1.4 | 15 | 1.3 |
| Other Home Improvements | 30 | 0.2 | 15 | 1.1 | 13 | 1.1 | 7 | 3.3 |
| Travel: To/From Paid Work | 19 | 0.7 | 12 | 1.4 | ** | 0.0 | 10 | 1.9 |

**\* Measures the percentage of respondents who reported the activity on their diary day.**
**\*\* Activity was not reported.**
**MVPA = moderate and vigorous physical activities**

MVPA, in each survey cycle, was used to rank each of the activities from most reported to least reported, and if an activity is among the top 10 in any of the four survey cycles its rank is included for all of the survey cycles. Table 2 also reports the proportion of respondents who engaged (i.e., participation rates) in each activity.

The results clearly illustrate that the top 10 aerobic activities represent the vast majority of aerobic activities in each of the four survey cycles. For example, the top 10 account for 79.1 per cent of all aerobic activities reported by older Canadians in 1992, 81.0 per cent in 1998, 88.9 per cent in 2005, and 79.4 per cent in 2010. The results also highlight the importance of activities within the "domestic chores" domain of physical activity, which comprise about one half of the top 10 aerobic activities in each survey cycle. Of particular importance is "gardening and grounds maintenance" activities, which rank among the top three most frequently reported MVPAs over all four survey cycles. It should be noted that the activity code used to describe "gardening and grounds maintenance" activities was disaggregated in Cycle 24, which is why ranks of two and three are used to represent, respectively, the separate activities of "gardening" and "grounds maintenance". Similarly, the activity code used to represent "exercises, yoga, and weight lifting" in the first three survey cycles was disaggregated in the Cycle 24 coding scheme, yet – save weightlifting (ranked 17th in 2010) – both

exercises and yoga remain in the top 10 most frequently reported MVPA in 2010 (4th and 8th respectively). Also noteworthy is "other domestic work" (code 183), which ranks prominently in Cycles 7, 12, and 19, but which does not appear in the most frequently reported MVPA in Cycle 24, presumably because the list of domestic chores was considerably expanded in the Cycle 24 coding scheme.

Active transportation (i.e., travel activities by walking or bicycling) for various purposes also dominates the most frequently reported aerobic activities over all four survey cycles. However, despite the prevalence of active transportation in Cycles 7 and 12 where, for example, active transportation for "shopping and services" is the most common MVPA among older Canadians, the importance of active transportation appears to have declined in the two most recent survey cycles. It remains unclear whether this decline in active transportation is due to increased automobility among elderly Canadians (see Rosenbloom, 2001; Scott et al., 2009) or to some other reason. The results do, however, clearly indicate that the prominence of active transportation has been replaced by recreational walking. In fact, recreational walking ranks increasingly high across the four survey cycles (4th in 1992, 2nd in both 1998 and 2005, and 1st in 2010), with about 20 to 30 per cent participation rates in the three most recent survey cycles. It is noteworthy that recreational walking (code 821) includes hiking, jogging, and running in the first

three survey cycles, but that this activity code was disaggregated in Cycle 24 where recreational "walking" (code 8211) makes the top 10 whereas codes for jogging and running (code 8212) and hiking (code 8213) both fail to do so.

Although the number of occurrences and participation rates are important in understanding MVPA engagement among older Canadians, it is also important to understand how much time is devoted to each these activities. Therefore, the daily durations (in minutes per day), using median and inter-quartile range (central tendency and dispersion respectively), are reported in Table 3 for the same MVPAs listed in Table 2.

Remarkable similarities exist among the median daily durations of the most frequently reported aerobic activities over the four survey cycles. The longest duration aerobic activity is golfing (see Table 3), but less than two percent of respondents participated in that activity (see Table 2). On the other hand, leisure activities such as swimming, exercises, and walking typically have median daily durations that exceed one hour per day. Considering the prevalence of recreational walking, its contribution to meeting recommended levels of daily physical activity is considerable. Much more prevalent and also of relatively long duration are domestic chores, such as interior maintenance and repair,

exterior maintenance and repair, plus gardening and grounds maintenance.

Considering the proportion of older Canadians who engage in domestic chores and the amount of time engaged in these activities, their contribution to maintaining or improving health should not be understated. In fact, older Canadians who engage in domestic chores (i.e., participant sub-sample) do so for around two hours a day over the four survey cycles. This is about two or three times as long as the time spent on leisure activities such as walking, exercises, or swimming. Despite active transportation activities being listed among the top 10 MVPA, the number of older Canadians who engage in active transportation (i.e., participation rates) is generally low (see Table 2), except for walking for shopping and services, and the median daily durations for those who do (see Table 3) are typically less than half an hour per day over the four survey cycles. Therefore, it seems that neighbourhood design policies aimed at improving the walkability of neighbourhoods, whether for active transportation or recreational walking, may go a long way towards increasing levels of physical activity among older Canadians.

