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# Relationships Among Dog Ownership and Leisure-Time Walking in Western Canadian Adults

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**Background:** Dog ownership may be an effective tailored intervention among adults for promoting physical activity. This study examined the relationship between walking, physical activity levels, and potential psychological mediators between people who owned dogs and those who did not own dogs in the Capital Region District of Greater Victoria, British Columbia, Canada. Data were collected in September 2004; analyses were conducted in January 2005.

**Methods:** A random sample of men ( $n = 177$ ) and women ( $n = 174$ ) aged 20 to 80 years participated. Questionnaires were mailed out in 2004 to collect information about demographics, dog ownership, leisure-time walking, physical activity levels, and theory of planned behavior (TPB) constructs.

**Results:** The analyses revealed that dog owners spent more time in mild and moderate physical activities and walked an average of 300 minutes per week compared to non-dog owners who walked an average of 168 minutes per week. A mediator analysis suggests that dog obligation acts as a mediator between dog ownership and physical activity. Moreover, the theory of planned behavior constructs of intention and perceived behavioral control explained 13% of the variance in walking behavior with an additional 11% variance in walking behavior being explained by dog obligation. Regarding intention to walk, the TPB explained 46% of the variance in intention to walk with dog obligation adding an additional 1% variance.

**Conclusions:** In this group of Canadians, those who owned a dog participated in more mild to moderate physical activity than those who did not. Acquiring a dog should be explored as an intervention to get people more physically active.

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## Introduction

Physical inactivity has been linked to several chronic degenerative conditions, rising obesity rates, premature deaths, and billions of dollars in healthcare spending.<sup>1-4</sup> Population health researchers are exploring all reasonable options to promote physical activity, and recent research has focused on walking.<sup>5,6</sup> Walking is low cost, convenient, generally accessible, and the most popular reported physical activity,<sup>7,8</sup> yet the marketing of exercise through walking is presently underused.<sup>8</sup> Dog ownership is one targeted factor that has received little attention.<sup>9</sup>

Considering physical activity levels and dog ownership, only five studies have been conducted.<sup>9-13</sup> Three of these studies have provided support for the notion that dog owners are more physically active than non-dog owners.<sup>11-13</sup> In contrast, Anderson et al.<sup>10</sup> found

that pet owners reported themselves as significantly more active than non-pet owners, but the findings did not extend to dog ownership specifically. Bauman et al.<sup>9</sup> did not find a physical activity difference between dog owners and non-dog owners.

Several limitations exist in these studies that make interpreting the results difficult. First, previous studies have mixed both urban and rural participants.<sup>9-11</sup> Only Giles-Corti and Donovan<sup>13</sup> used an urban area, while Serpell<sup>12</sup> did not provide details as to type of area. It would seem logical that dog owners in urban settings would be more likely to walk their dogs than dog owners in rural settings who could let their dogs run freely. Second, many of the participants of the previous studies were not randomly sampled from the general population. Several of these previous studies have used convenience samples,<sup>10-12</sup> which may affect the generalizability of results. Third, pet ownership characteristics have not been described nor used to predict how owners interact with their dogs,<sup>10,11,13</sup> which makes generalizability of results difficult. Many of these studies are limited because they have not included specific questions pertaining to type of pet, primary caregiver of pet, purpose and attachment to the pet, and whether

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the pet lives primarily inside or outside.<sup>14,15</sup> Finally, there is a lack of theory-based studies,<sup>11,16</sup> with no attempts to understand the mechanisms of dog ownership and physical activity. As Headey<sup>17</sup> has stated, “we can be fairly confident that pets do confer health benefits, but we do not know exactly how.” That is, understanding the psychological mediators is of the utmost importance.<sup>18,19</sup>

Therefore, the general purpose of this study was to improve on the limitations of previous studies by exploring dog ownership as it relates to physical activity levels within a Western Canadian sample. We focused on dog owners in an urban setting, ensured that the dog was a household pet (compared to a working or guard dog) and that the person filling out the questionnaire was the primary provider for the dog, and examined potential psychological mediators between dog ownership and physical activity. Specifically, since it is generally well accepted that dog ownership requires more responsibilities and work than caring for other pets,<sup>20</sup> it was hypothesized that the sense of responsibility/obligation for the health and well-being of one’s dog is what mediates the relationship between physical activity and dog ownership. Lastly, dog ownership and its relationship to regular walking within a full psychological model of walking motivation were examined.<sup>21</sup> To this end, dog ownership was included with the well-validated<sup>22</sup> theory of planned behavior<sup>23</sup> (TPB) for predicting regular walking behaviors. It was tentatively hypothesized that dog walking may augment the predictive ability of the TPB because traditional concepts of the TPB, or any of the other leading psychological models, fail to consider animals.

