Profile of Physical Activity Levels in Community-Dwelling Older Adults

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ABSTRACT

CHAD, K. E., B. A. REEDER, E. L. HARRISON, N. L. ASHWORTH, S. M. SHEPPARD, S. L. SCHULTZ, B. G. LINDSTROM, K. L. FISHER, and J. A. LAWSON. Profile of Physical Activity Levels in Community-Dwelling Older Adults. *Med. Sci. Sports Exerc.*, Vol. 37, No. 10, pp. 1774–1784, 2005. **Purpose:** To examine relationships between selected sociodemographic, health-related and environmental factors and levels of physical activity in older adults across three age groups. **Methods:** Seven hundred sixty-four older adults (mean age = 77.4 ± 8.6 yr) from a midsize Canadian city completed a self-administered questionnaire under researcher supervision. Level of physical activity was determined using the Physical Activity Scale for the Elderly (PASE). Correlates of physical activity were examined using previously validated questionnaires. The findings pertaining to personal and environmental factors are presented. **Results:** Overall, significantly higher mean PASE scores were seen in those individuals in the following categories: male ($P < 0.001$), married or common-law ($P < 0.001$), not living alone ($P < 0.001$), not living in senior's housing ($P < 0.001$), higher levels of education ($P < 0.001$) and higher incomes ($P < 0.001$). Better physical health showed significant positive associations ($P < 0.001$) with PASE score. Individuals reporting at least four or more chronic health conditions had significantly lower PASE scores than those reporting no chronic conditions ($P < 0.001$). Significantly lower PASE scores were also reported in those using domestic services ($P < 0.001$). Higher PASE scores were related to the presence of hills, biking and walking trails, street lights, various recreation facilities, seeing others active and unattended dogs ($P < 0.001$ to $P < 0.05$). **Conclusion:** An understanding of the factors that influence physical activity behavior in older adults is critical to developing effective intervention strategies that will address the problem of physical inactivity in this population, and in doing so, improve the health status and quality of life of the older adult, while having a significant impact on healthcare expenditures. **Key Words:** EXERCISE, HEALTH, CHRONIC DISEASE, CORRELATES, ENVIRONMENT, ELDERLY

Physical inactivity is widely recognized as a risk factor in the development of numerous chronic diseases including coronary heart disease (CHD), type 2 diabetes mellitus (T2DM), obesity, stroke, and certain types of cancer (5). Despite the efforts of various international health organizations to increase public awareness of the health benefits of physical activity, levels of physical activity remain low in industrialized nations, particularly among older adults. In the United States, at least 60% of adults are not active enough to achieve health benefits (5). Similarly, in Canada, 55% of men and 67% of women over the age of 50 are not active enough to achieve reduction in disease risk (2).

Currently, persons aged 50 yr and older account for 29.3% of the Canadian population and it is estimated that by 2026, this segment of the population will account for 41% of the total Canadian population (28). The high prevalence of lifestyle-related chronic diseases, such as CHD and T2DM, among this growing population of older adults has significant implication for the economic costs and burden of treating these diseases. Because physical inactivity is a modifiable risk factor, there is significant potential to increase the health and quality of life of older adults, as well as improve the economic health of the nation through physical activity intervention strategies. An understanding of the factors that influence physical activity behavior in older adults is critical to developing effective intervention strategies that will address the problem of physical inactivity in this population. In doing so, the health status and quality of life of the older adult will be improved, while having a significant impact on healthcare expenditures (9).

The associations between physical activity behavior and certain personal (age, gender, education, socioeconomic status, stage of change, self-efficacy, barriers to physical activity participation such as lack of time and bad weather) and social factors (social support) in the adult population (aged 18 yr or older), have been well-established (30). More recently the role of the environment (e.g. recreation facilities and green spaces) in determining physical activity behavior has been examined (23). Despite the extensive work done in the area of physical activity correlates in the general adult population, the relation between these environmental factors and the physical activity behavior of older-aged

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adults (i.e. those over the age of 50) are still less explored (30). Although in recent years the older adult population as a group has been increasingly studied in the physical activity context, most of the published literature has been gender specific (i.e., female) (12), limited to those aged 60 and older (1) or have been narrowly focused on a few select correlates (i.e., age, psychosocial factors) (12). While some research has been conducted on the correlates of physical activity in older adults, little has been done to examine these correlates across different age groups within the older adult population, and thus our understanding remains incomplete. As the term "older adult" can encompass a large age range (i.e., 50 yr and older), it is important to identify the possible differences in correlates of physical activity so that effective intervention programs can be designed.

In the current study, we examined a comprehensive set of personal, social and environmental correlates of physical activity in a diverse, community-living older adult population and investigated whether these relationships were consistent across three age categories (50–64, 65–79, and ≥80 yr). These 15-yr age groups were based on the existing gap in the literature on younger older adults (50–65 yr), the age of pension eligibility (65+ yr), and the representation of the old older adults (80+ yr) (4). This paper presents the findings relative to selected sociodemographic, health-related, and environmental factors and levels of physical activity in the three age stratified groups of older individuals.

METHODS

Subject recruitment. This study used a convenience sampling approach as it has been argued that convenience sampling is often the norm in health behavior research (7), particularly in the older adult population (16). The sample consisted of 764 community-dwelling older adults in a mid-sized Canadian city (total population approximately 200,000, with individuals over age 50 comprising approximately 20% of the population). Individuals were recruited for the study from seniors' organizations, service clubs, and seniors' housing units. A citywide senior's directory and community housing authority were used to identify retirement communities and older adult housing units, while service organizations and clubs were identified through the local council on aging and the city telephone directory. Senior's housing included self-contained units (apartment complexes where residents are responsible for meals, housekeeping, etc., with some limited support services) and supported independent residences (apartment complexes where residents have their own suite, but have access to services such as meals and housekeeping). Of the total 41 community groups, retirement communities and housing units contacted, 30 agreed to participate.

Following approval from the tenants' associations, study recruitment posters and information letters were distributed to the retirement communities and housing units one week before the arranged day of data collection. The posters were displayed in the common areas of the facility and letters were hand-delivered to each resident. For interested service organizations and clubs, the information was given to a contact person for distribution. As an incentive, participants were informed that one dollar would be donated back to the tenants' association, service organization or club, or to a charity of their choice for each questionnaire completed.

Questionnaire administration. Completion of the questionnaire at the retirement communities and housing units was typically arranged around an event or meeting and administered in a small group setting of six to eight participants per research assistant. The purpose of the study and procedures for completing the questionnaire were outlined to the group and participants were encouraged to complete the questionnaire at their own pace. Informed written consent according to the guidelines established by the university advisory committee on ethics in behavioral science research was obtained from all participants. Although participants completed the questionnaires independently, the research assistants provided clarification as necessary. Research assistants reviewed questionnaires for completeness and attempted to obtain responses for all items. Data were collected from May to August 2002 to avoid the impact of possible seasonal variations in activity levels.

Questionnaire items. The complete survey instrument consisted of previously validated and reliable questionnaires (12,14,18,20,22,24,25,32). The questionnaire items focused on the dependent variable, physical activity and its relationship with independent variables thought to be associated with physical activity across three domains: interpersonal, environmental, and social (21).