## Discussion

This study used nationally representative time use data that were fused with energy expenditure information

**Table 3: Daily time budgets\* for most frequently reported MVPA**

| Activity | Cycle 7 – 1992 Median min/day (IQR) | Cycle 12 – 1998 Median min/day (IQR) | Cycle 19 – 2005 Median min/day (IQR) | Cycle 24 – 2010 Median min/day (IQR) |
|---|---|---|---|---|
| Travel: Goods/Services | 30 (30) | 30 (26) | 30 (40) | 30 (35) |
| Gardening/Grounds Maintenance | 115 (120) | 102 (120) | 120 (120) | 165 (135) |
| Other Domestic Work | 20 (30) | 30 (159) | 60 (94) | ** |
| Walking, Jogging, Hiking | 60 (60) | 60 (50) | 60 (60) | 60 (60) |
| Travel: In-Home Socializing | 30 (40) | 22.5 (35) | 30 (40) | ** |
| Travel: Religious Services | 20 (25) | 20 (20) | 25 (25) | ** |
| Exercises, Yoga, Weight Lifting | 30 (45) | 30 (40) | 45 (34) | 65 (0) |
| Stacking and Cutting Firewood | 30 (61) | 30 (110) | 120 (225) | 45 (115) |
| Travel: Restaurant Meals | 20 (30) | 20 (20) | 20 (25) | ** |
| Interior Maintenance and Repair | 120 (236) | 120 (124) | 120 (180) | 120 (240) |
| Travel: Other Socializing | 25 (25) | 25 (30) | 25 (35) | 25 (38) |
| Travel: Civic & Voluntary | 20 (35) | 20 (35) | 26 (36) | 30 (30) |
| Exterior Maintenance and Repair | 190 (198) | 152.5 (229) | 120 (190) | 150 (190) |
| Swimming, Waterskiing | 50 (59) | 80 (100) | 70 (50) | 65 (75) |
| Golf, Miniature Golf | 240 (130) | 265 (198) | 240 (161) | 240 (132) |
| Packing/Unpacking for Move | ** | 450 (0) | 60 (135) | 60 (120) |
| Other Home Improvements | 65 (44) | 90 (255) | 60 (94) | 60 (80) |
| Travel: To/From Paid Work | 37 (36) | 40 (45) | 30 (45) | 30 (45) |

\* Time spent engaged in activity among only those who participated.
\*\* Activity was not reported.
IQR = inter-quartile range
MVPA = moderate and vigorous physical activities

from the CPA in order to provide a unique investigation into the 10 most frequently reported MVPAs by older Canadians. This study also examined the proportion of older Canadians who engaged in each of these activities and the daily amount of time they spent engaged in each MVPA. Results from the study indicate that over the past three decades the most frequently reported aerobic activities among older Canadians are dominated by domestic chores, recreational walking, and active transportation, with few sport and leisure activities. A similar linkage of the American Time Use Survey and CPA (Tudor-Locke, Washington, Ainsworth, & Troiano, 2009) resulted in similar findings (Tudor-Locke, Johnson, & Katzmarzyk, 2010) whereby gardening (ranked 2nd in moderate-effort activities with a 10.6% participation rate) and walking (ranked 5th in moderate-effort activities with a 5.2% participation rate) ranked high among American adults age 20 and older.

The results of this study are also corroborated by results from the 2000–2001 Canadian Community Health Survey in which walking, gardening, and home exercises were reported as the three most frequently reported physical activities among adults aged 65 and older (Ashe et al., 2009). Also echoing the findings from previous studies (Spinney et al., 2011; Millward & Spinney, 2011), this research demonstrates that moderate-effort household chores and active transportation are performed more often, and for longer durations, than most moderate- and vigorous-effort sports. Although the importance of, and benefits derived from, sports activities should not be dismissed, the results presented here suggest that interventions and infrastructure aimed at promoting recreational walking and active transportation are more likely to be adopted by a larger proportion of older Canadians. Furthermore, the importance of domestic chores towards meeting recommended levels of physical activity has implications for the discourse on aging-in-place (Barrett, Hale, & Gauld, 2012) and the potential for increasing levels of physical activity among older Canadians. Such potential needs to be supported, however, by analysis that examines the most frequently reported MVPA by various socio-demographic groups, because older Canadians are a particularly heterogeneous group in terms of their behaviour (e.g. Hildebrand, 2003; Scott et al., 2009; WHO, 1998; Spinney, Scott, & Newbold, 2009).