## Methods

### Participants and Design

Participants for this study were limited to residents of the Greater Victoria Capital Region District (CRD), British Columbia, Canada, aged 20 to 80 years. A random sample of 1000 addresses within the CRD area was obtained from Dominion Directories (SuperPages Telephone Company). In September 2004, questionnaires approved by the University of Victoria’s Human Research Ethics Board were mailed out to the 1000 potential participants. Of the original 1000 questionnaires, 26 envelopes were returned unopened because the resident had moved or was recently deceased, and 214 questionnaires were returned completed. Of the possible 760 remaining participants, a second mailing of a postcard reminder and questionnaire<sup>24</sup> was sent out 2 weeks later in which an additional 137 questionnaires were returned. A total of 351 participants (36% response rate) completed and returned the questionnaire. Data analysis was conducted in January 2005.

Of the 351 participants, 177 (50.4%) were men and 174 (49.6%) were women, with a mean age of 56.26 (SD=16.22) and 54.20 (SD=18.22), respectively. Respondents reported themselves as well educated; 45.7% had at least a bachelor’s

degree, which is slightly above the 40.1% reported in the census of 2001 for the locale.<sup>25</sup> Of those reporting race/ethnicity ( $n=325$ ), 87% of participants were Caucasian. Participant characteristics were similar to the general population of British Columbia, especially Vancouver Island.<sup>26</sup> Only 3.2% were unemployed, with 39.1% being retired, 4.3% attending college or university, and 53.5% employed. Annual family income showed that 56.4% had a household income >\$40,000 per year, which is the Victoria median.<sup>25</sup> A total of 19.9% of the sample reported dog ownership ( $n=70$ ).

## Measurements

**Dog ownership.** Based on Friedmann and Thomas’s<sup>20</sup> definition, dog ownership was defined as “claiming a pet as one’s own.” Dog owners were asked questions pertaining to the size, age, primary reason for having a dog (i.e., household pet, guard dog, working dog), and whether their dog was mainly an inside or outside dog. Finally, dog owners were asked the following questions: (1) “On average, how many minutes per week do you walk your dog?” and (2) “Regardless by who walked the dog, ‘What is the total dog-walking minutes your dog is walked per week?’”

**Physical activity and walking behavior.** Using the validated Godin Leisure Time Exercise Questionnaire (GLTEQ),<sup>27–29</sup> participants were asked to recall their average weekly physical activity during their free time over the past month. In this particular study, it made sense to have two very analogous measures for both physical activity and walking.<sup>30</sup> Therefore, average weekly leisure-time walking was requested in the same transparent way using the format of the GLTEQ. The GLTEQ contains three open-ended physical activity questions pertaining to the average frequency of mild, moderate, and strenuous physical activities (with examples of each) during free time during a typical week. The GLTEQ was also modified to include an open-ended assessment of average duration of physical activities and walking in minutes. Mild, moderate, and strenuous physical activities were changed to mild (slow walk), moderate (average pace), and strenuous (very brisk pace) walking, respectively, for the walking measure.

**Theory of planned behavior.** Using 7-point Likert-type questions, this study measured constructs of the TPB through questions on affective attitude (two items,  $\alpha=0.87$ ); instrumental attitude (two items,  $\alpha=0.83$ ); subjective norm (three items,  $\alpha=0.75$ ); perceived behavioral control (PBC) (three items;  $\alpha=0.76$ ); and intention (three items;  $\alpha=0.95$ ).<sup>31</sup> For the TPB questions, regular walking was defined as “walking for at least 20 minutes, at least three times or more per week during your free time.” This leisure-time walking definition was kept slightly below the minimal physical activity suggested by Health Canada’s<sup>32</sup> guide because people were not expected to achieve their entire physical activity quota with walking alone. That is, people do other forms of physical activities besides walking and/or walking their dog.<sup>9</sup> Indeed, our findings supported this notion since walking accounted for 64% of total physical activity minutes.