Physical activity. The Physical Activity Scale for the Elderly (PASE), a 12-item questionnaire, was used to assess self-reported physical activity. The PASE has previously been shown to be a valid and reliable instrument, and is easy to administer and score. It has been noted that the PASE more reasonably represents the types of activities that older adults commonly participate in such as housework, gardening and caring for others, as opposed to other instruments that focus only on sport or recreational activities (34). The PASE score is based on 12 leisure, household, and occupational activities that have been performed in the previous seven days. The 12 activities include light, moderate and strenuous sport/recreational activities, muscle strength/endurance exercises, light and heavy housework, home repairs, lawn work or yard care, caring for another person, and work for pay or as a volunteer. As outlined by Washburn et al., (33) the PASE score is computed by multiplying duration of activity ($h \cdot wk^{-1}$) or participation in an activity (yes/no) by empirically derived weights, based on Caltrac counts, daily energy expenditures (metabolic equivalents; METs) and self-reported physical activity, and then summing the product for all 12 items (15).

Sociodemographic characteristics. Items from a Canadian census survey (24) were modified and used to develop questions related to sociodemographic characteristics. Information on age, gender, marital status, residence status, ethnicity, education, income, and employment status was collected.

Self-reported health and chronic health conditions. The 12-item Short Form Health Survey (SF-12) was used to assess self-reported health. It has been reported to be a reliable and valid estimate of individual levels of health when compared to the SF-36 (Medical Outcomes study 36-item Short-Form Health Survey) (32), which has been validated for use in the Canadian population (8).

Single item responses in the SF-12 are combined into 8 subscales. The physical health component score (PCS) is based on four subscales: physical functioning, role-physical, bodily pain and general health. The mental health component score (MCS) is based on the vitality, social functioning, role-emotional and mental health subscales. Using norm-based methods developed on the American general population outlined by Ware et al. (32) the PCS and MCS components are derived by creating indicator variables (scored 1/0) for the item response categories. The indicator variables are then weighted and aggregated. The PCS-12 and MSC-12 are computed by multiplying their respective regression weights and summing the products to produce the two scores (31).

The descriptions for questions related to defining chronic health conditions were based on items from the National Population Health Survey (25). Participants were asked to identify from a listing any medically diagnosed conditions that have affected their overall health for longer than six months. These conditions included: musculoskeletal problems, breathing problems, heart and circulation problems, digestive system problems, kidney, bladder or urinary problems, neurological problems, mental or emotional problems, cancer, blood problems, eye problems, high blood pressure, diabetes, and others unspecified above.

Services used. Two questions were asked regarding domestic services and activities available and used by the participants. Services and activities considered included housekeeping, meals, nursing (registered nurse), personal care, home care, social activities, and physical activities/exercise time.

Neighborhood characteristics. Neighborhood environment, convenient facilities, and neighborhood safety were determined using a modified environmental questionnaire developed by Sallis et al. (23). Defined neighborhood characteristics included hills, enjoyable scenery, sidewalks, biking lanes or trails, walking/hiking trails, water fountains, benches to sit, streetlights, heavy traffic, dogs unattended, frequently seeing people walking or exercising, and high crime. The presence of neighborhood physical activity facilities was also assessed. Participants were asked to indicate which items were found in their neighborhood (within a five minute walk or drive); to indicate the safety of their neighborhood (1 = very unsafe to 5 = very safe) and to define the type of neighborhood in which they resided (residential, mixed commercial and residential, or mainly commercial).

Statistical analysis. The independent variables included sociodemographics, self-reported health and chronic health conditions, services used, and neighborhood characteristics. Due to small sample sizes within various levels of sociodemographic characteristics, these independent variables were collapsed, resulting in the following categories: living situation was recoded from living "alone," "with a spouse/common-law partner/partner," "children (daughter, son, son-in-law, daughter-in-law)," "other family member," "friend," or "other" to either living "alone" or "not alone." Marital status was recoded from "married/common law," "living with a partner," "divorced," "single (never married)," "widowed," "separated," or "other" into four categories: "married/common law/living with a partner," "divorced/separated," "widowed," or "single." Education level was recoded from "no formal schooling," "elementary only," "some secondary (without graduation diploma)," "secondary or high school graduation diploma," "some trade, technical, vocational school, business college, community college, nursing school, or university," "diploma/certificate from trade, technical, vocational school, business college, community college, or nursing school," "degree/certificate from university of teacher's college," "master's degree, degree in medicine, dentistry, veterinary medicine, optometry, or doctorate," or "other" into three categories: "less than secondary education," "some or completed secondary education," and "postsecondary education." Employment was recoded from "full-time employment," "part-time employment," "retired," "unemployed," or "other" to "employed," "unemployed," or "retired." Type of dwelling was recoded from "own home," "own apartment," "senior's housing," "family member's home," or "other" to a dichotomous variable of "living in senior's housing" or "not living in senior's housing." Total annual household income was recoded from "less than $20,000," "$20,000 to less than $30,000," "$30,000 to less than $40,000," "$40,000 to less than $50,000," "$50,000 to less than $60,000," or "greater than $60,000" into three levels: "$<$20,000," "$\geq$20,000 to $<$30,000," and "$\geq$30,000." The low-income cutoff of $20,000 was based on that employed by Statistics Canada (27). Age groups were categorized as 50–64, 65–79, and $\geq$80 yr, and were based on the existing gap in literature (i.e., those younger than 65), the age of retirement (65+) years, and to represent the old older adult (80+) (1). Chronic disease status was considered by examining each chronic illness, as well as looking at the total number of chronic illnesses reported by each participant.

The contribution of each PASE item to the overall PASE score was derived from the product of the PASE item weight and the sample mean for each question, as outlined by Washburn et al. (34).

All analyses were completed using the Statistical Package for the Social Sciences (SPSS) version 11.0. Level of significance was defined as $P < 0.05$. For categorical independent variables, the PASE mean scores were compared through the use of independent samples *t*-tests or one way analysis of variance (ANOVA) if the assumptions for these tests were met. In cases where the ANOVA was used and significant differences were found, pairwise comparisons using Scheffe's *post hoc* procedure was completed. When a continuous variable exhibited a nonnormal distribution or when there was no clear pattern of the distribution, the

TABLE 1. Description of the study population by age group.