Because time diary data capture information about the type, duration, timing, and contextual conditions associated with all four domains of physical activity, this research provides some insights into the potential public health research opportunities afforded by GSS-TU data, especially when linked with energy expenditure information from the CPA. However, these data are not without limitations. For example, although

interviewers have been trained to prompt the respondent for greater detail of their daily activities, the GSS-TU survey relies on self-reported activity information, and the amount of detail collected (i.e., number of activity episodes) has experienced a slight decline over each successive survey cycle. Although the inclusion of accelerometers holds the potential to mitigate this limitation (Webber & Porter, 2009) and have been incorporated into the Canadian Health Measures Survey (Colley et al., 2011), their incorporation into the GSS-TU survey design is not anticipated. Furthermore, the GSS-TU survey length places a considerable burden on respondents, which represents another limitation of time use data. Moreover, the challenges in linking time use coding schemes with the more-detailed CPA coding scheme also results in some over- and under-estimating of the intensity of some activities, as noted by Spinney et al. (2011) and Tudor-Locke et al. (2009).

Despite the limitations, this study has demonstrated that over the four GSS-TU survey cycles examined, the most frequently reported aerobic activities among older Canadian are dominated by domestic chores, recreational walking, and active transportation, with few sport and leisure activities. Notwithstanding recreational walking (which ranks high among the most frequently reported MVPA by older Canadians and has median daily durations of about an hour), the only top 10 MVPAs in the leisure domain are exercises, swimming, and golfing. There may be some who question whether gardening and grounds maintenance activities should be included in the domestic chores or leisure domain, with level of enjoyment perhaps being the determining factor, but there is no debate about the prevalence of such activities.

It is interesting that the vast majority of the most frequently reported MVPAs among older Canadians are "unstructured", meaning they may occur at any time and any location (yet often in close proximity to the respondent's home). On the other hand, there are few instances of "structured" activities, which typically occur either at a fixed time or at a fixed out-of-home location (e.g., swimming, golfing, and organised sports). The revealed preferences for "unstructured" activities bode well for health promotion strategies aimed at increasing levels of physical activity among older Canadians because structured activities typically require high levels of transport mobility (see Merrill, Shields, White & Druce, 2005). Health promotion strategies aimed at increasing unstructured physical activities, such as recreational walking and active transportation, must consider the needs of older members of society (DeMelo, Menec, Porter, & Ready, 2010; Gallagher et al., 2010; Li et al., 2005; Rosenberg et al., 2012), and should also consider seasonal substitutes for walking, such as skiing, skating, and snowshoeing (Rhodes &

Dean, 2009) or indoor walking (e.g., mall walking), particularly for older members of society who are more "weather sensitive" (Dunn, Shaw, & Trousdale, 2012; Von Mackensen, Hoeppe, Maarouf, Tourigny, & Nowak, 2005). Neighbourhood design and health promotion strategies that promote active modes of transportation (e.g., walking and, to a lesser extent, bicycling) have the potential to increase not only levels of physical activity but also mobility, well-being, and independence, because they are inexorably linked (Spinney et al., 2009; Schwanen & Ziegler, 2011).

## Conclusion

A mounting body of evidence suggests that many potential benefits can be derived from increased levels of physical activity among older Canadians, both by the individual and for society. Societal benefits from increased levels of older-adult physical activity stem mainly from reduced health care costs (Katzmarzyk & Janssen, 2004), while benefits to the individual include improved balance, reduced risk of falls and injuries, greater independence, and reduced risk of heart disease, stroke, osteoporosis, type 2 diabetes, some cancers, and premature death (Public Health Agency of Canada, 2011). This study has shown that despite their limitations, time use data represent the most comprehensive source of information about activity engagement over all four domains of physical activity. Moreover, when time use data are fused with energy expenditure information, they represent a valuable data source that can provide surveillance of and valuable insights into the most popular modes of aerobic activity, which should be of considerable interest for developing effective and targeted health intervention strategies and programming.

## Note

1 The disaggregation of activity codes in Cycle 24 has implications for analysis and interpretation of the MVPA analysed in this study. For example, code 821 is used in Cycles 7, 12, and 19 to describe "walking, hiking, jogging, running" activities, but the activity code has been disaggregated in Cycle 24 whereby code 8211 describes "walking", code 8212 describes "jogging and running", and code 8213 describes "hiking".

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