**Dog obligation.** Participants were also asked to complete dog obligation questions, which were assessed on an 8-point scale ranging from 0 (not applicable) to 7 (completely true). The three items were as follows: “I feel an obligation to walk my

**Table 1.** Descriptive statistics for dog owners and non-dog owners for walking and physical activity

Source	F <sub>(1, 350)</sub>	Mean (SD)		d
		Dog owners	Non-dog owners	
Mild walking frequency (number of times)	<b>28.00*</b>	4.99 (6.50)	2.20 (2.96)	0.71
Moderate walking frequency	<b>13.93*</b>	3.76 (4.43)	2.29 (2.43)	0.50
Strenuous walking frequency	1.96	0.66 (1.24)	0.45 (1.04)	0.19
Total mild walking minutes (frequency × duration)	<b>26.15*</b>	137.79 (182.72)	59.27 (89.43)	0.69
Total moderate walking minutes	<b>7.93*</b>	136.39 (164.46)	89.55 (111.54)	0.38
Total strenuous walking minutes	0.269 <sup>a</sup>	28.43 (64.19)	19.80 (60.79)	0.14
Total walking minutes	<b>32.42*</b>	300.18 (223.38)	168.38 (163.62)	0.74
Total mild physical activity (frequency × duration)	<b>10.58<sup>a*</sup></b>	155.62 (189.30)	96.41 (131.37)	0.41
Total moderate physical activity	<b>6.91*</b>	164.93 (179.79)	115.21 (129.54)	0.35
Total strenuous physical activity	0.28 <sup>a</sup>	82.71 (108.05)	72.30 (127.19)	0.08
Total physical activity (all levels)	<b>11.33<sup>a</sup></b>	410.28 (230.50)	287.52 (239.21)	0.57

\* $p < 0.01$  (bolded).

<sup>a</sup>Controlling for covariates when bivariate relationship was found, such as income, age, and education level.

d, Cohen's effect size using pooled standard deviations; SD, standard deviation.

dog regularly," "I feel a responsibility to walk my dog regularly," and "My dog pressures me to take him/her for a regular walk." These three questions were aggregated into a three-item variable titled "dog obligation" ( $\alpha = 0.99$ ).

## Results

### Correlations and Descriptive Statistics for Walking and Physical Activity

Correlations were first run to check for any potential demographic covariates that may confound the relationship between walking and physical activity levels for both dog owners and non-dog owners. Bivariate relationships were found regarding total strenuous walking minutes and annual income ( $r = 0.14$ ,  $p < 0.05$ ); total mild physical activity and age ( $r = 0.11$ ,  $p < 0.05$ ); total strenuous physical activity and age ( $r = -0.28$ ,  $p < 0.01$ ); education level ( $r = 0.13$ ,  $p < 0.05$ ); and annual income ( $r = 0.22$ ,  $p < 0.01$ ); and last, total physical activity and annual income ( $r = 0.13$ ,  $p < 0.05$ ). Thus, these demographics were entered as covariates when reporting descriptive statistics for walking and physical activity.

Reported in Table 1 are descriptive statistics, analysis of variance (ANOVA) results, and Cohen's<sup>33</sup> effect size  $d$  for walking and physical activity by dog ownership. Dog owners participated in more mild and moderate walking bouts than non-dog owners ( $p < 0.01$ ). Dog owners also spent more time in all forms of mild and moderate physical activities ( $p < 0.01$ ). Finally, in the most desired walking variable, that of total walking minutes, dog owners walked more minutes per week compared to non-dog owners ( $p < 0.01$ ). It is noteworthy that there was no difference between males and females on total walking minutes, nor was the size of the dog found to be related to total walking minutes ( $p > 0.05$ ). Furthermore, there were no statistically significant differences found between dog owners and non-dog owners for strenuous walking, nor strenuous physical activity ( $p > 0.05$ ).