Demographics	50–64 yr (*N* = 60) *N* (%)	65–79 yr (*N* = 351) *N* (%)	≥80 yr (*N* = 307) *N* (%)	Overall (*N* = 764) *N* (%)
Gender				
Male	14 (23.3)	80 (22.8)	52 (16.9)	150 (19.6)
Female	46 (76.7)	271 (77.2)	255 (83.1)	610 (79.8)
Missing	0 (0.0)	0 (0.0)	0 (0.0)	4 (0.5)
Living alone				
No	29 (48.3)	132 (37.6)	82 (26.7)	253 (33.1)
Yes	18 (30.0)	135 (38.5)	160 (52.1)	334 (43.7)
Missing	13 (21.7)	84 (23.9)	65 (21.2)	177 (23.2)
Marital status				
Married/common law	34 (56.7)	147 (41.9)	79 (25.7)	267 (34.9)
Divorced/separated	6 (10.0)	27 (7.7)	5 (1.6)	40 (5.2)
Widowed	7 (11.7)	137 (39.0)	189 (61.6)	352 (46.1)
Single	12 (20.0)	38 (10.8)	33 (10.8)	91 (11.9)
Missing	1 (1.7)	2 (0.6)	1 (0.3)	14 (1.8)
Dwelling				
Not senior's housing	30 (50.0)	179 (51.0)	106 (34.5)	335 (43.8)
Senior's housing	30 (50.0)	170 (48.4)	199 (64.8)	422 (55.2)
Missing	0 (0.0)	2 (0.6)	2 (0.7)	7 (0.9)
Education				
Less than secondary	8 (13.3)	55 (15.7)	85 (27.7)	156 (20.4)
Some or completed secondary	20 (33.3)	134 (38.2)	118 (38.4)	284 (37.2)
Postsecondary	32 (53.3)	153 (43.6)	97 (31.6)	295 (38.6)
Missing	0 (0.0)	9 (2.6)	7 (2.3)	29 (3.8)
Income				
<$20,000	25 (41.7)	109 (31.1)	110 (35.8)	257 (33.6)
$20,000–<$30,000	10 (16.7)	65 (18.5)	52 (16.9)	131 (17.1)
>$30,000	14 (23.3)	85 (24.2)	44 (14.3)	148 (19.4)
Missing	11 (18.3)	92 (26.2)	101 (32.9)	228 (29.8)
Chronic health conditions				
No chronic conditions	11 (18.3)	35 (10.0)	32 (10.4)	81 (10.6)
1 chronic condition	13 (21.7)	83 (23.6)	53 (17.3)	157 (20.5)
2 chronic conditions	7 (11.7)	73 (22.2)	58 (18.9)	151 (19.8)
3 chronic conditions	14 (23.3)	63 (17.9)	52 (16.9)	138 (18.1)
4 or more chronic conditions	14 (23.3)	89 (25.4)	102 (33.2)	211 (27.6)
Missing	1 (1.7)	3 (0.9)	10 (3.3)	26 (3.4)

Frequencies and proportions are presented unless otherwise stated.
Some of the row totals may not add up due to missing values.
Unable to categorize 46 individuals into age categories due to missing data.

Mann–Whitney test or Kruskal–Wallis test was used in place of the independent samples *t*-test and ANOVA, respectively. Where the result from the Kruskal–Wallis test was significant, pairwise comparisons were completed through the use of multiple Mann–Whitney tests with a Bonferonni correction. In cases where the independent variable was continuous, correlation was assessed through the use of Pearson's correlation coefficient when the assumptions were met, or Spearman's correlation coefficient if either of the variables were nonnormally distributed. Sample size calculations based on the comparison of means for a *t*-test were conducted. Based on these calculations, an effect size of 0.50 in the older two age groups (65–79 yr: $N = 351$; 80+ yr: $N = 307$) was sufficient to detect differences with 80% power. In the youngest age group, however, the effect size required to detect differences was near 0.80.

RESULTS

Population Characteristics

Sociodemographics. Table 1 provides an overview of the study population overall and stratified by age, and includes demographic characteristics and number of chronic health conditions. Briefly, participants ranged in age from 50 to 99 yr (mean = 77.4 ± 8.6 yr). Most participants were female (79.8%) and over the age of 65 (92%). The majority of the study population lived alone (43.7%), were widowed (46.1%), lived in senior's housing (55.2%), were retired (95.8%), earned less than $20,000 annually (33.6%), and had completed at least some secondary education (75.8%). Not shown in Table 1 is ethnic background, which revealed that most of the population was Caucasian (95.8%).

A gender-stratified analysis showed that a greater proportion of females compared with males lived alone (66.5 vs 18.8%, respectively, $P < 0.001$), were never married (13.6 vs 6.1%, respectively, $P < 0.05$) or widowed (55.4 vs 12.8%, respectively, $P < 0.05$), and lived in senior's housing (59.0 vs 41.6%, respectively, $P < 0.05$). A greater proportion of males compared with females had completed at least some postsecondary education (53.7 vs 36.7%, respectively, $P = 0.001$) and earned more than $20,000 annually (79.8 vs 44.3%, respectively, $P < 0.001$).

Self-reported health and chronic conditions. Overall, 86% of the study population reported one or more chronic health problems, with 27.6% reporting at least four chronic health problems (Table 1). The distribution of chronic conditions in our sample is similar to Canadian data in which arthritis, hypertension, and heart disease are re-

TABLE 2. Mean PASE scores by demographic variables for each age group.

Demographic Variable	50–64 yr			65–79 yr			≥80 yr			Overall		
	N	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*	Mean	SD
Gender												
Male	14	154.3	(80.4)	80	148.6	(73.3)*	52	97.5	(55.3)*	150	129.6	(72.3)*
Female	46	137.9	(76.7)	271	122.2	(62.2)	255	78.1	(45.2)	610	102.9	(61.4)
Living alone												
No	29	137.9	(83.8)	132	138.6	(71.6)*	82	89.1	(51.1)	253	121.3	(70.2)*
Yes	18	118.2	(38.1)	135	112.6	(55.8)	160	77.9	(47.9)	334	95.1	(55.1)
Marital status												
Married/common law	34	160.1	(89.0)	147	143.2	(68.4)*	79	98.3	(52.6)*	267	131.5	(70.2)*
Divorced/separated	6	137.2	(65.7)	27	110.9	(70.6)	5	67.2	(40.0)	40	108.8	(67.1)
Widowed	7	126.8	(33.0)	137	121.5	(61.7)	189	76.1	(45.7)	352	95.7	(58.0)
Single	12	101.9	(52.1)	38	107.7	(56.0)	33	74.5	(37.7)	91	92.0	(51.4)
Dwelling												
Not senior's housing	30	144.4	(77.8)	179	146.9	(72.5)*	106	88.7	(51.3)*	335	126.3	(72.2)*
Senior's housing	30	139.1	(77.8)	170	108.9	(51.2)	199	769	(44.9)	422	93.8	(53.5)
Education												
Less than secondary	8	83.4	(57.3)*	55	113.2	(64.9)*	85	72.9	(47.1)	156	87.4	(57.0)*
Some or completed secondary	20	176.1	(83.2)	134	119.1	(58.8)	118	82.6	(44.8)	284	106.8	(60.6)
Postsecondary	32	134.8	(68.4)	153	142.2	(69.3)	97	88.0	(49.4)	295	123.1	(68.2)
Income												
<$20,000	25	117.8	(80.9)	109	112.9	(59.1)*	110	77.4	(45.8)*	257	95.5	(58.3)*
$20,000–<$30,000	10	159.8	(80.2)	65	127.7	(63.1)	52	85.6	(45.7)	131	112.1	(62.3)
>$30,000	14	163.1	(76.6)	85	153.6	(70.1)	44	105.0	(55.0)	148	140.3	(69.5)
Chronic health conditions												
No chronic conditions	11	171.8	(88.9)	35	130.6	(59.9)*	32	92.0	(42.7)*	81	123.0	(67.0)*
1 chronic condition	13	161.1	(100.6)	83	144.7	(64.6)	53	84.0	(50.3)	157	122.6	(70.3)
2 chronic conditions	7	143.7	(61.0)	78	140.3	(66.2)	58	95.3	(49.1)	151	122.0	(62.6)
3 chronic conditions	14	144.2	(66.2)	63	127.1	(68.8)	52	76.1	(44.1)	138	105.7	(64.5)
4 or more chronic conditions	14	92.1	(37.6)	89	101.7	(58.8)	102	72.7	(46.9)	211	86.8	(53.6)

* Indicates $P < 0.05$ between variables in each demographic category.
Some columns may not add up due to missing values.

ported to be among the most common conditions in adults aged 65 and older (26).

The SF-12 mean physical health score of 40.3 ± 12.3 for the sample population was below the standardized score of 50 (31). The SF-12 mean mental health score of 51.9 ± 10.3 was slightly above the standardized score of 50 (31). Males had significantly higher scores than females on the physical (43.6 ± 11.5 vs 39.5 ± 12.4; $P < 0.001$) and mental (53.6 ± 9.3 vs 51.4 ± 10.5; $P < 0.05$) scales. Both the physical scale scores and mental health scores decreased with age. On the physical composite scale, the 50–64 and 65–79 age groups had higher mean scores (41.6 ± 12.8 and 42.0 ± 12.5, respectively) compared with the 80+ age group (38.1 ± 11.8), with significant differences observed between the 65–79 and 80+ age groups ($P = 0.001$). Higher mental composite scores were seen in the youngest age group (54.7 ± 8.7) compared with the 65–79 and 80+ age groups (52.1 ± 10.4 and 51.0 ± 10.3, respectively). There was a significant difference in the mental health composite score between the youngest and oldest age groups ($P < 0.05$).

Services used. Respondents reported the following services being used (percent using): housekeeping (20.3%), meals (33.0%), nursing (2.0%), personal care (5.9%), home care (6.3%), physical activities (23.2%), and social activities (49%). A greater proportion of females reported participating in social (54.8%) and physical (26.0%) activities compared with their male counterparts (35.1 and 14.2%, respectively, $P < 0.05$). Comparing age groups, domestic services (housekeeping and meals) were used less frequently in the 50–64 age group (housekeeping: 5%; meals: 16.7%) compared with the 65–79 and ≥80 age groups (housekeeping: 13.4 and 31.6%; meals: 24.8 and 46.8%, respectively; $P < 0.05$). Personal care services and home care services were used more frequently in the ≥80 age group (10.3 and 9.0%, respectively) compared with the two younger age groups (4.3% or less, $P < 0.05$). Use of all other services (e.g., registered nurse, social, and physical activities) were not statistically different across the age groups.

Neighborhood characteristics. The findings related to neighborhood characteristics for the overall sample population are presented in Table 6. Most respondents reported living in neighborhoods with attractive scenery, sidewalks, benches, streetlights, parks, and people frequently seen walking. In addition, neighborhoods were most often described as being without hills, bike trails, fountains, golf courses, skating rinks, pools, tennis courts, dance studios, recreation centers, unattended dogs, or high crime.

PASE

Sociodemographics. A wide range in the level of physical activity, as measured by PASE, was reported (Table 2). PASE scores were significantly higher in the 50–64 (141.7 ± 77.2, $P < 0.001$) and 65–79 (128.2 ± 65.7, $P < 0.001$) age groups compared with the ≥80 age group (81.4 ± 47.5). Overall, significantly higher mean PASE scores were seen in the following categories: male ($P < 0.001$), married or common-law ($P < 0.001$), not living alone ($P < 0.001$), not living in senior's housing ($P < 0.001$), higher levels of education ($P < 0.001$), and higher incomes ($P < 0.001$). Within each age group, similar patterns emerged with two notable exceptions. In the 50–64 age group, significant differences in PASE score were associated with only level of education ($P < 0.05$), whereas in the ≥80 age

TABLE 3. Mean PASE scores by chronic health condition for each age group.

Chronic Health Condition	50–64 yr			65–79 yr			≥80 yr			Overall		
	N	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*	Mean	SD
Musculoskeletal												
Absent	29	155.7	(85.7)	178	131.3	(60.6)	152	89.8	(48.6)*	379	115.2	(63.3)*
Present	30	126.1	(66.7)	183	125.0	(70.6)	151	74.2	(45.2)	369	102.6	(65.0)
Breathing												
Absent	44	148.3	(78.9)	291	135.2	(66.1)*	252	82.0	(47.7)	615	112.6	(66.1)*
Present	15	118.0	(70.5)	60	94.1	(52.1)	50	82.0	(47.1)	133	92.0	(52.8)
Heart and circulation												
Absent	50	149.0	(77.7)	270	133.4	(65.5)*	195	84.2	(47.2)	542	115.8	(65.8)*
Present	9	94.3	(60.0)	81	110.9	(63.7)	108	78.0	(48.0)	206	91.3	(57.1)
Digestive system												
Absent	42	142.2	(82.8)	277	132.6	(67.3)*	249	84.5	(49.7)*	596	111.9	(66.3)*
Present	17	136.8	(64.3)	74	111.6	(56.4)	54	70.7	(33.5)	152	97.9	(55.2)
Kidney, bladder, or urinary												
Absent	50	148.9	(80.3)	286	132.0	(65.4)*	250	83.8	(46.7)	614	112.7	(64.7)*
Present	9	94.4	(33.1)	65	111.3	(65.0)	53	73.3	(50.6)	134	92.2	(60.2)
Neurological												
Absent	55	143.5	(79.2)	322	130.0	(35.7)	258	83.7	(47.2)	669	111.7	(64.9)*
Present	4	101.4	(26.9)	28	108.0	(63.7)	45	72.3	(48.3)	78	86.2	(55.8)
Mental or emotional												
Absent	46	151.0	(81.4)	323	130.5	(66.5)*	279	82.5	(48.2)	680	110.8	(65.7)*
Present	13	103.8	(47.4)	28	101.4	(49.3)	24	76.8	(38.8)	68	90.8	(46.4)
Cancer												
Absent	54	136.8	(75.2)	311	129.6	(66.4)	267	82.4	(47.9)	664	109.8	(64.8)
Present	5	182.1	(98.5)	40	117.0	(59.6)	36	78.9	(44.8)	84	102.8	(61.4)
Blood												
Absent	55	143.4	(79.4)	341	128.3	(65.2)	280	81.3	(47.8)	710	109.5	(64.8)
Present	4	101.9	(13.9)	10	126.3	(84.5)	20	92.7	(46.9)	35	101.6	(59.1)
Eye												
Absent	56	142.4	(79.0)	229	134.4	(63.9)	146	82.5	(48.2)	450	117.2	(66.7)*
Present	3	107.2	(17.5)	122	116.6	(67.7)	156	81.9	(47.1)	297	96.8	(58.8)
High blood pressure												
Absent	39	152.3	(86.9)	214	129.6	(66.7)	182	82.2	(45.1)	453	110.9	(66.6)
Present	20	117.9	(48.5)	137	126.1	(64.3)	120	81.0	(50.6)	294	105.9	(60.9)
Diabetes												
Absent	57	143.6	(76.7)	307	130.0	(66.2)	274	83.3	(47.4)	671	110.6	(64.7)*
Present	2	55.0	(53.5)	43	113.1	(59.0)	28	69.9	(48.7)	74	94.1	(58.7)
Other												
Absent	50	140.4	(78.1)	307	128.7	(65.6)	271	82.5	(47.2)	660	109.1	(64.2)
Present	9	141.7	(78.0)	43	125.7	(67.4)	30	74.7	(48.7)	84	108.9	(66.9)

* Indicates $P < 0.05$ between absence and presence for each condition.
Some columns may not add up due to missing values.

group there were no differences in PASE score related to living arrangement or level of education.

Overall, PASE scores increased as education level increased. When stratified into age groups, significant differences in PASE scores by level of education were apparent in only the two youngest age groups. In the 65–79 age group, significantly lower PASE scores were observed among those with less than secondary education and those who had at least some postsecondary education ($P < 0.05$). As well, there were significantly lower PASE scores between those who had completed some secondary school and those who had completed some postsecondary school ($P < 0.05$). In the 50–64 age group, the highest PASE scores were seen in those who had attended and/or completed secondary school.