An ANOVA was also conducted to determine if there was a difference between activity levels between the dog owners and non-dog owners once total walking minutes was subtracted from total physical activity minutes. No significant difference between the two groups ( $p > 0.05$ ) was identified. Once dog walking minutes were subtracted from total walking minutes within the dog-owning group, there was a significant mean difference in walking minutes per week ( $F_{(1,350)} = 37.77$ ,  $p < 0.01$ ,  $d = 0.82$ ) and total physical activity ( $F_{(1,350)} = 23.00$ ,  $p < 0.01$ ,  $d = 0.64$ ). Dog walkers walked less and were less physically active than non-dog owners once dog walking was removed.

### Mediator analysis

The mediator analysis was based on the format suggested in Baron and Kenny.<sup>34</sup> Hierarchical regression was conducted to determine whether dog obligation was a mediator between owning a dog and total walking frequency (dependent variable [DV]). Specifically, dog owner independent variable (IV<sub>1</sub>) was first entered in Step 1, resulting in  $F_{1,336}$  of 50.58 ( $p < 0.01$ ;  $R^2 = 0.13$ ). In Step 2, dog obligation showed a significant addition ( $\Delta F_{1,335} = 10.92$ ,  $p < 0.01$ ;  $\Delta R^2 = 0.03$ ). Furthermore, the DV was reduced in the regression equation from a significant standardized beta of 0.36 ( $p < 0.01$ ) to a nonsignificant standardized beta of 0.09 ( $p > 0.05$ ), suggesting full mediation. Following the mediator analysis, a correlation of 0.30 ( $p < 0.05$ ) between dog obligation and total walking frequency was found in only the dog-owning group ( $n = 70$ ), which suggests substantive predictive ability of the obligation variable even when dog ownership was held constant.

**Theory of planned behavior.** Correlations for the TPB constructs and walking are presented in Table 2. Dog obligation was found to correlate with both intention and total walking ( $p < 0.01$ ), but did not correlate with

**Table 2.** Correlations for theory of planned behavior constructs and walking

Items	2	3	4	5	6	7	Mean (SD)
Affective attitude	<b>0.56*</b>	<b>0.33*</b>	0.08	<b>0.29*</b>	<b>0.58*</b>	<b>0.29*</b>	6.04 (1.21)
Instrumental attitude		<b>0.31*</b>	0.10	<b>0.30*</b>	<b>0.51*</b>	<b>0.28*</b>	6.42 (0.93)
Subjective norm			0.04	<b>0.20*</b>	<b>0.41*</b>	<b>0.21*</b>	5.72 (1.03)
Dog obligation				-0.01	<b>0.18*</b>	<b>0.33*</b>	1.29 (2.54)
Perceived behavioral control					<b>0.33*</b>	<b>0.16*</b>	6.40 (1.02)
Intention						<b>0.42*</b>	5.96 (1.38)
Total walking							

\* $p < 0.01$  (bolded).

SD, standard deviation.

other TPB constructs ( $p > 0.05$ ). Additionally, all TPB constructs correlated with intention and total walking behavior ( $p < 0.01$ ).

**Predicting walking behavior and intent.** Data for predicting walking behavior (DV-total walking frequency) and walking intent (DV) utilizing a hierarchical regression analysis appear in Table 3. For predicting walking behavior, the TPB independent variables of intention and PBC were entered in Step 1; subjective norm, instrumental attitude, and affective attitude were entered in Step 2; and dog obligation was entered in Step 3. Overall, the TPB constructs of intention and PBC (Step 1) explained 13% of the variance in walking behavior ( $p < 0.01$ ) with no additional variance being explained in Step 2 ( $p > 0.05$ ); however, an additional 11% variance in walking behavior was explained by dog obligation in Step 3 ( $p < 0.01$ ). Interpreting these effects (Table 3) revealed that the two predictors of walking behavior were intention ( $\beta = 0.31$ ,  $p < 0.01$ ) and dog obligation ( $\beta = 0.34$ ,  $p < 0.01$ ).