With regard to employment status, significant differences were noted only in the 65–79 age group, with higher mean PASE scores reported by those who were employed (208.8 ± 91.2) compared with those who were retired (127.8 ± 64.7; $P < 0.05$; data not shown). As noted previously, 95.8% of our study participants were retired.

Self-reported health and chronic health conditions. General physical health, measured by the SF-12 physical component score, showed statistically significant positive associations with the PASE score. The oldest age group had a higher correlation (Pearson's r = 0.40; $P < 0.001$) followed by the youngest age group (Spearman's $\rho = 0.36$; $P < 0.01$), with the lowest correlation observed in the 65–79 age group (Pearson's r = 0.35; $P < 0.001$). The association between PASE and the SF-12 mental health score was also significant, although the correlations were weaker when compared with the physical scale. The highest correlation was in the 65–79 age group (Pearson's r = 0.23; $P < 0.001$), with the oldest (Pearson's r = 0.13; $P < 0.05$) and youngest (Spearman's $\rho = 0.13$) age groups being lower.

The relationship between level of physical activity and specific chronic conditions is outlined in Table 3. Overall, significantly lower PASE scores were seen in participants reporting the presence of a chronic condition compared to those who reported no chronic conditions. When at least four chronic conditions were reported, the PASE score was significantly lower than when zero, one, or two conditions were reported ($P < 0.001$; data not shown). In the 65–79 age group, PASE scores were significantly lower among those reporting breathing ($P < 0.001$), heart and circulation ($P = 0.006$), digestive ($P = 0.014$), kidney/bladder/urinary ($P = 0.002$), and emotional problems ($P = 0.024$). In the oldest age group there were significantly lower PASE scores when musculoskeletal ($P = 0.004$) and digestive ($P = 0.014$)

TABLE 4. Mean PASE scores by services used for each age group.

Services Used	50–64 yr			65–79 yr			≥80 yr			Overall		
	N	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*	Mean	SD
Domestic services												
Housekeeping												
No	57	144.8	(76.8)	295	131.6	(63.5)*	206	90.3	(48.1)*	582	117.1	(63.7)*
Yes	3	84.0	(75.2)	47	102.5	(71.5)	95	62.0	(39.4)	155	76.5	(55.9)
Meals												
No	50	145.6	(76.9)	252	133.8	(67.8)*	160	90.6	(49.2)*	487	120.2	(66.5)*
Yes	10	122.2	(80.2)	87	108.8	(54.7)	141	71.0	(43.1)	252	86.1	(52.8)
Health related services												
Registered nurse												
No	59	142.9	(77.3)	347	128.2	(65.1)	295	81.7	(48.0)	736	109.2	(64.5)
Yes	1	69.6	(—)	3	71.0	(29.4)	10	82.1	(33.7)	15	77.9	(29.9)
Personal care services												
No	58	142.6	(77.9)	334	128.1	(65.6)	270	84.4	(47.3)*	694	111.1	(64.3)*
Yes	2	117.5	(67.8)	10	106.7	(51.5)	31	55.4	(40.5)	45	69.1	(48.6)
Home care services												
No	58	143.5	(76.7)	329	130.2	(64.9)*	273	83.2	(47.3)*	690	111.8	(64.1)*
Yes	2	91.3	(104.9)	15	68.2	(40.6)	27	64.2	(45.6)	48	63.1	(45.7)
Social activities												
Social activities												
No	27	153.1	(81.2)	186	136.1	(73.0)*	130	85.6	(52.3)	362	117.8	(71.5)*
Yes	33	132.4	(73.8)	156	117.6	(53.5)	170	78.1	(43.3)	374	99.7	(55.1)
Physical activities/exercise time												
No	49	149.3	(82.4)*	263	129.1	(66.4)	229	81.6	(50.3)	572	110.3	(66.9)
Yes	11	108.1	(32.5)	85	124.4	(61.3)	76	82.0	(38.2)	177	103.5	(54.3)

* Indicates $P < 0.05$ between services used (yes) and not used (no) in each category.
Some columns may not add up due to missing values.

conditions were present. The youngest group showed no statistically significant differences in PASE score between absence and presence of a chronic condition. However, in most cases this age group had few persons reporting a condition.

Services used. Significantly lower PASE scores were reported in respondents using housekeeping ($P < 0.001$), meals ($P < 0.001$), personal care ($P < 0.001$), home care ($P < 0.001$), and social activity services ($P < 0.001$). When stratified by age, significantly lower PASE scores were reported in subjects using housekeeping ($P < 0.01$), meals ($P < 0.05$), home care ($P < 0.001$), and/or social activity ($P < 0.05$) services in the 65–79 age group (Table 4). In the ≥80 age group, PASE scores were significantly lower in those utilizing housekeeping ($P < 0.001$), meal ($P < 0.001$), personal care ($P < 0.001$), and/or home care services ($P < 0.01$) (Table 4). There were very few people in the 50–64 age group who utilized any of the services we examined.

Neighborhood characteristics. The PASE scores were evaluated to assess the associations with various neighborhood environmental characteristics (Table 6). Overall, respondents reported significantly higher PASE scores when the following neighborhood characteristics were present: hills ($P < 0.05$), biking lanes/trails ($P < 0.001$), walking/hiking trails ($P < 0.001$), street lights ($P < 0.05$), seeing active people in their neighborhoods ($P < 0.001$), unattended dogs ($P < 0.01$), golf courses ($P < 0.001$), public parks ($P < 0.001$), skating rinks ($P < 0.001$), swimming pools ($P < 0.05$), and tennis courts ($P < 0.01$). In addition, the absence of benches ($P < 0.01$) was associated with a significantly higher mean PASE score than when they were present.

Compared with the overall sample, there was no apparent pattern between levels of physical activity and environment in each age group. In the 50- to 64-yr-old group, significantly higher PASE scores were seen in those living in neighborhoods with enjoyable scenery ($P < 0.05$), skating rinks ($P < 0.05$), and swimming pools ($P < 0.05$), while in the 65- to 79-yr-old group, significantly higher PASE scores were seen with the presence of public parks ($P < 0.05$), skating rinks ($P < 0.05$), and the absence of benches ($P < 0.01$). In the ≥80-yr-old group, significantly higher PASE scores were reported with the presence of walking/hiking trails ($P < 0.001$), golf courses ($P < 0.05$), public parks ($P < 0.01$), skating rinks ($P < 0.05$), swimming pools ($P < 0.05$), tennis courts ($P < 0.01$), dance studios ($P < 0.001$), unattended dogs ($P < 0.05$), and frequently seeing active people ($P < 0.01$).

PASE score. The contribution of each PASE component to the overall PASE score for each age group is presented in Table 5. PASE components making the largest contribution to the PASE score in all age groups were walking and household-related activities (i.e., housework, home repairs, lawn/yard care, outdoor gardening, caring for others), as opposed to planned and structured exercise (i.e., light, moderate, and strenuous sports, muscle strength/endurance).

TABLE 5. Contribution to total PASE score by PASE component.