Regarding intention to walk, the TPB independent variables (PBC, subjective norm, instrumental attitude, affective attitude) were entered in Step 1 and dog

obligation was entered in Step 2. Overall, the TPB in Step 1 explained 46% of the variance in intention to walk ( $p < 0.01$ ), with dog obligation adding an additional 1% variance ( $p < 0.01$ ). Specifically, PBC did not predict intention to walk ( $p > 0.05$ ); however, subjective norm, instrumental attitude, and affective attitude all independently predicted intention to walk ( $\beta = 0.21$ ,  $\beta = 0.20$ ,  $\beta = 0.39$ , respectively;  $p < 0.01$ ) as did dog obligation ( $\beta = 0.12$ ,  $p < 0.01$ ).

## Discussion

This was the first North American study to collect walking and physical activity baseline data on dog owners in a completely urban setting, and the first study to examine dog ownership and the relationship to regular walking within a full psychological model of walking motivation (i.e., TPB). This study further added to and strengthened the literature by using a random sample that included both an equal gender representation as well as representative dog ownership of the population.

**Table 3.** Hierarchical regression analysis for predicting walking behavior and walking intent

	F <sub>change</sub>	df	R <sup>2</sup> <sub>change</sub>	$\beta^1$	$\beta^2$	$\beta^3$
<b>Behavior</b>						
(Block 1)	24.19*	2323	0.13			
Intention				<b>0.37*</b>	<b>0.38*</b>	<b>0.31*</b>
Perceived behavioral control				-0.07	-0.07	-0.04
(Block 2)	0.17	3320	0.00			
Subjective norm					0.00	0.02
Instrumental attitude					0.04	0.02
Affective attitude					-0.04	-0.03
(Block 3)	45.60*	1319	0.11			
Dog obligation						<b>0.34*</b>
<b>Intent</b>						
(Block 1)	68.58*	4326	0.46			
Perceived behavioral control				0.07	0.07	
Subjective norm				<b>0.21*</b>	<b>0.21*</b>	
Instrumental attitude				<b>0.22*</b>	<b>0.20*</b>	
Affective attitude				<b>0.40*</b>	<b>0.39*</b>	
(Block 2)	8.38*	1325	0.01			
Dog obligation					<b>0.12*</b>	

\* $p < 0.01$  (bolded). $\beta^{1-3}$ , standard regression coefficients for equations 1, 2, and 3; df, degrees of freedom.

### What This Study Adds . . .

Previous research on dog ownership and physical activity has shown mixed results; however, these studies may have been limited by sampling and measurement issues.

This study used a random urban sample and included dog ownership within a motivational theory.

Results showed that dog owners walk more than non-dog owners, and that obligation to care for one's dog appears to be the key mediator in this relationship.

Further, dog obligation had an effect on walking independent of intention.

Based on the findings in the literature on dog ownership and physical activity, it was hypothesized that dog owners would be more physically active than non-dog owners. Our hypothesis was supported. After controlling for demographic covariates, dog owners reported more walking than non-dog owners. These findings are consistent with most of the findings on this topic;<sup>10,13,35</sup> however, our results are the most robust in this literature to date. Interpreting the magnitude of our findings with Cohen's<sup>33</sup> effect size *d*, a borderline large effect size was found in the desirable total walking minutes per week variable. That is, irrespective of any covariates, an effect size that would be observable to the naked eye<sup>33</sup> was identified. This large effect size finding is much larger than the environmental correlates of walking,<sup>5</sup> which suggests that dog-ownership physical activity interventions may be a useful course of action. Our findings may be attributed in part to the clean and well-represented (gender, age, personal dog ownership, household pet, urban setting) data set. Of additional interest, it was found that dog walkers walked less and were less physically active than non-dog owners once dog walking was removed. This suggests that when dog owners choose to participate in activities such as walking, they are selecting to be active with their dogs.

It was also hypothesized that the sense of responsibility/obligation for the health and well-being of one's dog is what mediates the relationship between physical activity and dog ownership. Our hypothesis was supported by the results. This novel finding advances the field by identifying the potential mechanism for why dog owners walk more. Our results also showed that even among dog owners, some people do not take responsibility for walking their dog. Thus, a higher level of walking is not necessarily associated with owning a dog per se, but rather with people who are willing to accept obligation and responsibility for a dog. The finding may have interesting implications for intervention because it suggests that a willingness to take

responsibility for one's dog is essential, not just dog ownership. Importantly, about a quarter of dog owners were not walking their dog at  $\geq 120$  minutes per week, which suggests that an intervention promoting taking responsibility for one's dog may be helpful.