PASE Component	Contribution to total PASE score		
	50–64 yr	65–79 yr	≥80 yr
Walking	25.6	28.8	20.6
Light sports	5.0	8.0	4.2
Moderate sports	8.1	5.1	1.8
Strenuous sports	4.1	3.5	1.2
Muscle strength/endurance	3.3	3.0	2.7
Work/volunteer activities	13.4	5.0	1.9
Light housework	23.8	23.2	22.7
Heavy housework	19.2	19.2	14.2
Home repair	5.4	3.6	0.9
Lawn/yard work	9.7	10.8	2.5
Outdoor gardening	9.0	7.8	3.4
Caregiving duties	15.1	10.2	5.3

TABLE 6. Mean PASE score by neighborhood characteristics for each age group.

Neighborhood Characteristic	50–64 yr			65–79 yr			≥80 yr			Overall		
	N	Mean	(SD)	*N*	Mean	(SD)	*N*	Mean	(SD)	*N* (%)	Mean	(SD)
Hills												
Absent	30	131.9	(75.4)	219	127.6	(66.9)	217	81.2	(49.5)	466 (67.3)	106.3	(64.4)*
Present	27	151.6	(83.0)	105	134.1	(62.2)	94	89.3	(50.3)	226 (32.7)	117.5	(65.1)
Enjoyable scenery												
Absent	13	99.5	(70.6)*	54	124.6	(64.8)	59	77.5	(53.5)	126 (18.2)	100.0	(63.9)
Present	44	153.6	(77.8)	270	130.8	(65.6)	251	84.8	(48.5)	565 (81.8)	112.1	(64.7)
Sidewalks												
Absent	2	237.5	(17.1)	21	122.5	(59.2)	29	91.2	(70.8)	52 (7.5)	109.5	(70.9)
Present	55	137.7	(78.2)	303	130.2	(65.9)	282	83.0	(47.2)	640 (92.5)	110.1	(64.3)
Biking lanes or trails												
Absent	29	126.5	(68.8)	199	124.7	(62.6)	229	82.4	(50.6)	457 (66.0)	103.6	(61.0)*
Present	28	156.5	(86.9)	125	137.7	(69.2)	82	87.7	(47.6)	235 (34.0)	122.5	(69.8)
Walking/hiking trails												
Absent	24	138.1	(75.9)	141	122.2	(58.8)	175	74.8	(46.1)*	340 (49.2)	98.9	(59.5)*
Present	33	143.5	(82.2)	182	135.4	(69.8)	136	95.3	(52.0)	351 (50.8)	120.6	(67.8)
Water fountains												
Absent	53	139.4	(77.5)	285	129.4	(64.2)	268	85.9	(50.3)	606 (87.7)	111.1	(63.8)
Present	4	165.2	(107.0)	39	132.0	(74.8)	42	70.3	(44.8)	85 (12.3)	103.1	(70.9)
Benches to sit on												
Absent	20	142.6	(86.3)	85	150.3	(74.2)*	72	82.5	(52.6)	177 (25.6)	121.9	(75.0)*
Present	37	140.5	(76.0)	239	122.4	(60.5)	239	84.1	(49.0)	515 (74.4)	105.9	(60.4)
Street lights												
Absent	9	102.2	(81.2)	39	116.8	(58.6)	57	82.3	(53.6)	105 (15.2)	96.8	(59.8)*
Present	48	148.6	(77.3)	285	131.5	(66.2)	254	84.1	(49.0)	587 (84.8)	112.4	(65.3)
Golf course												
Absent	51	138.7	(78.8)	265	126.4	(126.4)	283	82.1	(49.1)	599 (86.6)	106.5	(63.5)*
Present	6	163.1	(85.1)	59	144.5	(144.5)	28	101.1	(54.5)	93 (13.4)	132.6	(68.2)
Public park												
Absent	16	121.5	(82.6)	68	112.6	(54.1)	119	72.6	(49.2)*	203 (29.3)	89.8	(57.6)*
Present	41	149.0	(77.2)	256	134.3	(67.5)*	192	90.7	(49.0)	489 (70.7)	118.4	(65.7)
Skating rink												
Absent	43	126.8	(71.4)*	258	125.2	(63.3)	265	81.2	(47.3)	566 (81.9)	104.7	(61.1)*
Present	14	185.5	(87.2)	66	147.4	(70.6)*	45	99.8	(60.7)	125 (18.1)	134.6	(74.4)
Swimming pool												
Absent	40	127.4	(72.3)*	200	132.1	(67.1)	221	78.8	(49.0)*	461 (66.7)	106.2	(65.0)*
Present	17	173.7	(86.6)	124	125.9	(62.6)	89	96.1	(50.1)	230 (33.3)	117.9	(63.6)
Tennis courts												
Absent	48	139.3	(80.8)	238	126.1	(58.5)	252	80.4	(48.0)*	538 (77.7)	105.9	(61.2)*
Present	9	151.7	(72.3)	86	139.8	(81.0)	59	98.0	(54.8)	154 (22.3)	124.5	(74.2)
Dance Studio												
Absent	53	138.7	(76.4)	290	129.8	(65.7)	281	80.8	(48.4)*	624 (90.2)	108.5	(64.6)
Present	4	174.3	(117.7)	34	129.4	(63.5)	30	111.2	(55.0)	68 (9.8)	124.0	(64.4)
Public recreation center												
Absent	38	134.0	(81.0)	207	129.3	(64.7)	224	81.7	(51.2)	469 (67.9)	106.9	(64.7)
Present	19	155.7	(74.9)	117	130.5	(67.0)	86	89.1	(46.1)	222 (32.1)	116.6	(64.5)
Heavy traffic												
Absent	21	147.1	(88.9)	148	129.9	(70.2)	143	80.1	(48.8)	312 (45.1)	108.2	(67.9)
Present	36	137.8	(73.7)	176	129.6	(61.3)	168	86.9	(50.5)	380 (54.9)	111.5	(62.0)
Dogs that are unattended												
Absent	45	141.2	(80.9)	268	128.3	(65.3)	266	79.8	(45.4)*	579 (83.8)	107.0	(63.7)*
Present	12	141.2	(74.9)	56	136.5	(66.3)	44	104.9	(65.2)	112 (16.2)	124.6	(68.1)
Frequently (see active) people												
Absent	8	101.8	(57.8)	62	117.8	(58.7)	75	71.8	(45.7)*	145 (21.0)	93.1	(56.5)*
Present	49	147.7	(80.6)	262	132.6	(66.7)	236	87.6	(50.5)	547 (79.0)	114.5	(66.1)
High crime												
Absent	50	140.4	(78.9)	285	130.7	(65.7)	274	83.6	(49.4)	609 (88.0)	110.3	(64.8)*
Present	7	147.3	(85.8)	39	122.5	(63.9)	37	85.2	(53.2)	83 (12.0)	108.0	(64.3)
Type of neighborhood												
Residential	32	151.1	(84.8)	208	137.2	(67.7)	201	87.4	(51.4)	441 (65.0)	115.5	(67.4)*
Commercial	0			3	151.9	(57.4)*	6	61.6	(43.6)	9 (33.6)	91.7	(72.1)
Mixed	26	128.6	(69.2)	107	116.5	(91.5)	95	75.3	(41.3)	228 (1.3)	100.7	(57.7)

% Indicates percentage of respondents reporting each neighborhood characteristic; * indicates $P < 0.05$ between absence and presence for each neighborhood characteristic. Some columns may not add up due to missing values.

DISCUSSION

Previous studies investigating physical activity in older adults have been limited in certain groups such as women and particular age ranges (i.e., predominantly those older than 60 yr). In this study we have examined physical activity levels in a large, inclusive community-dwelling, older adult population across many sociodemographic, health-related, and neighborhood environmental characteristics.

As expected, a shift in certain demographic variables with increased age was found including an increase in the proportion of persons who lived alone and were widowed, and a decrease in the proportion that were married. Similarly, the decrease seen in the proportion of persons living in their own home and the increase in the proportion living in seniors' housing reflects a trend among older adults over the age of 80 yr. The inverse relationship between age and level

of education is also reflective of past societal trends in that those over 65 yr tended to have lower levels of education. This may have implications with regards to understanding and acting upon health-related information or advice (i.e., lower level of literacy). For example, the ability to evaluate the benefits (or risks) of lifestyle choices such as engaging in physical activity (16). Overall, our findings support previous studies specifically showing physical activity levels are higher in younger older adults (33), males (1,19), individuals reporting higher levels of education (12,19), and those with higher household incomes (19). As expected, physical activity levels were found to vary between age groups, showing an age-related decline. The associations between physical activity and age, gender, education, and income were evident in each age group, highlighting the diversity within the older adult population. As this study focuses on the descriptive nature of the population, the interaction between these variables has not been investigated, and thus we are unable to fully identify the underlying factors associated with levels of physical activity in this sample population.

The results further showed that lower levels of physical activity were associated with several chronic conditions, namely those involving the musculoskeletal, respiratory, heart and circulatory, digestive, and kidney/bladder/urinary systems as well as mental/emotional conditions. This was most apparent in the 65–79 age group among those reporting breathing, heart and circulation, digestive system, kidney, urinary and bladder, and mental or emotional problems. Intuitively, one would think that older adults with more health problems would be less physically active. Therefore, it was somewhat surprising that there were no significant differences in physical activity scores, apart from those reporting musculoskeletal and digestive conditions, in the oldest age group. This is particularly interesting given that one third of the respondents in this age category reported four or more chronic conditions. This begs the question of what has a greater influence on levels of physical activity: the total number of conditions or the specific nature of the condition. For example, an individual may report several chronic conditions that are less likely to influence physical activity levels (e.g., cataracts, constipation, bronchitis), whereas another may report few chronic conditions that result in severe limitations with respect to physical activity (e.g., COPD, Parkinson's, etc.). It is interesting to note that of the clinical conditions (i.e., musculoskeletal, breathing, heart and circulation, diabetes) associated with significantly lower PASE scores, the majority are exacerbated by a sedentary lifestyle.

The positive associations between physical activity and physical and mental health observed in the present study was expected, given the abundance of literature supporting the physical and psychological benefits of physical activity (29). Although in our study the association between physical activity and overall mental health, derived from the SF-12, was low across all age groups, the results suggest that individuals who are more physically active tend to have higher levels of psychological well-being. These findings are supported by previous literature, which showed that older adults aged 50–64 who adopted or maintained physical activity experienced better emotional health (10,13) and improved self-rated mood (11) Interestingly, the positive association between physical activity and mental health was strongest in the 65–79 age group. Often, this is a time of transition for older adults, when events such as such as retirement, the death of a spouse, reduced incomes, and changes in living arrangements are commonly experienced. These changes play an important role in emotional health, as such stressors may have a negative impact on well-being in the absence of good mental health and adequate coping mechanisms. Therefore, our results suggest that physical activity may serve as an important coping mechanism during this period of change for the older adult.

The results emphasizing that adults living in senior's housing had significantly lower activity levels than those living in self-supporting environments (i.e., own home or apartment) were not surprising. The physical activities required for maintenance of one's home, such as housework, home repairs, and lawn care, would contribute to the higher PASE score observed in this group compared with those living in senior's housing complexes where such services are often provided. The lower physical activity levels observed in those who utilize domestic services such as housecleaning and meal preparation further support the hypothesis that household tasks contribute significantly to increased physical activity levels in older adults, regardless of age. Previous studies have shown that a significant proportion of physical activities undertaken by older adults are in the form of household-related activities (33). Although the PASE scores provide an assessment of physical activity levels in older adults, it is important to recognize the nature of activities contributing to the PASE scores (i.e., caregiving duties, housework, and home repairs). Although the ability to perform activities of daily living is an important component for maintaining functional independence, these types of activities may be insufficient to achieve health benefits as suggested by Health Canada (3) and the U.S. Surgeon General (5).

The findings from the present study highlight the importance of informing older adults of the need to engage in additional types of leisure-time physical activity beyond those required within self-supporting environments to attenuate the age-related decline in physiological function and reduced activity associated with upkeep of household work. This may be particularly pertinent for those living in senior housing complexes who have many activities of daily living services provided, and therefore are likely not receiving the functional benefits associated with these tasks. This is reflected in our results as the use of domestic (e.g., housekeeping, meals) and health-related (e.g., registered nurse, personal care, home care) services were associated with lower levels of physical activity.

The environment is an emerging area of study in physical activity correlates research, encompassing a broad range of disciplines including environmental design, urban planning, health promotion, and behavioral medicine (1,17). Overall

findings in this study reflect the results of previous research in this area (1,12,17,19). Notably, the overall results indicated that the presence of hills, unattended dogs, and the absence of benches were associated with increased PASE scores, whereas high crime and heavy traffic were not associated with physical activity status. Because these environmental variables have typically been regarded as barriers to physical activity, these results seem counterintuitive. However, previous literature has reported similar findings, with the suggestion that perhaps individuals who are active outdoors may be more cognizant of their environmental surroundings (i.e., hills, dogs, etc.) simply due to "getting out more often in their neighborhood," whereas inactive individuals may be unaware of their environmental surroundings and therefore do not report the presence of these neighborhood characteristics (12).

However, when stratified by age, we highlight some differences between the age groups. With respect to the age-related differences in physical activity levels associated with environmental factors, it is possible that convenience and access to formal (i.e., golf courses, skating rinks, swimming pools, etc.) and informal (i.e., parks, walking and biking trails, enjoyable scenery) physical activity facilities may act as enablers to physical activity. However, personal and social influences of the older adult may outweigh the role of an individual's environmental surroundings, particularly given the personal and social changes that accompany aging. Another explanation could be that environmental influences on physical activity are context-specific, and therefore are more relevant to those participating in outdoor activities compared with those who participate in indoor physical activity programs. Currently, research in this area is somewhat limited by the self-reported nature of the data. To fully investigate the contribution of the physical environment to the physical activity status of older adults, further research combining objective measures of the environment with self-report data is required. The application of Geographic Information Systems (GIS) is one such method that would broaden our understanding in this area (6).

Certain limitations are inherent in cross-sectional study designs such as the present study, including sample representativeness, potential selection, and recall bias. Despite efforts to minimize these, certain demographic groups remain underrepresented (males, persons aged 50–64 yr, and persons of non-Caucasian ethnic background). Given the small sample sizes in these groups, and in particular within certain variables in the youngest age group, the relationships identified in this study may not reflect those present in these underrepresented groups. The small number of respondents in these groups will reduce the power of the statistical tests and may therefore limit some comparisons. As well, given the focus of the survey, respondents may have tended to overreport their levels of physical activity. As disease status and physical and mental health were assessed at a single point in time, one cannot discount the possibility that the relationships were due to factors which prompted physical activity or contributed to low levels of physical activity, resulting in disease, reduced function, and poor mental health. Finally, it should be noted that the volume of information provided in this paper precluded the inclusion of a gender main effect analysis. Given the apparent differences in physical activity levels between males and females, future research will be directed towards this question.