Finally, using a full psychological model of walking motivation (TPB), it was hypothesized that dog obligation would independently predict both intention to walk as well as walking behavior. Our hypothesis was supported. An additional 1% variance in intention and an additional 11% variance in walking behavior were explained by dog obligation over and above the TPB (Table 3). Interestingly, dog obligation correlated with walking intention/behavior but did not correlate with other TPB constructs (Table 2), which suggests that our current social cognitive theories do not account for a factor such as dog obligation. Further, the additional 11% variance that dog obligation provided is one of the largest extensions to the TPB in any of the population health literature.<sup>36</sup>

The results of this study must be considered in the context of a few limitations. First, the results are limited in generalizability to urban populations with similar weather patterns and demographics to the South Vancouver Island region of British Columbia. Also of note, participants in this study were a relatively active group; the average minutes per week for walking and physical activity were considerably above the Surgeon General's<sup>37</sup> recommended activity. These results are to be expected for Greater Victoria, since Victoria has the highest percentage of physically active people in all of Canada.<sup>25</sup>

Second, the GLTEQ was modified to include walking specifically, and this modification has not been validated. There is a need to extend and attempt to replicate these results with objective physical activity measures. This would also help determine the activity of dog owners on their walks (i.e., they could be at dog parks standing while their dogs are running around). Third, cross-sectional designs such as this one are limited in determining causality, and there is a need for directional prospective quasi-experimental designs. These designs will help answer questions of whether dog owners obtain pets because they are interested in walking, or if the pet is the stimulus to walking. Future investigators may want to consider other forms of activity with their dogs such as running. Fourth, there was only a 36% response rate. If the population that did not respond differs from the population that did, there could be unknown biases in the data set.

### Conclusions

In summary, the results suggest that dog owners walk more than non-dog owners, and that obligation to care for one's dog appears to be the key mediator of this relationship. Further, dog obligation appears to have a

considerable effect on walking behavior that is independent of intention. The results support the notion that dog ownership, for those who are willing to take responsibility for a dog, may be a viable physical activity intervention strategy.

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A full description of our instrument has not been included due to space restrictions. The instrument will be provided on request to the second author.