CONCLUSIONS

Our results have supported previous findings in other groups, and in many cases have shed further light on the associations between physical activity and a variety of lifestyle and health factors. The findings of the present study highlight the heterogeneity within the older adult population, and underscore the importance of resisting the temptation to create "one size fits all" programs for older adults, but rather design and implement innovative strategies to increase physical activity that target specific segments of the older adult population and their changing needs. Effective solutions to the problems associated with sedentary older adults requires multifaceted approaches that consider the collective influences of the personal, social, and environmental factors associated with physical inactivity. These findings are particularly important for community programmers and healthcare practitioners to ensure the appropriateness and effectiveness of physical activity programs and interventions.

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REFERENCES

1. Booth, M., N. Owen, A. Bauman, O. Clavisi, and E. Leslie. Social-cognitive and perceived environment influences associated with physical activity in older Australians. *Prev. Med.* 31:15–22, 2000.
2. Cameron, C., C. L. Craig, T. Stephens, and T. Ready. *Increasing Physical Activity; Supporting an Active Workforce.* Ottawa, ON: Canadian Fitness and Lifestyle Research Institute, 2002, pp. 22.
3. *Canada's Physical Activity Guide to Healthy Active Living.* Ottawa, Ontario: Health Canada, 1998, pp. 5–8.
4. *Canada's Retirement Income System.* Human Resources Development Canada, Income Securities Programs, Hull QC2001, pp. 4–10.
5. Center for Disease Control. *Physical Activity and Health. A report of the Surgeon General.* Atlanta: Department of Health and Human Services, 1999, pp. 4, 28–29.
6. Duncan, M., and K. Mummery. Psychosocial and environmental factors associated with physical activity among city dwellers in regional Queensland. *Prev. Med.* 40:363–372, 2005.
7. Gochman, D. S. Handbook of Health Behavior Research I: Personal and Social Determinants. New York: Plenum Press, 1997, 381–400.
8. Hopman, W. M., T. Anastassiades, A. Tenenhouse, et al. Canadian normative data for the SF-36 Health Survey. *Can. Med. Assoc. J.* 163:265–271, 2000.
9. Katzmarzyk, P. T., N. Gledhill, and R. J. Shephard. The economic burden of physical inactivity in Canada. *Can. Med. Assoc. J.* 163:1435–1440, 2000.
10. King, A., L. Pruitt, R. Oka, A. Rodenburg, and W. Haskell. Comparative effects of two physical activity programs on mea-

sured and perceived physical functioning and other health-realted quality of life outcomes in older adults. *J. Gerontol.* 55A:M74–M83, 2000.
11. King, A., C. Taylor, and W. Haskell. Effects of different intensities and formats of 12 months of exercise training on psychological outcomes in older adults. *Health Psychol.* 12:292–300, 1993.
12. King, A. C., C. Castro, A. A. Eyler, S. Wilcox, J. F. Sallis, and R. C. Brownson. Personal and environmental factors associated with physical inactivity among different racial-ethnic groups of U.S. middle-aged and older-aged women. *Health Psychol.* 19: 354–364, 2000.
13. Lee, C., and A. Russell, Effects of physical activity on emotional well-being among old Australian women: Cross-sectional and longitudinal analyses. *J. Psychosom. Res.* 54:155–160, 2003.
14. McAuley, E., and S. L. Mihalko. Measuring exercise-related self-efficacy. In: *Advances in Sport and Exercise Psychology Measurement.* J. Duda (Ed.). Morgantown, WV: Fitness Information Technology, Inc., 1998, pp. 371–390.
15. New England Research Institutes. *PASE Physical Activity Scale for the Elderly Administration and Scoring Instruction Manual* Watertown, MA: New England Research Institutes, Inc., 1991, pp. 1–6.
16. Newsom, J. T., M. S. Kaplan, N. Huguet, and B. H. McFarland. B. H. Health Behaviors in a Representative Sample of Older Canadians: Prevalences, Reported Change, Motivation to Change, and Perceived Barriers. *Gerontologist* 44:193–205, 2004.
17. Owen, N., E. Leslie, J. Salmon, and M. J. Fotheringham. Environmental determinants of physical activity and sedentary behavior. *Exerc. Sport Sci. Rev.* 28:153–158, 2000.
18. Prochaska, J. O., and B. H. Marcus. The Transtheoretical Model: Applications to Exercise. In: *Advances in Exercise Adherence.* R. Dishman (Ed.) Champaign, IL: Human Kinetics, 1994, pp. 161–180.
19. Ross, C. E. Walking, exercising, and smoking: Does neighborhood matter. *Soc. Sci. Med.* 51:265–274, 2000.
20. Sallis, J., M. F. Johnson, K. J. Calfas, S. Caparosa, and J. F. Nichols. Assessing perceived physical environmental variables that may influence physical activity. *Res. Q. Exerc. Sport.* 68:345–351, 1997.
21. Sallis, J., and N. Owen. *Physical Activity and Behavioral Medicine.* Thousand Oaks, CA: Sage Publications, 1999, pp. 110–134.
22. Sallis, J. F., R. M. Grossman, R. B. Pinski, T. L. Patterson, and P. R. Nader. The development of scales to measure social support for diet and exercise behaviors. *Prev. Med.* 16:825–836, 1987.
23. Sallis, J. F., M. F. Johnson, K. J. Calfas, S. Caparosa, and J. F. Nichols. Assessing perceived physical environment variables that may influence physical activity. *Res. Q. Exerc. Sport.* 68:345–351, 1997.
24. Statistics Canada. *1996 Census Questionnaire.* Ottawa, ON1996, pp. 4–10.
25. Statistics Canada. *1998 National Population Health Survey.* Ottawa, ON: Health Statistics Division, 2001, pp. 12–15.
26. Statistics Canada. *2001 Canada Year Book*: Ottawa, ON: Communications Division, 2003, pp. 120–121.
27. Statistics Canada. *Low Income Cutoffs from 1992-2001 and Low Income Measures from 1991-2000.* Ottawa, ON2002, pp. 10–34.
28. Statistics Canada. *Population Projections for Canada, Provinces and Territories 2000-2026.* Ottawa, ON: Ministry of Industry, 2001, pp. 78–81.
29. Stephens, T. Physical activity and mental health in the United States and Canada: Evidence from four population surveys. *Prev. Med.* 17:35–47, 1988.
30. Trost, S. G., N. Owen, A. E. Bauman, J. F. Sallis, and W. Brown. Correlates of adults' participation in physical activity: Review and update. *Med. Sci. Sports Exerc.* 34:1996–2001, 2002.
31. Ware, J. E., M. Kosinski, D. M. Turner-Bowker, and B. Gandek. *How to Score Version 2 of the SF-12 Health Survey (With a Supplement Documenting Version 1).* Lincoln, Rhode Island: QualityMetric Incorporated, 2002, pp. 227–244.
32. Ware, J. E. J., M. Kosinski, and S. D. Keller. A 12-Item short-form health survey: Construction of scales and preliminary tests of reliability and validity. *Med. Care.* 34:220–233, 1996.
33. Washburn, R. A., E. McAuley, J. Katula, S. L. Mihalko, and R. A. Boileau. The Physical Activity Scale for the Elderly (PASE): Evidence for validity. *J. Clin. Epidemiol.* 52:643–651, 1999.
34. Washburn, R. A., K. W. Smith, A. M. Jette, and C. J. Janney. The Physical Activity Scale for the Elderly (PASE): Development and evaluation. *J. Clin. Epidemiol.* 46:153–162, 1993.