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## References

1. Booth M. Assessment of physical activity: an international perspective. *Res Q Exerc Sport* 2000;71(suppl 2):114–20.
2. Bouchard C, Blair SN. Introductory comments of the consensus of physical activity and obesity. *Med Sci Sports Exerc* 1999;31(suppl 11):S498–501.
3. Craig C, Cameron C. Increasing physical activity: assessing trends from 1998–2003. Ottawa: Canadian Fitness and Lifestyle Research Institute, 2004.
4. Katzmarzyk PT, Gledhill N, Shephard RJ. The economic burden of physical inactivity in Canada. *CMAJ* 2000;163:1435–40.
5. Owen N, Humpel N, Leslie E, Bauman A, Sallis JF. Understanding environmental influences on walking: review and research agenda. *Am J Prev Med* 2004;27:67–76.
6. Suminski R, Poston W, Petosa R, Stevens E, Katzenmoyer L. Features of the neighborhood environment and walking by U.S. adults. *Am J Prev Med* 2005;28:149–55.
7. Canadian Fitness and Lifestyle Research Institute. Physical activity monitor, 2000. Available at: [www.cflri.ca/cflri/pa/surveys/2000survey/2000survey.html](http://www.cflri.ca/cflri/pa/surveys/2000survey/2000survey.html). Accessed December 27, 2004.
8. Siegel P, Brackbill R, Heath G. The epidemiology of walking for exercise: implications for promoting activity among sedentary groups. *Am J Public Health* 1995;85:706–10.
9. Bauman A, Russell S, Furber S, Dobson A. The epidemiology of dog walking: an unmet need for human and canine health. *Med J Aust* 2001;175:632–4.
10. Anderson W, Reid C, Jennings G. Pet ownership and risk factors for cardiovascular disease. *Med J Aust* 1992;157:298–301.
11. Dembicki D, Anderson J. Pet ownership may be a factor in improving health of the elderly. *J Nutr Elder* 1996;15:15–31.
12. Serpell J. Beneficial effects of pet ownership on some aspects of human health and behaviour. *J R Soc Med* 1991;84:717–20.
13. Giles-Corti B, Donovan R. Relative influences of individual, social environmental, and physical environmental correlates of walking. *Am J Public Health* 2003;93:1583–9.
14. Beck A, Meyers M. Health enhancement and companion animal ownership. *Annu Rev Public Health* 1996;17:247–57.
15. Johnson RA, Meadows RL. Older Latinos, pets, and health. *West J Nurs Res* 2002;24:609–20.
16. Siegel J. Stressful life events and use of physician services among the elderly: the moderating role of pet ownership. *J Personality Social Psychol* 1990;58:1081–6.
17. Headey B. Pet ownership: good for health? *Med J Aust* 2003;179:460–1.
18. Baranowski T, Anderson C, Carmack C. Mediating variable framework in physical activity interventions: how are we doing? How might we do better? *Am J Prev Med* 1998;15:266–97.
19. Lewis BA, Marcus BH, Pate RR, Dunn AL. Psychosocial mediators of physical activity behavior among adults and children. *Am J Prev Med* 2002;23:26–35.
20. Friedmann E, Thomas S. Pet ownership, social support, and one-year survival after acute myocardial infarction in the cardiac arrhythmia suppression trial (CAST). *Am J Cardiol* 1995;76:1213–7.
21. Courneya KS. Antecedent correlates and theories of exercise behaviour. In: Morris T, Summers J, eds. *Sport psychology: theories, applications, and issues*. 2nd ed. Sydney: John Wiley and Sons, 2004:492–512.
22. Hagger MS, Chatzisarantis NLD, Biddle SJH. A meta-analytic review of the theories of reasoned action and planned behavior in physical activity: predictive validity and the contribution of additional variables. *J Sport Exerc Psychol* 2002;24:1–12.
23. Ajzen I. The theory of planned behavior. *Organ Behav Hum Decision Process* 1991;50:179–211.
24. Dillman DA. Mail and other self-administered questionnaires. In: Rossi PH, Wright JD, Anderson AB, eds. *Handbook of survey research*. Toronto: Academic Press, 1983:359–78.
25. Gilmore J. Health of Canadians living in census metropolitan areas, 2004. Available at: [www.statcan.ca/english/freepub/11-015-XIE/cma/health.htm](http://www.statcan.ca/english/freepub/11-015-XIE/cma/health.htm). Accessed May 1, 2005.
26. Ministry of Labour and Citizens' Services. BC Stats. Infoline: retirement in British Columbia, 1997. Available at: [www.bcstats.gov.bc.ca/releases/info1997/in9702.pdf](http://www.bcstats.gov.bc.ca/releases/info1997/in9702.pdf). Accessed September 14, 2005.
27. Godin G, Jobin J, Bouillon J. Assessment of leisure time exercise behavior by self-report: a concurrent validity study. *Can J Public Health* 1986;77:359–61.
28. Godin G, Shephard RJ. A simple method to assess exercise behavior in the community. *Can J Appl Sport Sci* 1985;10:141–6.
29. Shephard R. Godin leisure-time exercise questionnaire. *Med Sci Sports Exerc* 1997;29(suppl 6):S36–8.
30. Sudman S, Bradburn NM. *Asking questions*. 2nd ed. San Francisco: Jossey-Bass Publishers, 1983.
31. Rhodes RE, Jones L, Courneya KS. Extending the theory of planned behavior in the exercise domains: a comparison of social support and subjective norm. *Res Q Exerc Sport* 2002;73:193–9.
32. Health Canada. *Canada's physical activity guide to healthy active living*. Ottawa: Health Canada, 1998.
33. Cohen J. A power primer. *Psychol Bull* 1992;112:155–9.
34. Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J Personality Social Psychol* 1986;51:1173–82.
35. Parslow R, Jorm A. Pet ownership and risk factors for cardiovascular disease: another look. *Med J Aust* 2003;179:466–8.
36. Conner M, Armitage CJ. Extending the theory of planned behavior: a review and avenues for further research. *J Appl Soc Psychol* 1998;28:1429.
37. U.S. Department of Health and Human Services. *Physical activity and health: a report of the Surgeon General*. Atlanta GA: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996.